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Social, Economic and Competitiveness aspects of Green Innovation

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Abstract

Objective: This study aims to examine the impact of companies incorporating green innovation practices on the economic (Gross Domestic Product - GDP), social (Human Development Index - HDI), and competitive (Global Competitiveness Index - GCI) development of Developed Countries (DC) and Emerging Countries (EC).

Method: For the analysis, a three-level hierarchical regression model was used with repeated measures and estimated by Maximum Likelihood from a sample of 4061 publicly traded companies, 80% of which from the G7 countries and 20% from the BRICS (Brazil, Russia, India, China, and South Africa).

Results: The results showed that in relation to GDP, all green innovation indicators negatively influenced economic development in both DC and EC. With regard to the HDI, green innovation practices such as environmental management and environmental investments positively influence social development in DCs and ECs, respectively. As for competitiveness, the results revealed that only green innovation practices related to environmental policies showed statistically significant results demonstrating a negative relationship with the GCI both in the DC and in the EC.

Contributions: The research provides insights into potential strategies for companies and governments to establish objectives in alignment with Sustainable Development Goals. These include SDG-8, aimed at fostering sustainable and inclusive economic growth; SDG-9, focused on promoting sustainable industrialization and innovation; and SDG-10, emphasizing the reinforcement and revitalization of global partnerships for sustainable development.

Keywords: Green Innovation; Competitiveness; Economic development; Social development; Green Growth; SDG.

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Introduction

The new patterns of consumption and production intensified by the modern economy brought to the agenda discussions on environmental issues and, as a result, sustainable business models and the challenges of sustainability (Oftedal et al., 2021). The application of the Triple Bottom Line, or Sustainability Tripod, is a concept presented by Elkington in the late 1990s. It emerges as a responsible and conscientious proposal for companies seeking to remain globally and economically competitive in a scenario where pressures social and environmental issues increasingly demand a sustainable profile.

In addition, the 2030 Agenda for Sustainable Development, published by the United Nations in 2015, also consolidates what is most advanced in sustainability, setting 17 Sustainable Development Goals (SDGs), 169 goals, and 230 indicators. They must be implemented by 2030 by developed and developing countries and constitute an action plan for the planet, individuals, and prosperity. For the implementation of these goals, it is necessary to consider multi-sector partnerships, in addition to planning for the implementation of sustainable urban development policies that require innovative models of collaboration between local governments, society, and the business sector, in a process of transparent collaboration and inclusion (Un-Habitat, 2016).

According to Büyükozkan and Karabulut (2018), Sustainability is becoming a key theme among academics, regulators, and businesses and it is driven by social change, environmental deterioration and monitoring of public interest. Therefore, companies, in addition to seeking to contribute to a sustainable development model, are also concerned with their business objectives of profit, market and competitiveness.

In the context of sustainability, technological advancements enable greater competitiveness and can facilitate the adoption of more eco-efficient production practices. Scientific studies use terms such as eco-innovation, environmental innovation, green innovation, or sustainable innovation to categorize these innovative initiatives that are capable of reducing resource consumption, energy usage, and waste generation, thus promoting a sustainable environment by introducing significant improvements in ecological terms (Bossle et al., 2016; Xavier et al., 2017). In addition, the topic has been approached from the perspective of its impact on the economic and social growth of countries (Lin & Yuan, 2023).

Many authors have researched the topic looking for factors that encourage companies' green innovation practices, such as Foreign Direct Investment (FDI) flows (Song et al., 2015), the intensity of market competition, environmental regulations, and investments in R&D (Borsatto & Amui, 2019; Dangelico, 2016; Song & Wang, 2018). Another stream of studies has analyzed the impacts of this innovation on the economic and environmental performance of companies (Borsatto et al., 2020; Huang & Li, 2017; Stucki, 2019). Another approach that has been emerging on Green Innovation refers to its relationship with Green Growth and Green Technology in countries in promoting sustainable development (Ribeiro et al., 2023).

In addition to this approach, the relationship between green innovation and competitiveness has also been depicted, with green innovation being considered a strategic tool for gaining a competitive advantage in the global market (Apak & Aty, 2015), indirectly reinforcing the competitive performance of organizations (Podcameni, 2007). Shafique et al. (2017) found that establishing a green image through ecological practices is a strategy to obtain competitive advantages. Sellitto et al. (2020) found that both product innovation and process innovation positively affect the competitiveness of companies in the furniture sector. These studies addressed the relationship between green innovation and competitiveness in the business environment. In the context of regional competitiveness, According to Borsatto and Amui's (2019) findings, the study revealed that the competitiveness of countries did not have a positive impact on the green innovation initiatives of industrial firms. This suggests that competitiveness does not act as an impediment to innovation in environmentally sustainable business practices.

One of the streams of study that analyze innovation as a strategic resource that leads to competitive advantage is the Natural Resource-Based Vision (NRBV). According to Hart and Dowell (2011), there are three key strategic eco-innovation capabilities: pollution prevention, product management, and sustainable development. The first is aimed at avoiding waste and emissions and is associated with lower costs. The second capability includes stakeholder engagement in the company's environmental management, creating the potential for competitive advantage. Finally, a sustainable development strategy means production processes that can be maintained indefinitely into the future. This third capability involves not only economic but also social and ecological concerns.

In this same approach, Guinot et al. (2022) asserted that while Green Innovation initiatives by companies aim to enhance their environmental sustainability, such efforts yield favorable outcomes across various domains, such as the economy and society. Additionally, they emphasized that these initiatives could serve as a competitive advantage for both companies and countries.. Given the issues of Global Sustainable Development and considering that green innovation in companies is a topic widely studied in the literature, and it is almost a consensus that this movement

strengthens companies in the national and international market, generating increased competitiveness for them, for the region where they operate and for the country. Considering that, in the context of the Coronavirus Disease 2019 (COVID-19) pandemic, the economic and social recovery of a region will depend on a joint effort of government, society, and the business sector. This study seeks to answer the following question: How can the adoption of green innovation practices by companies affect the economic and social development, and competitiveness of developed countries (DC) and developing countries (EC)?

To answer this question, the objective is to analyze how the adoption of green innovation practices by companies can affect the economic and social development, and competitiveness of developed and developing countries. It is expected that the appropriation of this content, both by managers in private and public companies and by governments, will contribute to improving decision-making processes in the search for competitiveness through the implementation of practices that result in the construction of a more sustainable.

Moreover, by considering the role of innovation in developing products and processes that minimize environmental, social, and economic harm, this study aims to reinforce a line of inquiry examining the collaborative partnership between the private and public sectors in pursuit of Sustainable Development. The findings can also lend support to the objectives outlined in the United Nations (UN) 2030 Agenda, particularly those related to fostering sustainable and inclusive economic growth (SDG 8), promoting sustainable industrialization and innovation (SDG 9), and reducing inequalities (SDG 10). This can be achieved through private sector investments in innovations that not only generate financial returns for companies but also contribute to mitigating environmental impacts and enhancing the overall quality of life for the population.

2 Literature Review and Hypothesis Development

The concept of sustainability has evolved over the years, and it can be considered simultaneously an objective, a process and a discipline of global interest. In addition to local objectives, it involves concepts of equity and serves as a horizon for society in a time of economic inequalities and social and high environmental impact (Sotto et al., 2019).

The discussion about sustainable development spans decades and even today some definitions and relationships can be considered controversial and even inconclusive in the literature. However, the application of the Triple Bottom Line to organizations as a multi-criteria model and other strategies based on the SDGs has been considered a tool to establish both competitive advantages and to promote the country's development.

It is salutary to emphasize that there are authors who criticize this model for finding it insufficient and questionable to capture the sustainable reality, given that they believe there is no interconnection between the dimensions and that they do not include aspects sensitive to cultural and natural characteristics. Seghezzo (2009) states that sustainability is usually considered a guide in the formulation of economic and social policies in balance with ecological conditions and, therefore, its structure must be broad, inclusive, and plural. The author proposes in his study a conceptual structure of five dimensions that bring together space, time, people and the relationships between them.

Besides the three dimensions present in the Triple Bottom Line, sustainable development must encompass innovation, develop important strategies, and contribute to national and international economic policies (Barbieri et al., 2010). These innovations are often driven by aspects such as environmental regulations that seek greater global competitiveness in markets and better performance.

From a business point of view, Dangelico and Pujari (2010) asserted that green innovation stands out as a crucial factor in simultaneously enhancing the environmental, social, and financial performance of companies. The study by Cai and Li (2018) demonstrated that the behavior of eco-innovation, or green innovation, can significantly improve a company's environmental performance, indirectly generating a positive impact on its economic performance. On the other hand, Borsatto et al. (2020) found that green innovation efforts did not positively impact the financial performance of companies, which demonstrated a divergence from what has been reported in the literature.

Besides the impact of green innovation practices on company performance, they can reflect on the economic and social performance of the region where these companies operate. One of the main indicators to measure the performance of nations is the Gross Domestic Product (GDP), which captures the entire production growth of a country. However, it is insufficient to inform the use of natural resources and the life quality of the population. Hence the Human Development Index (HDI), an indicator that has been useful in measuring the development of countries and the comparability of quality of life, as it captures aspects of health, education, and income (Guimarães & Jannuzzi, 2005).

Several studies addressed the relationship between innovation, sustainable development, and economic growth in countries. Santana et al. (2014) considered the multidimensional concept of sustainable development and assessed the impact of investments in technological

innovation on the economic growth of the BRICS. They found that investments in innovations implied positive changes in the social-economic performance and negative changes in the environmental performance of the countries when compared with each other.

Cracolici et al. (2009) proposed a model to integrate economic, social, and environmental aspects that aim to analyze a multidimensional phenomenon on the well-being of countries. The authors found that GDP is a basic condition for social performance. However, the high GDP index can lead to an increase in the country's pollution level, impacting its environmental aspect. This result implies that policymakers must pay attention to controlling and monitoring the negative effects of economic growth on the environment. In this same approach, Lin and Yuan (2023) investigated the relationship between natural resources and economic growth in China and demonstrated that natural resources, environmental productivity, green innovation and consumption of renewable energy negatively affected the region's GDP. Under the business aspect Xiong et al. (2020) demonstrated that business transformation through green innovation is an important way for a country's long-term economic development.

Pressure from customers, suppliers, investors, creditors and regulators on companies' actions in relation to their social and environmental responsibility has been causing Green Innovation practices to intensify, seeking to reduce CO2 emissions, use of renewable energy, more inclusive social practices, which at the same time improve the performance and competitiveness of companies and reflect on the environmental, economic and social performance of countries (Borsatto & Bazani, 2021; Schiederig et al., 2012; Tang et al., 2018). In this context, the first two hypotheses of this study emerge:

H_1 – The green innovation practices of publicly traded companies in the DC and EC are positively related to the economic development of the countries.

H_2 – The green innovation practices of publicly traded companies in DCs and Ecs are positively related to the social development of countries.

In addition to the impact of innovations on the economic and social development of countries, these aspects of innovations also affect their competitiveness. In this sense, the competitive advantage approach was consolidated from Porter's studies in the 1980s, which addressed the industrial organization linked to competitiveness. Porter (1985) affirmed the need to face competition from the maintenance of a sustainable position by organizations, that is, adopting a positioning strategy based on their competitive strengths. Porter (1989) also assured the importance of understanding a context of competitive globalization, where organizations must obtain a competitive advantage in an international context to bring competitive advantage to their nation.

For Balkyte and Tvaronavičiene (2010), competitiveness must be supported by a broad vision of economy and society, in a deep relationship between sustainable development and competitiveness. The literature discusses that competitive advantage is a strategic component for organizations and nations. Studies show that the adoption of a three-dimensional model that can measure its impact on environmental, social and economic issues is a tool for organizations to obtain a competitive advantage (Despotovic et al., 2015; Faisal et al., 2017; Schulz & Flanigan, 2016).

Despotovic et al. (2016) ensured that the promotion of competitiveness represents one of the central objectives of economic policy in most countries. They found that there is an undeniable positive impact of the social and environmental dimensions on the economic dimension of competitiveness in 34 European countries analyzed in the study. Schulz and Flanigan's (2016) research introduced a novel method for evaluating the environmental, social, and financial impact, positioning it as a strategic tool for industrial companies to achieve a competitive edge.. The findings indicate the feasibility of creating a model that incorporates both environmental and social responsibility metrics, along with conventional financial data. This integrated model can function as a competitive advantage tool using data that is broadly applicable.

However, these analyzes were developed by analyzing the competitiveness of companies. Studies on the topic verifying the relationship between green innovation and the competitiveness of countries are little covered in the literature. Borsatto and Amui (2019) and Borsatto et al., (2020) analyzed the competitiveness of countries as an antecedent of green innovation, however they found that this competitiveness does not promote green innovation in companies, demonstrating that the country being more competitive internationally does not defines the search for green innovation by companies.

For competitiveness analysis, this study uses the Global Competitiveness Index (GCI), an internationally recognized index published by the World Economic Forum. It has been ranking nations according to their competitiveness since 2004. This index is presented through reports based on a weighted average score of 12 pillars aggregated into the basic requirements, efficiency and innovation and sophistication enhancers categories, and it ranges from 0 to 7, being worse performance and better overall performance, respectively.

The pillars that make up the GCI are considered determinants of competitiveness. They are institutions, infrastructure, macroeconomic environment, health and primary education, higher education and training, goods market efficiency, labor market efficiency, market

development financial, technological preparation, market size, production sophistication, and innovation. Part of the data in this index comes from the Executive Opinion Survey (EOS) and the rest from publicly available sources, such as the World Bank, the World Health Organization (WHO) and UNESCO, demonstrating the scope and reliability for the study analysis. In this context, considering that the interconnection between economic, social, and environmental progress leads to sustainable competitiveness for nations (Herciu & Ogrean, 2014), the following research hypothesis is formulated:

H_3 – The green innovation practices of publicly traded companies in DCs and Ecs are positively related to the competitiveness of countries.

3 Material and Methods

3.1 Data Source and Sample

The hypotheses of this research were tested through a quasi-natural experiment with a longitudinal design. The study variables were collected between January 2011 and December 2019 for 4061 publicly traded companies. 80% of them are from the G7 countries to represent the developed countries (DC), and 20% from the BRICS to represent the emerging countries (EC) (Figure 1).

To compose the sample, firstly, we searched all publicly traded companies from the G7 and BRICS countries that declared to adopt the Resource Reduction Policy in the Thomson Reuters database in 2021. Due to specificities regarding the preparation and disclosure of accounting and financial information, we excluded companies in the financial and utility sector, and those with negative assets, liabilities and revenues. Figure 1 shows the composition of the sample considering companies separated by a region of origin and sector.

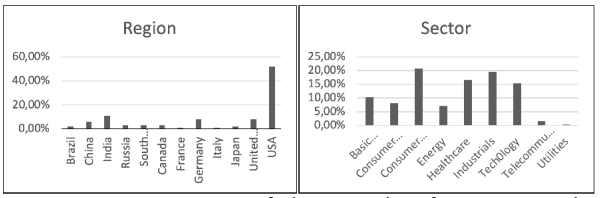

Figure 1 – Description of the sample of companies by country and by sector

The choice to separate the analyzes by economic groups is justified because the issues of Global Sustainable Development and green innovation in companies are topics widely studied in the literature, normally considering developed countries, BRICS (Santana et al., 2014), or China (Lin & Yuan, 2023), separately. In this sense, we add to the existing literature an analysis that considers different regions and countries.

The choice of the BRICS and G7 economic alliances is justified due to the representation they have on the global stage. While the G7 includes the world's largest economies, the BRICS is composed of the largest emerging economies, and with over 42% of the world's population, it contributes to 23% of the global GDP and 18% of international trade (Brazil, 2023).

The time interval is justified due to the inclusion of South Africa in the BRICS in 2011. In addition, this time interval eliminates the effects of the subprime crisis and the pandemic caused by the SARS-CoV-2 virus on the socioeconomic and competitiveness of these countries. The financial data and green innovation were taken from the Data Stream database, which is owned by Thomson Reuters. It features historical financial statement data for all listed companies around the world.

3.2 Model Variables

3.2.1 Dependents Variables

The dependent variables of this research are the economic and social development, and the competitiveness of developed countries (DC) and emerging countries (EC). To measure the economic development of countries, it used the Gross Domestic Product (GDP) of the countries collected from data available at the World Bank. GDP is an important concept regarding the wealth produced by economic activities in a country. Its value corresponds to everything that was produced and properly consumed, whether this consumption is direct or indirect.

The social development was measured based on the Human Development Index (HDI) of the countries. The HDI was created by the United Nations Development Program (UNDP) in 1990, and it was motivated by the deficiency of the First Generation indicators (GDP and GDP per capita) in measuring the quality of life of the population (Guimarães and Jannuzzi, 2005). According to the UNDP (2021), it has stood out as a measure of human development considering the aspects of income, from GDP per capita; longevity, from life expectancy at birth; and education through literacy data of adults and average years of schooling.

The last dependent variable is the competitiveness of the countries, as we used the proxy Global Competitiveness Index (GCI) of the WEF. The GCI constitutes the Global Competitiveness Report (GCR), being a comprehensive assessment of countries' competitiveness developed by the World Economic Forum's Global Competitiveness Network (GCN). The GCI corresponds to a weighted average of over 100 different variables, each representing an aspect of competitiveness. Such data stem from the Executive Opinion Survey (EOS) and publicly available sources (World Bank, World Health Organization (WHO), and UNESCO).

3.2.2 Independent and control variables

Based on the literature on the subject, 12 indicative variables of companies' green innovation practices were identified. These variables refer to environmental characteristics, policies and investments.

The preliminary correlation analysis found that some of these variables showed strong correlations. Specifically, we noticed a substantial number of correlations greater than 0.30. To reduce potential multicollinearity problems, we chose a factor analysis.

To confirm the suitability of the technique, a Bartlett test of sphericity was performed, whose result (p-value <0.000) indicated that there are significant correlations between the variables. In addition, the KMO statistic (0.923) demonstrated the adequacy of the sample regarding the degree of partial correlation between the variables. The analysis was performed by principal components and orthogonal rotation to achieve a simpler factorial pattern for interpretation and theoretically more significant (Hair et al., 2005).

The results generated 3 factors. Factor 1 was composed of the variables Policy Environmental Supply Chain (PESC), Environment Materials Sourcing (EMS) and Environmental SCManagement (ESCM), and it was called Environmental Management (EM). Factor 2 was composed of the variables Environment Management Team (EMT), Environment Management Training (EMTr), Policy Water Efficiency (PWE), Policy Energy Efficiency (PEE), Policy Emissions (PE) and Resource Reduction Policy (RRP), and it was named Environmental Policies (EP). Factor 3 was composed of the variables Environmental Restoration Initiatives (ERI), Environmental Investments (EII) and Biodiversity Impact Reduction (BIR), and it was called Environmental Investments (EI).

Finally, to verify the reliability of the generated factors, it used Cronbach's alpha, which generated results of 0.87, 0.83 and 0.64 for environmental management, environmental policies, and environmental investments, respectively. These results indicate that factor consistency is considered adequate.

To achieve a better fit of the model, it used some control variables: Company size (SIZE) measured by the natural log of assets; business performance measured by Return on Assets (ROA); and the sector in which companies operate. Table 1 presents a summary of the model's variables, the forms of measurement and the data source described in section 3.1.

Variables	Initials	Measurement	Source
Dependents Variables			
Economic Development	GDP	Sum of all wealth generated by the country	World Bank
Global Competitiveness Index	GCI	GCI	Competitiveness Report of WEF
Social Development	HDI	Human Development Index	World Bank
Independent Variables			
Green Innovation	E.M.	PESC, SEM e ESCM	Thomson Reuters Thomson Reuters
	E.P.	EMT, EMTr, PWE, PEE, PE e RRP	Thomson Reuters Thomson Reuters Thomson Reuters
	E.I.	ERI, EII e BIR	Thomson Reuters
Control Variables			
Size	SIZE	Natural logarithm of assets	Thomson Reuters
Performance	ROA		Thomson Reuters
Net Income / Total Assets	Thomson Reuters		Thomson Reuters
Sector	Sector		Thomson Reuters

Table 1 - Definitions of model variables

The study's conceptual framework was established based on the formulation of research hypotheses, illustrating the connections between variables, as depicted in Figure 2.

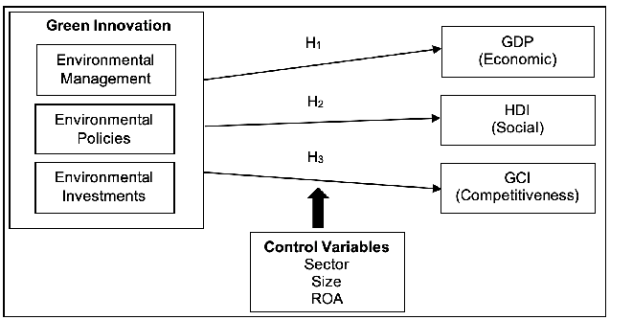

Figure 2 - Conceptual Model

3.3 Data analysis

Considering that the sample has a nested structure, it is necessary to observe the behavior of the dependent variables at country, firm and time levels. In this context, following Bernardo et al. (2018), a multilevel regression model with random and fixed coefficients was adopted. Previous multi-country studies have adopted the classic linear regression models estimated by Ordinary Least Squares (Turrent &

García, 2015; Vazquez et al., 2020). However, these models are heavily criticized in the literature for failing to capture important factors that are omitted, which ends up presenting biased estimators (Bernardo et al., 2018; Fávero & Confortini, 2010).

In this study, we used a three-level hierarchical regression model with repeated measures and estimated by the Maximum Likelihood (Full maximum likelihood - ML) so that in addition to capturing the unobservable factors that can influence the models, also to reduce the problems of endogeneity that may exist in the analysis (Bernardo et al., 2018; Jesuka & Peixoto, 2022). The first level was estimated in equation (1) in which the linear function for the average of economic development, social development and competitiveness Y_{jt} assumed over period t was considered:

$$Y_{jt}=\beta_{0ij}+e_{ijt} \qquad \sim ND\ (0,\ \sigma_e^2) \qquad (1)$$

Where β_{0j} represents the average of economic development, social development and assumed competitiveness over period t, for country j and the random error e_{ijt} which is the variation in the dependent variables over time and the variation of the omitted factors. In this model, the random error term has a normal distribution of zero mean and σ^2 variance. At the second level, the mean value of the dependent variables β_{00j} for the entire period for each country j and each firm i was analyzed in equation (2), where e μ_{ij} is the random error term for firm i in country j, and has a normal distribution with mean zero and variance σ^2.

$$\beta_{0j}=\beta_{00j}+\mu_{ij} \qquad \sim ND\ (0, \sigma^2\mu^2) \qquad (2)$$

In the last level presented in equation (3) we considered the linear function of the average of economic development, social development, and competitiveness for all countries during the entire period t β_{00j} . Where β_{000} is the mean value of the dependent variables assumed over the period across all countries, plus the random effect ε_{ij} , which assumes a normal distribution with zero mean and variance σ^2.

$$\beta_{00k}=\beta_{000}+E_{ij} \qquad \sim ND\ (0, \sigma_\varepsilon^2) \qquad (3)$$

Once the hierarchical models were estimated at the three levels, regressions were run separately in equations 4, 5 and 6 for the general sample and to compare Developed Countries and Developing Countries, considering each dependent variable, that is, development economic, social development and competitiveness.

Additionally, to verify the robustness of the models, we repeat the estimations procedure excluding the American companies from the sample. This measure aims to ensure that the results are not biased, despite the sample of companies from DC is made up of approximately 50% of American companies.

$$GPD_{j,t}=\beta_{000}+\beta_1 greeninnovation_{i,j,t}+\beta_2 controlvariables_{i,j,t}+E_{ij}+\mu_{ij}+e_{ijt} \qquad (4)$$

$$HDE_{j,t}=\beta_{000}+\beta_1 greeninnovationi_{,j,t}+\beta_2 controlvariables_{i,j,t}+E_{ij}+\mu_{ij}+e_{ijt} \qquad (5)$$

$$GCI_{j,t}=\beta_{000}+\beta_1 greeninnovation_{i,j,t}+\beta_2 controlvariables_{i,j,t}+E_{ij}+\mu_{ij}+e_{ijt} \qquad (6)$$

where $GDP_{(j,t)}$, $HDI_{(j,t)}$ e $GCI_{(j,t)}$ indicate, respectively, the economic development, social development and competitiveness of country k at time t; Green $innovation_{(i,j,t)}$ represents the proxies for green innovation: environmental management, environmental policies and environmental investment of company i from country j at time t; Controlvariables $_{(i,j,t)}$ indicates the control variables considered: size, roa and sector of company i in country j at time t; ε_j is the random effect of country j; μ_{ij} : the random effect of firm i in country j, and e_{ijt} is the random error term representing the variation in the dependent variables of the jth country over time

To verify the existence of a multicollinearity problem, the Variance Inflation Factor (VIF) test of the models' predictive variables was performed. In none of the cases did the results indicate the presence of multicollinearity. Likewise, no serial autocorrelation problems were identified using the Wooldridge test.

4 Results and Discussions

4.1 Descriptive Analysis

Table 2 presents the descriptive statistics of the quantitative variables of the model, separated according to the region of origin DC and EC. Companies in emerging countries were found to be on average larger and more profitable than companies in DCs. This can be explained by the characteristic of the sample, composed of publicly traded companies, 80% coming from DC whose capital market is stronger and more diversified and comprises companies of different sizes. In developing countries, the capital market is composed and more concentrated in large companies, generally more profitable and with more solid environmental policies.

Concerning economic and social aspects, the G7 member countries presented, on average, a GDP and an HDI higher than the countries that make up the BRICS, confirming a better economic and social performance of the DCs in relation to the emerging countries. It is also observed that DCs have, on average, a higher GCI than ECs, which means that companies in these countries are inserted in a more competitive environment, making them seek more competitive advantages in relation to other companies.

	Total Sample			DC			EC		
	Obs.	Average	DP	Obs.	Average	DP	Obs.	Average	DP
ROA	32235	0.077	0.315	24470	0.075	0.359	7765	0.085	0.073
SIZE	32304	22.578	2.569	24539	22.235	2.662	7765	23.661	1.871
GDP	39248	70109.49	145459.4	30834	72787.8	163006.5	8414	60294.4	34659.0
HDI	39248	0.872	0.088	30834	0.916	0.011	8414	0.711	0.050
GCI	39248	5.226	0.525	30834	5.308	0.419	8414	4.925	0.725

Nota: ROA – Return on Assets; SIZE – logarithm of assets; GPD – Gross Domestic Product; HDI – Human Development Index; GCI – Global Competitiveness Index.

Table 2 - Descriptive Statistics of Quantitative Variables

Because all green innovation variables are binary, Table 3 presents the frequency distribution of the total sample separated accordingly to the region of origin DC and EC to define the green innovation practices adopted by the companies. It is observed that, in relation to Environmental Management, in the ECs, a higher percentage of the companies present environmental supply chain policies, materials supply and an environmental management of the supply chain, compared to companies in the DCs.

Variables			Total Sample		DC		EC	
			f	%	f		f	%
Environmental Management (E.M.)	PESC	0	19949	50,8	15257	49,5	4692	55,7
		1	19299	49,2	15577	50,5	3722	44,3
	EMS	0	25622	65,3	19653	63,7	5969	70,9
		1	13626	34,7	11181	36,3	2445	29,1
	ESCM	0	21110	53,8	16277	52,8	4833	57,4
			18138	46,2	14557	47,2	3581	42,6
Environmental Policies (E.P.)	EMT	0	21624	55,1	17076	55,4	4548	54,1
		1	17624	44,9	13758	44,6	3866	45,9
	EMTr	0	20597	52,5	16605	53,8	3992	47,4
		1	18651	47,5	14229	46,2	4422	52,6
	PWE	0	20508	52,3	17165	55,7	3343	39,3
		1	18740	47,3	13669	44,3	5071	60,3
	PEE	0	14562	37,1	12451	40,4	2111	25,1
		1	24686	62,9	18383	59,6	6303	74,9
	PE	0	16129	41,1	13914	45,1	2215	26,3
		1	23119	58,9	16920	54,9	6199	73,7
	RRP	0	10238	26,1	8866	28,7	1372	16,3
			29010	73,9	21968	71,3	7042	83,7
Environmental Investments (E.I.)	ERI	0	30159	76,8	23899	77,5	6260	74,7
		1	9089	23,1	6935	22,5	2154	25,6
	EII	0	31768	80,9	25450	82,5	6318	75,1
		1	7480	19,1	5384	17,5	2096	24,9
	BIR	0	30664	78,1	24173	78,4	6471	76,9
			8604	21,9	6661	21,6	1943	23,1

Table 3 - Frequency distribution of Green Innovation variables

Regarding the adoption of Environmental Policies, about 55% of the companies from both DCs and ECs present a team formation and training in environmental management. Considering the adoption of water efficiency policies, energy efficiency policies, emission policies and resource reduction policies, companies in DCs are more adept at this environmental profile than companies in developing countries. One of the reasons may be related to the difficulty in applying stricter environmental regulations that can encourage the adoption of these internal policies in the company.

For Environmental Investments, even when DC companies showed a higher percentage, more than 75% of the sample of both DCs and ECs have environmental restoration, environmental investments, and reduction of impact on biodiversity initiatives.

4.2 Regression Results

For the analysis, some tests were performed to verify whether the data met the regression assumptions. The correlation analysis between the independent variables was performed and it was found that they were not highly correlated with each other, without presenting multicollinearity problems. In addition to this analysis, Tolerance and Variance Inflation Factor (VIF) statistics were performed for the sample, and multicollinearity problems were not detected, as the mean VIF values were 1.15. It was also verified that the data presented a normal distribution (Shapiro-Wilk test) and did not present heteroscedasticity problems (White test).

For the analysis, a multilevel regression model with random and fixed coefficients was adopted. To test the esearch hypotheses, a three-level hierarchical regression model was used with repeated measures and estimated by the Maximum Likelihood (Full maximum likelihood - ML) so that, in addition to capturing the unobservable factors that can influence the models, also to reduce endogeneity problems that may exist in the analysis. General data are shown in Table 4.

From the regression values, it was found that in relation to GDP, all green innovation indicators negatively influenced economic development in DC (coef. -0.6154; -0.4575; -0.4548) and in EC (coef. -0.5898; -0.3959; -0.8024). These results demonstrate that the green innovation practices of the business sector do not boost the wealth produced by the economic activities of the countries, not confirming the hypothesis H1 of this study.

Models Variables	GPD		HDI		GCI	
	EC	DC	EC	DC	EC	DC
Environmental Management (EM)	**-0.5898*** (00539)**	**-0.6154*** (0.0250)**	**-0.0071*** (0.0030)**	**0.0012*** (0.0710)**	**0,0021 (0.0068)**	0.00071 (0.0018)
Environmental Policies (EP)	**-0.3959*** (0.0331)**	**-0.4575*** (0.0104)**	**-0.0113*** (0.0018)**	**-0,0004*** (0.00011)**	**-0.0163*** (0.0041)**	**-0.0079*** (0.0074)**
Environmental Investments (EI)	**-0.8024*** (0.0508)**	**-0.4548*** (0.0189)**	**0.0061** (0.0028)**	**-0.0011*** (0.0002)**	**-0.030*** (0.0064)**	-0.0020 (0.0014)
SIZE	**0.5487*** (0.0156)**	**0.6903*** (0.0047)**	**-0.0073*** (0.0012)**	**-0.0022*** (0.0001)**	0.00076 (0.0020)	**0.0065*** (0.0034)**
ROA	**0.2066*** (0.0256)**	**0.1426*** (0.0113)**	**-0.0119*** (0.0014)**	**0.0009*** (0.0012)**	**-0.0078*** (0.0032)**	**0.0041*** (0.0080)**
Constant	**-1.9799*** (0.3721)**	**-5.2991*** (0.1046)**	**-0.1897*** (0.0207)**	**-0.0356*** (0.0011)**	**1.5638*** (0.0471)**	**1.5462*** (0.0075)**
Observations	2973	12615	2973	12615	2973	12615
VIF	1.15	1.15	1.17	1.19	1.15	1.15
Wald	**1385.27*** **	**23084.37*** **	**222.19*** **	**3122.53*** **	**64.58*** **	**453.87*** **
LR	**5182.51*** **	**19849.39*** **	**3379.27*** **	**37239.36*** **	**950.51*** **	**13445.43*** **

Table 4 – Multilevel Regression Results with Random and Fixed Coefficients

Regarding the HDI, the regression results showed that green innovation practices adopted by companies such as environmental management and environmental policies negatively influence (coef. -0.0071; -0.0113), and environmental investments positively influence social development measured by the HDI of the developing countries (coef. 0.0061). In the DC, while Environmental Management practices positively affect the HDI (coef. 0.0012), the adoption of Environmental Policies and Environmental Investments have a negative impact (coef. -0.0004; -0.0011).

About the GCI, the results of the regression revealed that only green innovation practices related to environmental management contribute to improving the competitiveness of developed countries (coef. 0.00071) and developing countries (coef. 0.0021), but these results did not show statistical significance. On the other hand, the adoption of environmental policies and environmental investments do not contribute positively to the competitiveness of either the DC or the EC, and in the DC, environmental investments are statistically significant, not confirming the hypothesis H3 of the study.

Concerning the control variables incorporated in the model, the size of the companies exhibited a positive and statistically significant correlation with the economic development (GDP) in both Emerging Countries (ECs)

and Developed Countries (DCs), as well as with the competitiveness of the DCs.. In relation to social development (HDI), the presence of large companies does not positively influence the HDI of either the PD or the EC.

Regarding the economic performance of companies measured by ROA, in the DC the performance of companies showed a positive and significant relationship with GDP, HDI and GCI (coef. 0.1426; 0.0009; 0.0041), demonstrating that a better financial performance measured by the ROA can positively influence both the generation of wealth in a country and the improvement in the quality of life of its population and the country's competitiveness. In the EC, the companies' ROA showed a positive relationship with the economic development indicator (coef. 0.2066) and a negative relationship with the countries' social development and competitiveness indicators (coef. -0.0119; coef. -0.00789), demonstrating that more profitable companies contribute significantly to the generation of wealth in the country, but this does not improve the quality of life of the population and does not make the country more competitive internationally.

In Table 5 are the hierarchical regression estimates at three levels with repeated measures and estimated by Maximum Likelihood for each of the hypotheses excluding the American companies from the sample.

When analyzing the results, it is clear that although there is a small change in the coefficients, the green innovation indicators continue to negatively influence economic development in DC (coef. -0.5182; -0.1514; -0.5710) and in EC (coef. -0.7419; -0.3871; -0.7464).

The same situation occurs in relation to the HDI, the results confirm the findings in the first estimated models that green innovation practices adopted by companies, such as environmental management and environmental policies, have a negative influence (coef. -0.0139; -0 .0164), and environmental investments positively influence social development measured by the HDI of developing countries (coefficient 0.0081).

Models Variable	GPD		HDI		GCI	
	EC	DC	EC	DC	EC	DC
Environmental Management (EM)	**-0.7419*** (0.0511)**	**-0.5182*** (0.0335)**	**-0.0139*** (0.0029)**	**0.0013*** (0.0036)**	**-0.0267*** (0.0032)**	**-0.0042*** (0.0016)**
Environmental Policies (EP)	**-0.3871*** (0.0340)**	**-0.1542*** (0.0234)**	**-0.0164*** (0.0019)**	**0.0049** (0.0025)**	**-0.0167*** (0.0022)**	-0.0019 (0.0011)
Environmental Investments (EI)	**-0.7464*** (0.0461)**	**-0.5710*** (0.0247)**	**0.0081*** (0.0026)**	**-0.0016*** (0.0002)**	**-0.0339*** (0.0029)**	-0.0015 (0.0012)
SIZE	**0.5744*** (0.0147)**	**0.8821*** (0.0055)**	**-0.0069*** (0.0008)**	**-0.0017*** (0.0005)**	**0.00065*** (0.0009)**	**0.0093*** (0.0027)**
ROA	**0.2511*** (0.0245)**	**0,1387*** (0.0163)**	**-0,0099*** (0.0014)**	**0.0042*** (0.0017)**	0.0024 (0.0033)	**0.0062*** (0.00/9)**
Constant	**-3.3426*** (0.3826)**	**-10.6004*** (0.1414)**	**-0.2396*** (0.0220)**	**-0.0684*** (0.0015)**	1.3329*** (0.0244)	**1.4633*** (0.0069)**
Observations	2812	6193	2812	6193	2812	6193
VIF	1.18	1.19	1.20	1.22	1.17	1.19
Wald	**2083.07*** **	**28208.48*** **	**631.59*** **	**5980.48*** **	**9937.05*** **	**2512.26*** **
LR	**4687.87*** **	**9670.97*** **	**3290.98*** **	**18307.75*** **	**3003.53*** **	**8952.2*** **

Table 5 – Multilevel Regression Results with Random and Fixed Coefficients Excluding American Companies

In relation to CD, the results regarding Environmental Management practices continue to indicate a positive influence on the HDI (coef. 0.0013) and Environmental Investments a negative effect (coef. -0.0011). The adoption of Environmental Policies has changed its effect, now indicating a positive effect of this variable on the HDI (coef. 0.0049).

Finally, with regard to the GCI, the results indicated results that differed slightly from the original model. The variable related to green innovation practices was significant and had a negative effect on the environmental performance of undeveloped countries (coef. -0.0042) and developing countries (coef. -0.0267). As for the adoption of environmental policies, although the variable has lost statistical significance for the CD, and environmental investments remain, they do not contribute positively to the competitiveness of either the CD or the EC. In CDs, the results did not change, environmental investments remained statistically significant only for ECs, not confirming hypothesis H3 of the study.

4.3 Discussions

This study analyzed how the adoption of green innovation practices by companies can affect the economic, social and competitiveness of developed and developing countries. This examination became feasible by confirming the relationships between variables using multilevel regression featuring both random and fixed coefficients. The data to measure companies' green innovation practices generated three factors defined as Environmental Management, Environmental Policies and Environmental Investments. It analyzed the relationship of each of them with economic performance measured by GDP; social performance measured by the HDI; and competitiveness countries measured by the GCI.

The empirical results highlight that all green innovation practices had a negative impact on the economic performance of both developing and EC countries. These results expand and corroborate the conclusions of Lin and Yuan (2023) who, when analyzing the relationship between natural resources and economic growth in China, found that natural resources, environmental productivity, green innovation and renewable energy consumption negatively affect the country's GDP. Taking into account the studied region and drawing on these findings, the authors proposed that sustainable development necessitates responsible extraction of natural resources. This, coupled with effective intervention by regulatory authorities and investments in environmentally relevant technologies, is deemed essential.

On the other hand, the results contrast with the studies by Santana et al. (2014) which, even though they did not directly analyze companies' green innovation, found that investments in innovations implied positive changes in economic performance and also with the findings of Xiong et al. (2020) that the transformation of companies through green innovation is an important path for the long-term economic development of a country and an effective way to promote the green development of the company itself. It is believed that this divergence in results is due to the fact that Santana et al. (2014) compared the effects of companies with each other within the BRICS and not between economic groups as is the case in the analysis carried out in this research.

Regarding social development, only the environmental policies adopted by the companies had an equal impact on the HDI of both the DC and the EC, showing a negative relationship. The results do not corroborate with authors such as Santana et al. (2014), who found that investments in innovations imply positive economic, social, and environmental changes in countries. The other green innovation indicators, such as Environmental Management and Environmental Investments, showed contradictory results in the social development of DC and CE. Environmental Management practices and environmental policies, when we exclude American companies from the sample, do not lead to the social well-being of the population in developing countries, only in developed countries. This result is justified by the fact that although EC economies are increasingly integrated into more developed economies in terms of trade and investment (Kravet, 2014), their accounting, governance, regulation and other social aspects are less developed. On the other hand, the companies' environmental investments positively impact the HDI in the ECs and negatively in the DCs. The analysis of this research innovates in this field of study, as it addresses the discussion of the role of the business sector for regional economic development and for the quality of life of populations.

Furthermore, this research provides an analysis of the relationship between organizations' green innovation practices and nations' competitiveness, demonstrating that in DC only the adoption of environmental policies by companies showed a significant relationship with countries' competitiveness, which is negative. In the EC, the companies' green innovation practices of adopting environmental policies and environmental investments negatively and statistically significantly affected the competitiveness of the countries, demonstrating that the companies' efforts to develop products and improve processes and their management to mitigate the impacts on the environment do not reflect positively on the competitive performance of their countries.

This result does not confirm the findings of other studies, which have demonstrated that green innovation constitutes an important tool for achieving competitive advantage in the global market (Apak & Atay, 2015), who identified the adoption of environmental innovations as a reinforcement of the competitive performance of companies (Podcameni , 2007), which also showed that the adoption of the three-dimensional model of sustainability is a tool for organizations to obtain competitive advantage (Despotovic et al., 2015; Faisal et al., 2017; Schulz & Flanigan, 2016).

In the literature, most studies that analyze this relationship do not address regional competitiveness, however Borsatto and Amui (2019) found a negative relationship between the competitiveness of countries and the green innovation of industrial companies and demonstrated that this competitiveness does not influence efforts to companies' green innovation, a result that converges with what was presented in this study. However, despite the authors having used competitiveness as a backdrop for green innovation, and in the present research it was analyzed because of companies' green innovation practices, both studies found a negative relationship between companies' green innovation practices and regional competitiveness.

Regarding the control variables, research shows that better conditions for the development of Green Innovation

practices result from the size of the company (Aguilera-Caracuel & Ortiz-de-Mandojana, 2013; Weng et al., 2015). This is confirmed in this study when we have data from large companies that present green innovation practices, but as the results of this research demonstrated that green innovation practices do not contribute to the economic, social development and competitiveness of countries, this can be an explanation so that it is not enough for a country to have large profitable companies and this does not reflect in the generation of wealth and in the promotion of the social good of its population. Sustainable development does not only depend on the size of companies and how they act internally in relation to the environment, there are aspects such as sustainable extraction of natural resources, adequate intervention by regulatory agents, investments in green technologies and renewable energy sectors that reflect not only on the environment, but on the population's quality of life.

Finally, the performance of companies measured by ROA showed a distinct relationship to economic and social development and the competitiveness of DC and EC. While in the DC the results of the companies positively influence the generation of wealth, the quality of life and the competitiveness of the country, in the DC this relationship was negative and statistically significant in the HDI and the GCI. Even though the EC companies showed, on average, a higher profitability than the DC companies, this result did not reflect in a better economic and social performance and the competitiveness of these countries, demonstrating that the concentration of good results of large companies does not guarantee a sustainable regional development inclusive with generation of wealth and quality of life for the population.

Large companies generally make investments in EC seeking to expand their markets with lower costs, cheaper labor and tax incentives. As they are companies with more solid and innovative industrial structures in environmental matters, these actions end up contributing to regional economic growth, however the profitability achieved with their businesses does not help to promote social development nor make these countries more competitive, because in the economies There are other relevant factors that negatively affect these indicators of sustainable regional development, such as social inequality, lack of investment in infrastructure, concentration of industrialization an others.

This divergent result can contribute to research that seeks to find the factors that interfere in the relationship between green innovation and financial performance of companies. The literature on the subject presents contradictory results, as shown by Borsatto and Bazani (2023), where some works indicate a positive effect between the variables, stating that eco-innovative companies have a higher financial performance (Aguilera-Caracuel & Ortiz-de-Mandojana, 2013; Fernando et al., 2019; Li, 2014; Przyhodzen & Przyhodzen, 2015; Zailani et al., 2015,). Others claim that there is no direct relationship between these variables (Chen et al., 2015; Cegarra-Navarro et al., 2016; Stucky, 2019). And these contradictions may be related to factors involving economic growth, education, quality of life, technological innovation and other variables reflected in GDP, HDI and GCI.

5 Conclusions

This study analyzed how the adoption of green innovation practices by companies can affect the economic and social development and competitiveness of developed and developing countries. To attain this goal, it was necessary to systematically review the literature on the subject and, based on the gathered data, assess the relationship between variables using multilevel regression analysis.

The main results were: (a) all green innovation practices negatively impacted the economic performance of both DC and EC; (b) in relation to social development, the results showed that environmental management and environmental policies negatively influence, and environmental investments positively influence social development measured by the HDI of the EC, and in the DC, Environmental Management practices positively affected the HDI and the adoption of Environmental Policies and Environmental Investments have a negative impact; (c) regarding competitiveness, environmental policies negatively affect the competitiveness of both DCs and ECs, and environmental investments have a negative relationship only with the competitiveness of ECs; (d) in relation to the size of the companies, the results showed that larger companies tend to have greater green innovation efforts that contribute to the generation of wealth but do not improve people's quality of life; (e) Finally, the performance of companies measured by ROA showed a distinct relationship to the economic, social development and competitiveness of DC and EC, while in DC the results of companies positively influence the generation of wealth, quality of life and the country's competitiveness, in the developing countries this relationship was positive with the GDP and negative with the HDI and the GCI.

These results corroborate the study by Lin and Yuan (2023) in relation to economic development, social development (Santana et al., 2014) and the competitiveness of countries (Borsatto & Amui, 2019). The financial performance of companies, on the other hand, showed divergent results considering the impacts on GDP, HDI and GCI in the DC and EC. It demonstrates that the concentration of good results from large companies does not guarantee sustainable regional development with the generation of wealth and quality of life for the population.

The findings of this study contribute to the literature, not only by confirming what previous research has already shown but also by highlighting contradictions

that generate insights and questions to be addressed in future investigations. Based on the results obtained, there is a need for studies that aim to identify the factors that interfere in the relationship between green innovation and the financial performance of companies related to economic growth, education, quality of life, technological innovation, and other variables reflected in GDP, HDI, and GCI.

In a practical manner, while also being mindful of social issues, the findings demonstrate that there are paths that both companies and governments can follow to strike a balance between economic growth and social and environmental concerns. The results emphasize that practices and tools, such as environmental investment and management, are applicable even to highly industrialized nations like those in the G7. These measures contribute to sustainable development by aligning with the objectives outlined in SDG-8 for promoting sustainable and inclusive economic growth, SDG-9 for encouraging inclusive and sustainable industrialization and innovation, and SDG-10 for reinforcing and revitalizing global partnerships for sustainable development.

References

Aguilera-Caracuel, J., & Ortiz-de-Mandojana, N. (2013). Green innovation and financial performance: An institutional approach. Organization & Environment, 26(4), 365-385. https://doi.org/10.1177/1086026613507931

Apak, S., & Atay, E. (2015). Global competitiveness in the EU through green innovation technologies and knowledge production. Procedia-Social and Behavioral Sciences, 181, 207-217. https://doi.org/10.1016/j.sbspro.2015.04.882

Balkyte, A., & Tvaronaviciene, M. (2010). Perception of competitiveness in the context of sustainable development: Facets of sustainable competitiveness. Journal of Business Economics and Management, 11(2), 341-365. https://doi.org/10.3846/jbem.2010.17

Barbieri, J. C., Vasconcelos, I. F. G, Andreassi, T., & Vasconcelos, F. C. (2010). Inovação e sustentabilidade: novos modelos e proposições. RAE - Revista de Administração de Empresas, 50(2), 146-154. https://doi.org/10.1590/S00347590201000020002

Bernardo, C. J., Albanez, T., & Securato, J. R. (2018). Macroeconomic and institutional factors, debt composition and capital structure of Latin American companies. BBR. Brazilian business review, 15, 152-174. https://doi.org/10.15728/bbr.2018.15.2.4

Borsatto, J. M. L. S., & Bazani, C. L. (2023). Green innovation and environmental and financial performance: trends and challenges for future research. International Journal of Innovation and Sustainable Development, 17(1-2), 152-181. https://doi.org/10.1504/ijisd.2023.127951

Borsatto, J. M. L. S., & Amui, L. B. L. (2019). Green innovation: Unfolding the relation with environmental regulations and competitiveness. Resources, Conservation and Recycling, 149, 445-454. https://doi.org/10.1016/j.resconrec.2019.06.005

Borsatto, J. M. L. S., Bazani, C., & Amui, L. (2020). Regulamentações Ambientais, Inovação Verde e Desempenho: Uma Análise de Empresas do Setor Industrial de Países Desenvolvidos e Países em Desenvolvimento. Brazilian Business Review, 17(5), 559-578. https://doi.org/10.15728/bbr.2020.17.5.5

Borsatto, J. M. L. S., & Bazani, C. L. (2021). Regulamentações Ambientais e Competitividade: um estudo comparativo entre Brasil e França. Revista De Ciências Da Administração, 23(60), 41-52. https://doi.org/10.5007/2175-8077.2021.e61944

Bossle, M. B., de Barcellos, M. D., Vieira, L. M., & Sauvée, L. (2016). The drivers for adoption of eco-innovation. Journal of Cleaner production, 113, 861-872. https://doi.org/10.1016/j.jclepro.2015.11.033

Büyüközkan, G., & Karabulut, Y. (2018). Sustainability performance evaluation: Literature review and future directions, Journal of Environmental Management, 217, 253-267. https://doi.org/10.1016/j.jenvman.2018.03.064.

Cai, W., & Li, G. (2018). The drivers of eco-innovation and its impact on performance: Evidence from China. Journal of Cleaner Production, 176, 110-118. https://doi.org/10.1016/j.jclepro.2017.12.109

Cegarra-Navarro, J. G., Reverte, C., Gómez-Melero, E., & Wensley, A. K. (2016). Linking social and economic responsibilities with financial performance: The role of innovation. European Management Journal, 34(5), 530-539. https://doi.org/10.1016/j.emj.2016.02.006

Chen, L., Tang, O., & Feldmann, A. (2015). Applying GRI reports for the investigation of environmental management practices and company performance in Sweden, China and India. Journal of Cleaner Production, 98, 36-46. https://doi.org/10.1016/j.jclepro.2014.02.001

Cracolici, M. F., Cuffaro, M., & Nijkamp, P. (2009). The Measurement of Economic, Social and Environmental Performance of Countries: A Novel Approach. Social Indicators Research, 95, 339-356. https://doi.org/10.1007/s11205-009-9464-3

Dangelico, R. M., & Pujari, D. (2010). Mainstreaming

green product innovation: Why and how companies integrate environmental sustainability. Journal of Business Ethics, 95(3), 471-486. https://doi.org/10.1007/s10551-010-0434-0

Dangelico, R. M. (2016). Green product innovation: Where we are and where we are going. Business Strategy and the Environment, 25(8), 560-576. https://doi.org/10.1002/bse.1886

Despotovic, D., Cvetanovic, S., Nedic, V., & Despotovis, M. (2015). Review and statistical analysis of different global solar radiation sunshine models. Renewable and Sustainable Energy Reviews, 52, 1869–1880. https://doi.org/10.1016/j.rser.2015.08.035

Despotovic, D., Cvetanovic, S., Nedic, V., & Despotovic, M. (2016). Economic, social and environmental dimension of sustainable competitiveness of European countries. Journal of Environmental Planning and Management, 59(9), 1656-1678. https://doi.org/10.1080/09640568.2015.1085370

Faisal, M. N., Al-Esmael, B., & Sharif, K. J. (2017). Supplier selection for a sustainable supply chain: Triple bottom line (3BL) and analytic network process approach. Benchmarking: An International Journal, 24(7), 1956-1976. https://doi.org/10.1108/BIJ-03-2016-0042

Fávero, L. P. L., & Confortini, D. (2010). Modelos multinível de coeficientes aleatórios e os efeitos firma, setor e tempo no mercado acionário Brasileiro. Pesquisa Operacional, 30, 703-727. https://doi.org/10.1590/S0101-74382010000300011

Fernando, Y., Jabbour, C. J. C., & Wah, W. X. (2019). Pursuing green growth in technology firms through the connections between environmental innovation and sustainable business performance: does service capability matter?. Resources, Conservation and Recycling, 141, 8-20. https://doi.org/10.1016/j.resconrec.2018.09.031

Governo Federal do Brasil. (2023). História do BRICS. Planalto. https://www.gov.br/planalto/pt-br/assuntos/reuniao-do-brics/historia-do-brics#:~:text=No%20total%2C%20o%20BRICS%20tem,%2C2%20milh%C3%B5es%20de%20km%C2%B2). Acesso em 08 de out. 2023.

Guimarães, J. R. S., & de Martino Jannuzzi, P. (2005). IDH, indicadores sintéticos e suas aplicações em políticas públicas. Uma análise crítica. Revista Brasileira de Estudos Urbanos e Regionais (RBEUR), 7(1), 73-90. https://doi.org/10.22296/2317-1529.2005v7n1p73

Guinot, J., Barghouti, Z., & Chiva, R. (2022). Understanding Green Innovation: A Conceptual Framework. Sustainability, 14(10), 5787, 1-14. https://doi.org/10.3390/su14105787

Hair, J., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2005). Fundamentos de métodos de pesquisa em administração. Bookman Companhia Ed.

Hart, S. L., & Dowell, G. (2011). Invited editorial: A natural-resource-based view of the firm: Fifteen years after. Journal of management, 37(5), 1464-1479. https://doi.org/10.1177/0149206310390219

Herciu, M., & Ogrean, C. (2014). An Overview on European Union Sustainable Competitiveness. Procedia Economics and Finance, 16, 651-656. https://doi.org/10.1016/S2212-5671(14)00853-3

Huang, J. W., & Li, Y. H. (2017). Green innovation and performance: The view of organizational capability and social reciprocity. Journal of Business Ethics, 145(2), 309-324. https://doi.org/10.1007/s10551-015-2903-y

Jesuka, D., & Peixoto, F. M. (2022). Corporate Governance and Firm Performance: Does Sovereign Rating Matter? Corporate Governance, 22(2), 243-256. https://doi.org/10.1108/CG-08-2020-0369

Kravet, T. (2014). Accounting conservatism and managerial risk-taking: Corporate acquisitions. Journal of Accounting and Economics, 57(2–3), 218-240. https://doi.org/10.1016/j.jacceco.2014.04.003

Li, Y. (2014). Environmental innovation practices and performance: moderating effect of resource commitment. Journal of Cleaner Production, 66, 450-458. https://doi.org/10.1016/j.jclepro.2013.11.044

Lin, S., & Yuan, Y. (2023). China's resources curse hypothesis. Evaluating the role of green innovation and green growth. Resources Policy, 80, 103-192. https://doi.org/10.1016/j.resourpol.2022.103192

Oftedal, E. M., Bertella, G., Lanka, S., Grzegorczyk, M., & Molthan-Hill, P. (2021). Perspectives of Sustainability. Revista de Administração Contemporânea, 25(3), 1-8. https://doi.org/10.1590/1982-7849rac2021200413.en

Podcameni, M. G. V. B. (2007). Meio Ambiente, Inovação e competitividade: uma análise da indústria de transformação brasileira com ênfase no setor de combustível. Dissertação (Mestrado em Economia) – Instituto de Economia, Universidade Federal do Rio de Janeiro, Rio de Janeiro.

Porter, M. E. (1985). Competitive advantage: creating and sustaining superior performance. New York: The Free Press.

Porter, M. E. (1989). A vantagem competitiva das nações.

Rio de Janeiro: Campus.

Przychodzen, J., & Przychodzen, W. (2015). Relationships between eco-innovation and financial performance–evidence from publicly traded companies in Poland and Hungary. Journal of Cleaner Production, 90, 253-263. https://doi.org/10.1016/j.jclepro.2014.11.034

Ribeiro, H. F., da Silveira, C. C., Borsatto, J. M. L. S., de Araújo, A. A., & Marcolin, C. B. (2023). Green Growth and Technology: Is there a Relationship with Green Innovation?. European Journal of Sustainable Development, 12(4), 339-354. https://doi.org/10.14207/ejsd.2023.v12n4p339

Santana, N. B., Aparecida do Nascimento Rebelatto, D., Périco, A. E., & Mariano, E. B. (2014). Sustainable development in the BRICS countries: an efficiency analysis by data envelopment. International Journal of Sustainable Development & World Ecology, 21(3), 259-272. https://doi.org/10.1080/13504509.2014.900831

Schiederig, T., Tietze, F., & Herstatt, C. (2012). Green innovation in technology and innovation management - an exploratory literature review. R&D Management, 42(2), 180–192. doi:10.1111/j.1467-9310.2011.00672.x

Schulz, S. A., & Flanigan, R. L. (2016). Developing competitive advantage using the triple bottom line: a conceptual framework. Journal of Business & Industrial Marketing, 31(4), 449-458. https://doi.org/10.1108/JBIM-08-2014-0150

Sellitto, M. A., Camfield, C. G., & Buzuku, S. (2020). Green innovation and competitive advantages in a furniture industrial cluster: A survey and structural model. Sustainable Production and Consumption, 23, 94-104. https://doi.org/10.1016/j.spc.2020.04.007

Seghezzo, L. (2009). The five dimensions of sustainability. Environmental politics, 18(4), 539-556. https://doi.org/10.1080/09644010903063669

Shafique, M., Asghar, M., & Rahman, H. (2017). The impact of green supply chain management practices on performance: Moderating role of institutional pressure with mediating effect of green innovation. Business, Management and Economics Engineering, 15(1), 91-108. https://doi.org/10.3846/bme.2017.354

Song, M., & Wang, S. (2018). Market competition, green technology progress and comparative advantages in China. Management Decision, 56(1), 188-203. https://doi.org/10.1108/MD-04-2017-0375

Song, M., Tao, J., & Wang, S. (2015). FDI, technology spillovers and green innovation in China: analysis based on Data Envelopment Analysis. Annals of Operations Research, 228(1), 47-64. https://doi.org/10.1007/s10479-013-1442-0

Sotto, D., Ribeiro, D. G., Abiko, A. K., Sampaio, C. A. C., Navas, C. A., Marins, K. R. D. C., & Buckeridge, M. S. (2019). Sustentabilidade urbana: dimensões conceituais e instrumentos legais de implementação. Estudos Avançados, 33(97), 61-80. https://doi.org/10.1590/s0103-4014.2019.3397.004

Stucki, T. (2019). Which firms benefit from investments in green energy technologies? The effect of energy costs. Research Policy, 48(3), 546-555. https://doi.org/10.1016/j.respol.2018.09.010

Tang, M., Walsh, G., Lerner, D., Fitza, M. A., & Li, Q. (2018). Green innovation, managerial concern and firm performance: An empirical study. Business Strategy and the Environment, 27(1), 39-51. https://doi.org/10.1002/bse.1981.

Turrent, G. D. C. B., & García, M. L. S. (2015). La composición del consejo de administración y la estructura accionaria como factores explicativos de la transparencia en el gobierno corporativo en Latinoamérica: evidencia en empresas cotizadas de Argentina, Brasil, Chile y México. Estudios gerenciales, 31(136), 275-286. https://doi.org/10.1016/j.estger.2015.02.001

UNDP. United Nations Development Programme (2021). Desenvolvimento Humano e IDH. Disponível em <https://www.br.undp.org/content/brazil/pt/ home/idh0.html> Acesso em: maio/2021.

Un-Habitat. (2016). World Cities Report 2016: Urbanization and Development – Emerging Futures. Nairobi: UN-Habitat. Recuperado de http://unhabitat.org/books/world-cities-report/

Vazquez, P., Carrera, A., & Cornejo, M. (2020). Corporate governance in the largest family firms in Latin America, Cross Cultural & Strategic Management, 27(2), 137-163. https://doi.org/10.1108/CCSM-11-2018-0194

Weng, H. H. R., Chen, J. S., & Chen, P. C. (2015). Effects of green innovation on environmental and corporate performance: A stakeholder perspective. Sustainability, 7(5), 4997-5026. https://doi.org/10.3390/su7054997

Xavier, A. F., Naveiro, R. M., Aoussat, A., & Reyes, T. (2017). Systematic literature review of eco-innovation models: Opportunities and recommendations for future research. Journal of cleaner production, 149, 1278-1302. https://doi.org/10.1016/j.jclepro.2017.02.145

Xiong, G., Luo, Y, & Zhao, J. (2020). An empirical test of the impact of corporate environmental responsibility on innovation performance. Statistics and Decision

Making, 21, 172-175. https://doi.org/10.13546/j.cnki.tjyjc.2020.21.035

Zailani, S., Govindan, K., Iranmanesh, M., Shaharudin, M. R., & Chong, Y. S. (2015). Green innovation adoption in automotive supply chain: the Malaysian case. Journal of Cleaner Production, 108, 1115-1122. https://doi.org/10.1016/j.jclepro.2015.06.039