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Analysis of the relationship between environmental performance and environmental disclosure in the light of the Sustainable Development Goals

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Abstract

Objective: This study aimed to analyze the relationship between corporate environmental performance and corporate environmental disclosures of companies listed on B³ that released their sustainability reports taking into account the Sustainable Development Goals (SDGs), with regard to the environmental dimension.

Method: The methodology is basic in nature, descriptive and explanatory in terms of objectives, documental in terms of technical procedures and, in terms of approach, quantitative, of the census type, with a total of 61 sustainability reports analyzed. In line with the objective of this study and to carry out the analysis of the results, it was decided to use the Multiple Linear Regression Analysis.

Results or Discussion: The findings indicated that environmental performance has a positive (moderate to strong) and significant relationship (p-value < 0.01) with environmental disclosure, explaining 43% of the disclosure of environmental information by companies in the universe studied. The other model variable, nature of activity, can also be associated with environmental disclosure, explaining 4.9%. These results are consistent with what the Legitimacy Theory predicts, reinforcing that the companies' strategies, reflected in their environmental performance, can explain the levels of their environmental disclosure.

Contributions: As for the contribution of this research, it is believed that it has provided the realization of a diagnosis about the relationship between the degree of environmental performance and the extent of disclosure of environmental information during the analyzed period, verifying and quantifying it.

Keywords: Environmental Disclosure; Environmental performance; Sustainable Development Goals.

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Introduction

In recent decades, discussions about the environmental theme and its relationship with organizations have evolved nationally and internationally, due to the uncontrolled use and scarcity of natural resources (Silva, Silva, & Borges, 2019). From this perspective, these debates end up arousing the interest of both academics in carrying out studies on the subject, and companies that aim to reduce their impacts on the environment and act sustainably (Kolk & Mauser, 2002; Silva, 2019).

This scenario reinforces the awakening to a new environmental awareness and creates mechanisms aimed at protecting and sustaining the environment, becoming one of the strongest demands of today's society (Creutzberg, Ferrari, & Engelage, 2019). Therefore, there is a growing concern on the part of society with the disorderly consumption of natural resources, since they are exhaustible, and the impact that it can bring to the environment, thus reflecting enormous problems for man and for the planet (Santos, 2020).

In this context, the definition of sustainable development has a broad spectrum through the characterization of human progress, the use of resources and business interactions (Mieg, 2012; Strandhagen et al., 2017). The seminal work by Elkington (1998) proposes that the concept of corporate sustainability consists of three pillars: social, economic and environmental. Such pillars constitute the Triple Bottom Line (TBL), requiring a balance between the social, economic and environmental dimensions. This concept aims to meet the resource needs of current and future generations without harming the environment (Khan, Ahmad, & Majava, 2021).

Since the 1960s, several initiatives and events have dealt with environmental issues, among which some have become historical references. In a more current context, there is Rio+20, the United Nations Conference on Sustainable Development, held in 2012, which was the basis for defining the post-2015 sustainable development agenda. It was at this conference that deliberations on the 17 Sustainable Development Goals (SDG) began. And that, only after three years, the final document for the establishment of the 17 SDGs was approved at the United Nations Sustainable Development Summit and its respective objectives, in 2015 (Silva, 2019; UN Brazil, 2020).

Given this conjuncture of events and initiatives, the environmental theme has been at the center of the agenda of several countries, organizations and multilateral institutions. In this scenario, environmental awareness enters the business environment, becoming a variable of fundamental importance for companies (Reis & Sellitto, 2015).

In this perspective, it is extremely important to deal with environmental issues, since not only the population is involved, but also governments and, mainly, business organizations. In this sense, the environmental theme involves the limitations of human use of nature and the conflict between economic, ecological balance and social aspects. As a result, organizations are under pressure to adopt and incorporate environmental policies (Durán & Puglia, 2007).

By incorporating such policies, research is needed that seeks to study the context in which they are inserted. Therefore, previous studies sought to verify the relationship between corporate environmental performance and environmental disclosure in financial reports, such studies showed different results (Clarkson, Richardson, & Vasvari, 2008; Farias & Farias, 2009; Corrêa, Antonovz, Panhoca, & Espejo, 2010; Fontana, D'amico, Coluccia, & Solimene, 2015; Luz & Severo Peixe, 2017; Ahmadi & Bouri, 2017; Ren et al., 2020).

In view of this, there is a research gap to be explored, as the relationship between corporate environmental performance and corporate environmental disclosure is still inconsistent in previous studies, making it necessary to carry out research, such as this one, that can contribute to mitigating the inconsistency of this relationship, given the interdependence between environmental performance and environmental disclosure in light of the SDGs advocated by the United Nations (UN) in today's world.

Investigating the language of corporate environmental disclosure, Cho, Roberts and Patten (2010) observed that the language and verbal tone used in corporate environmental disclosures should be considered when investigating the relationship between corporate disclosure and performance, since corporations make use of the language and verbal tone as a tool to manage stakeholder impressions. Cormier, Gordon and Magnan (2004), in their findings, concluded that there is a relationship between what is answered to various stakeholder groups through the decision to disclose and the actual disclosures made, above all, with regard to the form how the company communicates its actions to society to achieve or maintain its social legitimacy.

Along the same lines, Farias, Silveira, Huppes and Van Bellen (2018), investigating the disclosure of environmental information by companies listed on B[3] found that companies operating in environmentally sensitive sectors practice a higher Environmental Disclosure Index, that is, the disclosure of environmental information seeks to legitimize the actions of companies, as it encompasses various stakeholders and is an important tool in building the corporate image.

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Given the above, this research, aiming to contribute empirically to the understanding of the relationship between environmental performance and environmental disclosure and with the SDG theme related to the business context, proposes to answer the following question: what is the relationship between performance corporate environmental and corporate environmental disclosures of companies listed on B³ in light of the Sustainable Development Goals?

In summary, this research aims to analyze the relationship between corporate environmental performance and corporate environmental disclosures of companies listed on B³ that released their sustainability reports in 2019, taking into account the SDGs, regarding the environmental dimension. Thus, this study presents practical contributions due to the importance of disclosing environmental accounting information to stakeholders and legitimizing the ideas advocated by the sustainability tripod in a global economic context that is more adherent to the 17 SDGs.

It is justified, firstly, by the importance of disclosing information through accounting, and in terms of environmental accounting, since the disclosure of such information provides accounting information stakeholders with greater transparency and legitimacy, in addition to demonstrating the company's performance in relation to sustainability issues: economic, environmental and social (Santos, 2020). Second, it is the topicality of the topic that has become strategic and that, in which information related to the environmental aspect is increasingly being desired by interested parties (Cho, Roberts, & Patten, 2010; Cormier, Gordon, & Magnan, 2004; Farias, Silveira, Huppes, & Van Bellen, 2018).

2 Theoretical Reference

This topic presents the main theoretical contributions related to Disclosure, as well as the Theory of Stakeholders (interested parties) and, finally, the hypotheses to be analyzed in the research.

2.1 Disclosure

Disclosure is the act of highlighting, exposing, revealing or spreading information. Thus, disclosure can be understood as any disclosure by the organization that helps users to analyze the financial, social and environmental state, aiming to allow a better knowledge about the economic-financial situation and other relevant aspects of the organization (Cruz & Lima, 2010; Farias, Huppes, Lopes, & Noriller, 2016).

Additionally, Costa and Marion (2007) report that the concept refers to the practice of evidencing financial, economic and physical information, as well as the search for the generation of reports that are richer in quantitative

(monetary) and/or qualitative (declaratory) information.

Guia, Menezes Junior, Serrano and Franco (2017) argue that disclosure influences the behavior of investors, as well as managers, since it affects their perception of risks and, consequently, of disclosure levels, using costs as a parameter that are related to the provision of such information.

In general, it is said that disclosure "balances" the availability of information among market participants (Murcia & Machado, 2013). Leuz and Wysocki (2008) emphasize that this happens in two ways: i. the more public information available, the more difficult and expensive it is to obtain private information, consequently, there will be fewer investors with privileged information; and, ii. disclosure reduces uncertainty about the firm's value and therefore reduces the informational advantage of better-informed investors.

Disclosure, for Cruz and Lima (2010), strongly influences the behavior of investors, as it can affect their perception of the company's risks, as well as the perception of the organization's managers, who begin to decide the levels of disclosure based on the costs to be incurred in providing such information.

2.2 Stakeholder Theory (interested parties)

Managers, due to social pressures, are changing their conceptions and ways of acting, no longer having a purely economic vision and seeking to create relationships between the company and its stakeholders. Therefore, contemporary management in organizations began to be shaped by the dialectic relationship between the business manager and the stakeholders, that is, between the entrepreneur and other interested parties, such as: shareholders, employees, suppliers, customers, financiers, government, communities, media and non-governmental organizations (NGOs) (Freeman & McVea, 2001; Oliveira, Rodrigues, & Craig, 2013).

According to Freeman and McVea (2001), the theory of interested parties is based on the precepts of sociology, organizational behavior and the policies of interests of specific groups. Its approach prioritizes, in particular, the management of relationships between the various actors that are part of the business environment, seeking to integrate the different interests of the parties.

The main difference between stakeholder theory and legitimacy theory is the basis on which the information is provided. In stakeholder theory, the company responds by providing information that they believe is really what the stakeholders want. In legitimacy theory, information is provided by management to make the company look good in the eyes of stakeholders, but this information may not reflect performance (Cong & Freedman, 2011).

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The stakeholder theory, according to Garriga (2014), originated based on strategic management and having the key to stakeholder management as a business context. Accordingly, Oliveira et al. (2013) emphasize that the identification, management, approximation and involvement of the various stakeholders of organizations become essential tasks for business success and prestige.

For Lopes (2015), this theory, in general, analyzes the existing relationships between the organization and its stakeholders, and, in particular, the extent to which stakeholders are affected by companies (and vice versa). Adding that "it is this measurement of 'forces' that guides the theory and that emerges from a new narrative to understand" (Lopes, 2015, p. 9) and, according to Parmar et al. (2010), solve three business problems: i. how value is created and generated; ii. the link between ethics and capitalism; and, iii. the managers' approach to management and how they solve the two problems identified above.

The classification of stakeholders will substantially depend on the different criteria that are identified by researchers and companies. However, it is noteworthy that, in the process of managing stakeholder networks, all relationships are important, even if they do not all have the same relevance or priority (Post, Preston, & Sachs, 2002; Lopes, 2015).

As stakeholders, including shareholders, government regulators, consumers, employees and the general public, pay more attention to the environmental performance of companies, measurement issues are becoming increasingly important and the demand for information relevant is growing, to help stakeholders in making important decisions (Ilinitch, Soderstrom, & Thomas, 1998).

From the 1990s onwards, as a result of the decline of the old socio-environmental game that existed between companies and governmental agencies for environmental control, corporate environmentalism started to be seen as one of the main challenges, since new socio-environmental actors emerged in business processes, in which a great diversity of interest groups begin to exert strong pressure on the new strategic directions of organizations and establishing a new standard for socio-environmental games (Andrade, 2002).

In the current world scenario, environmental aspects have contributed to a greater demand by the market and society regarding the commitment of organizations with socially responsible attitudes, with the objective of minimizing the negative impacts of their activities on the environments in which they are inserted. However, it is important to emphasize that, even with the growth of sustainable actions, numerous discussions involving the implementation of sustainable management still persist in the corporate environment (Pennabel, Caldana, Cezarino, & Liboni, 2017).

The decision for sustainable management has a close relationship with the stakeholders of an organization. Therefore, stakeholder theory reinforces this relationship, as it represents one of the most used theoretical approaches in research that has sustainability, environmental and social management as its theme (Hörisch, Freeman, & Schaltegger, 2014).

2.3 Research hypotheses

Previous studies on the relationship between corporate environmental performance and environmental disclosure in financial reports showed mixed results (Clarkson et al., 2008). Despite the majority of previously researched studies, both national (Farias & Farias, 2009; Corrêa et al., 2010; Luz & Severo Peixe, 2017) and international (Clarkson et al., 2008; Fontana et al., 2015; Ahmadi & Bouri , 2017; Ren et al., 2020), point to the existence of a positive relationship between performance and environmental disclosure, it is reiterated that there is still no consensus on this relationship, since some results are neutral and others are negative.

Therefore, a negative relationship between environmental performance and environmental disclosure appears to be inconsistent with the discretionary model of disclosure (Verrecchia, 2001). Al-Tuwaijri, Christensen and Hughes (2004) state that if we assume that good environmental performance reduces the company's exposure to future environmental costs, the disclosure of this information should be seen as good news by investors. Therefore, companies with good environmental performance should disclose more environmental information (in quantity and quality) than companies with worse environmental performance.

In this sense, based on the literature findings that most studies point to a positive relationship between performance and environmental disclosure, the first hypothesis of the study is proposed.

Hypothesis 1: Environmental performance is positively related and can explain companies' environmental disclosure.

Patten (2002) emphasizes that the failure to find a significant and consistent relationship between environmental performance and environmental disclosure is allied to problems in existing research designs that include failure to control for other factors associated with the level of environmental disclosure, such as inadequate sample selection and inadequate performance measures and environmental disclosure.

The size control variable has been demonstrated in several

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studies that seek to relate company size to environmental disclosure (Patten, 1992; Hackston & Milne, 1996; Patten, 2002), these studies highlight a significant relationship between company size and the extent of environmental disclosure. Accordingly, Verrecchia (2001) emphasizes, theoretically, that, in the absence of disclosure costs, it is assumed that disclosure will be complete. Highlighting that disclosure costs tend to be relatively lower for larger companies. Therefore, it can be assumed that the level of disclosure is related to the size of the company, as follows:

Hypothesis 2: The size of companies is positively related and can explain the environmental disclosure of companies.

Similarly, other studies (Deegan & Gordon, 1996; Hackston & Milne, 1996; Williams, 1999; Patten, 2002; Brammer & Pavelin, 2006) have shown that companies in sectors with greater sensitivity to environmental regulation tend to provide environmental disclosure broader than companies in sectors less sensitive to the environment. In this case, it is assumed that companies that carry out activities with a high polluting potential are more likely to disclose information of an environmental nature. In light of this, it is proposed:

Hypothesis 3: The nature of the companies' activity is positively related and can explain the companies' environmental disclosure.

3. Methodological procedures

Scientific research can assume different typologies (Gil, 2019). Regarding the nature of this research, it can be classified as basic. As for the objectives, this study has a descriptive and explanatory characteristic, since its purpose is to analyze the relationship between corporate environmental performance and the corporate environmental disclosures of the companies listed on the B[3] that released their sustainability reports taking into account the SDG, regarding the dimension environmental.

The research, regarding the approach to the problem, is quantitative, since this study aims to analyze the level of the relationship between corporate environmental performance and corporate environmental disclosures. The procedure in scientific research refers to how the research is conducted so that data can be obtained. In the study in question, documentary research was used.

3.1 Scope and universe of research

The scope of a research refers to the delimitation of what is intended to be studied. In this sense, the scope of this research is the analysis of environmental information – environmental disclosure and environmental performance – present in the sustainability reports of companies listed

on B[3], which released such reports taking into account the SDGs, in the year 2019.

A survey is said to be a census when the study is carried out with all participants in a population (Gil, 2019). Therefore, the present study is of the census type, whose universe is composed of all the companies that, in correspondence with the scope and based on analysis with the Report or Explain Database for the Sustainable Development Goals (SDGs) available at B[3] website, released their sustainability reports taking into account the SDGs, making a total of 76 companies. However, some companies are part of the same group, which discloses environmental information in a single sustainability report. Therefore, the final number of analyzed sustainability reports corresponds to 61.

It should be noted that the scope only covers the year 2019, as the last year of disclosure of the Report or Explain initiative for the Sustainable Development Goals (SDGs) of B[3] was the referred year.

3.2 Research variables

The variables in the present study refer to constructs that seek to analyze the level of the relationship between environmental disclosure and environmental performance, using control variables.

3.2.1 Corporate environmental disclosure

Like the studies by Wiseman (1982) and Patten (2002), the extent of environmental disclosure was measured using content analysis. To this end, the presence or absence of statements related to aspects of an environmental nature were examined in the sustainability reports, more precisely, about the 5 SDGs of the environmental dimension and the 32 Environmental Indicators proposed by the GRI in the 2016 GRI Standards version, making up thus a total of 37 indicators to be analyzed, as shown in Table 1.

Table 1. Identification of environmental indicators through content analysis

DIMENSION	ASPECT	QUANTITY OF INDICATORS	MAXIMUM POSSIBLE SCORE
ENVIRONMENTAL	ODS 6	1	2
	ODS 11	1	2
	ODS 13	1	2
	ODS 14	1	2
	ODS 15	1	2
	Materials	3	6
	Energy	5	10
	Water	5	10
	Biodiversity	4	8
	Emissions	7	14
	Effluents and Waste	5	10
	Environmental Compliance	1	2
	Environmental Assessment of Suppliers	2	4
TOTAL		37	74

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Note. Source: Elaborated by the authors, based on the 2016 GRI Standards. The SDGs in the environmental dimension are: SDG 6 - Ensure availability and sustainable management of water and sanitation for all. SDG 11 - Make cities and human settlements inclusive, safe, resilient and sustainable. SDG 13 - Take urgent action to combat climate change and its impacts. SDG 14 - Conservation and sustainable use of oceans, seas and marine resources for sustainable development. SDG 15 - Protect, restore and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss.

Therefore, the content analysis was scored by applying the methodology used by Parente, Mota, Cabral, Santos and Brandão (2014), which consists of assigning a score to each highlighted indicator/SDG, by attributing "0" for the undisclosed indicator, "1" for partial disclosure and the value "2" for full disclosure. Therefore, environmental scores can range from zero to 74. Each company's score was established by the ratio of the score obtained by the company to the maximum possible score multiplied by 100.

3.2.2 Corporate environmental performance

This study examined the degree of environmental performance of companies through 10 indicators of the GRI Standards (described in Table 2), since several studies define them as a means of measuring environmental performance (Tannuri & Bellen, 2014; Almeida & Callado, 2017; Silva, Maia, & Leal, 2017; GRI, 2016).

Table 2. Indicators of the environmental performance variable

ASPECT	INDICATOR	FORMULA
Materials	1 Raw materials or recycled materials used	Total raw materials or recycled materials used / Total raw materials or materials used X 100
	2 Products and their packaging recovered	Percentage of products and their packaging recovered
Energy	3 Reduction of energy consumption	Total energy consumption reduction / Total energy consumption inside and outside the organization X 100
Water	4 Dispose of water	Total water disposal/Total water collection X 100
	5 Water consumption	Total water consumption/Total water collection X 100
Biodiversity	6 Protected or restored habitats	Size of all habitat areas, whether environmental protection areas or company restored areas/ Size of all habitat areas, whether environmental protection areas or company restored areas with greater disclosure X 100
Emissions	7 Reduction of greenhouse gas (GHG) emissions	Total GHG reduction in metric tons of CO_2 / Total GHG emissions in metric tons of CO_2 X 100
Effluents and Waste	8 Waste recovered / recycled / reused	Total weight in metric tons of waste recycled, reused, recovered and/or used in composting / Total weight of waste generated in metric tons X 100
Environmental Compliance	9 Non-compliance with environmental laws and regulations	100% for companies that do not present any amount referring to fines resulting from non-compliance with environmental laws and/or regulations 50% for companies that submit non-significant fines and non-monetary sanctions resulting from non-compliance with environmental laws and/or regulations 0% who submit significant fines and non-monetary sanctions resulting from non-compliance with environmental laws and/or regulations.
Environmental Assessment of Suppliers	10 New suppliers selected based on environmental criteria	Percentage of new suppliers that were selected based on environmental criteria

Note. Source: Prepared by the authors, based on the 2016 GRI Standards.

Regarding the environmental performance variable, the indicators have the percentage as the final unit, synthesized in a single indicator. This is represented by the ratio between the sum of the percentage of the 10 indicators mentioned above divided by 10, which can total the maximum percentage of 100%.

3.2.3 Control variables

The variables used as control variables are: the size and nature of the activity.

In view of this, when examining the relationship between environmental performance and environmental disclosure, it is essential to control the impact of the size and nature of the activity. The proxy employed to represent the company size variable, used in this analysis, is the natural logarithm of net revenues in 2019. With regard to the nature of activity variable, it has an ordinal polytomous nature, that is, an indicator variable zero / one / two is used to designate the companies of those activities with polluting potential: value 0 (zero) for companies with activities of small polluting potential; value 1 (one) for companies with medium polluting potential activities; and, 2 (two) for companies with high polluting potential activities. The classification was based on legislation, specifically on Law 10.165/2000, which provides for the National Environmental Policy, Annex VIII.

Table 3. List of study variables

VARIABLES		CONFIGURATION	EMPIRICAL SOURCE
Dependent	Environmental Disclosure (DISA)	environmental disclosure score for each of the companies in the sample, based on the content analysis of the 2019 sustainability report	Wiseman (1982) e Patten (2002)
Independent	Environmental Performance (DESA)	average percentage of the environmental indicators of the 2016 GRI Standards	Silva, Maia e Leal (2017)
	Size (TAM)	natural logarithm of net revenues for 2019	Patten (2002)
	Nature of activity (NA)	0 = Small potential 1 = Medium potential 2 = High potential	Law 10.165/2000

Note. Source: Prepared by the authors.

3.3 Statistical Proposition for Analysis of Results

To verify the level of relationship between environmental performance and environmental disclosure of the companies in the universe studied, with the size and nature of the activity of these companies also as independent variables, the Multiple Linear Regression technique (forward method) was implemented. Determining which most significant variable should be added at each step

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can be done so that, when added to the model: i. It has the smallest p-value; or, ii. It provides the biggest increase in R^2 (Choueiry, 2021). The size variable was not significant, therefore excluded from the models.

Therefore, the multiple linear regression equation is represented as follows: $Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + e_i$. In which, Y_i = DISA (*disclosure* ambiental), $\beta_1 X_{1i}$ = DESA (environmental performance) e $\beta_2 X_{2i}$ = NA (nature of the activity).

It is worth mentioning that the validation of the premises assumed by the multiple linear regression model was carried out through tests of collinearity, normality, independence and homoscedasticity of the error terms, which were verified from the model estimate, so that they are presented in the results.

4. Results and Discussions

Initially, there is the characterization of the variables environmental disclosure and environmental performance, as shown in Table 4.

Table 4. Descriptive statistics of variables

Variable	Average*	Median*
DISA	42.86	43.24
DESA	20.54	20.09

Note. Source: Prepared by the authors. * in percentage.

According to Table 4, the environmental disclosure of the companies that make up the universe studied is, on average, 42.86%, on a scale from 0 to 100%, regarding the 37 indicators analyzed. It is also observed that half of the companies have a disclosure extension of up to 43.24. As for environmental performance, estimated using the 10 indicators of the 2016 GRI Standards, it is found to be, on average, 20.54%. While half of the companies have a degree of environmental performance of up to 20.09%.

On the other hand, the Correlation Analysis (Table 5) points out that, of the independent variables studied, the variable Size (TAM) does not have a statistically significant correlation, at the level of 0.05, with the dependent variable.

Table 5. Pearson Correlation Matrix

	DISA	DESA	TAM	NA
DISA	1	0,656**	0,207	0,271*
DESA	0,656**	1	0,106	0,075
TAM	0,207	0,106	1	-0,033
NA	0,271*	0,075	-0,033	1

Note. Source: Prepared by the authors. ** The correlation is significant at the 0.01 level. * The correlation is significant at the 0.05 level.

The correlation findings (Table 5) lead to the identification of two independent variables as candidates for the regression model: DESA – environmental performance (r = 0.656, p-value < 0.01) and NA – nature of the activity (r = 0.271, p-value < 0.05), since the TAM variable

does not have a statistically significant correlation with the dependent variable (DISA). In addition, it is observed that the correlations between the independent variables are not statistically significant, and all of them can be classified as low ($0.1 < r \leq 0.3$), by the criteria of Miles and Shevlin (2001), thus reinforcing the choice of this set of predictors.

It should be noted that the observation of the non-statistically significant correlation between company size (TAM) and environmental disclosure (DISA) differs from previous findings that show a significant relationship between company size and the extent of environmental disclosure (Patten, 1992; Hackston & Milne, 1996; Ilinitch et al., 1998; Patten, 2002; Miranda & Malaquias, 2013; Burgwal & Vieira, 2014; Fontana et al., 2015; Ahmadi & Bouri, 2017). Patten (2002) and Wronski (2018) emphasize that, through previous studies, company size is a factor that can lead to greater public pressure regarding environmental concerns and, consequently, affect environmental disclosure.

In a similar sense, Verrecchia (2001) discusses that, in the absence of disclosure costs, it is assumed that disclosure will be complete, at least theoretically. Highlighting that disclosure costs tend to be relatively lower for larger companies, thus assuming that the level of disclosure is related to the size of the company. This was not observed in the study in question. Finally, the findings do not corroborate the views of Lobo and Zhou (2001) and Ahmadi and Bouri (2017), which assume that large companies tend to disclose more environmental information than smaller companies in their annual reports due to their competitive cost advantage, and can publish more information in their reports to disseminate relevant information to different users.

The independent variable with the strongest relationship with the dependent variable was DESA, with a moderate to strong correlation. For the construction of the best regression model, the forward method was used. According to Table 6, it is observed that two models were suggested, in which model 2 has greater explanatory power (adjusted $R^2 = 0.462$).

Table 6. Summary of multiple linear regression models

Model	Predictors	R	R2	Adjusted R2	Standard error of estimate
1	(constant), DESA	0.656	0.430	0.420	13.85581
2	(constant), DESA, NA	0.692	0.479	0.462	13.35608

Note. Source: Prepared by the authors.

Aiming at a better evaluation of the results, the assumptions made by the multiple linear regression model are verified.

Table 7 presents the collinearity statistics, through the results of the calculation of the variance inflation

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factor (hereinafter VIF) - validation of the absence of multicollinearity between the regressors, and the tolerance statistic.

Table 7. Validation of Assumptions (Collinearity Statistics)

Model		Tolerance	VIF
1	(Constant)		
	DESA	1.000	1.000
2	(Constant)		
	DESA	0.994	1.006
	NA	0.994	1.006

Note. Source: Prepared by the authors.

Table 7 shows the VIF value and the tolerance statistics, in which it is possible to review three items: first, the VIF must be observed, the highest VIF (1.006) for the two variables, but not greater than 5, being according to the criteria suggested by Gujarati (2000) and therefore within tolerance. Second, look at the corresponding tolerance statistic for DESA and NA of 0.994, which is not below 0.1, again being within tolerance. Finally, the average VIF and the average tolerance must be calculated, we have 1.006 and 0.994, respectively. Therefore, it is observed that the average VIF is not substantially greater than 1 and an average tolerance statistic that is not less than 0.2. Thus, suggesting that there is no multicollinearity.

In view of this result, it is understood that the most efficient model is model 2, since the value of adjusted R2 increased and that there was a reduction in the standard error of the estimate, as shown in Table 8. Furthermore, it is observed that the effect of the incremental predictive value of the NA variable over the dependent variable was 4.9%, that is, model 2 increased the R2 by 4.9% in relation to model 1.

Continuing with the verification of the assumptions made by the multiple linear regression model, Table 8, considering model 2, shows the Durbin-Watson tests, which seek to validate independence, and the Kolmogorov-Smirnov tests, which, in turn, tests the validation of the normality of the distribution.

Table 8. Validation of Assumptions (Independence and Normality)

Independence	Normality	
Durbin-Watson	Kolmogorov-Smirnov	
D	Statistic	Sig.
1.725	0.093	0.2

Note. Source: Prepared by the authors.

Through Table 8, it is observed that, for the Durbin-Watson statistic, the value is 1.725. In the table of critical dL and d_U values of the Durbin-Watson test, values for n = 61 were used, with a significance level of 0.05. The dL and dU values correspond to 1.5188 and 1.6539, respectively. As d_U 1.6539 < 1.725 < 2.3261 (4 – d_U), there is no evidence to reject the null hypothesis. In view of this, it is assumed that the stochastic perturbation term is independent. Still in relation to Table 10, we have the statistics of the Kolmogorov-Smirnov test, which does not allow us to reject the null hypothesis of normal distribution

of the stochastic term (p-value = 0.2), from which we can assume the assumption of normality.

According to Hair Jr. et al. (2009), some assumptions can be observed from the plotting of a graph with the standardized residuals and the predicted values in the model. Thus, Figure 1 shows such a graph, which denotes that the standardized residuals seem to be uniformly distributed and the homoscedasticity of the error distribution – it means that the dispersion of the residuals is the same along X (σ^2 = constant). A diagnostic analysis of the cases did not identify an outlier, that is, there is no case whose residual would be above two standard deviations, which was maintained in the model.(σ^2 = constante).
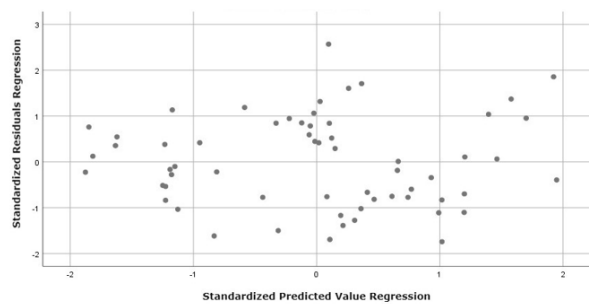

Figure 1. Graph of the relationship between standardized residuals and predicted DISA values.
Note. Source: Prepared by the authors.

Returning to Table 6, it is observed that the variables environmental performance (DESA) and nature of the activity (NA) (model 2) obtained a degree of association of 69.2% with the variable environmental disclosure (DISA) – that is, the multiple correlation between the dependent variable and the predictor score. In turn, the adjusted coefficient of determination (adjusted R2) of 0.462 shows that 46.2% of variations in environmental disclosure are explained by the joint variation of model 2 variables - DESA and NA.

Continuing the analysis, there is the ANOVA (Table 9), which shows, through a statistical test for the general adjustment of the model in terms of the F ratio, that there is evidence that allows rejecting the null hypothesis that the coefficient of determination is equal to zero, that is, at least one of the independent variables influences the environmental disclosure ($\exists \beta_i \neq 0$). Thus, attesting the statistical significance of the model. Or, in another way, using the DESA and NA variables reduces the squared error that would occur if only the mean of the DESA variable were used to predict the dependent variable by 52% (10346.33 / 19876.3), and this reduction is considered statistically significant with an F-ratio of 26.712 and a significance level of 0.000.

Table 9. Analysis of variance of models 1 and 2

Model		Sum of squares	Df	Average square	F	Sig.
1	Regression	8549,276	1	8549,276	44,531	0,000[b]
	Waste	11327,03	59	191,983		
	Total	19876,3	60			
2	Regression	9529,971	2	4764,985	26,712	0,000[c]
	Waste	10346,33	58	178,385		
	Total	19876,3	60			

Note: Source: Prepared by the authors. b. Predictors: (Constant), DESA c. Predictors: (Constant), DESA, NA.

In Table 10 it is possible to observe the standardized coefficients (Beta) of the variables present in the construction of the multiple linear regression model.

Table 10. Multiple linear regression coefficients of models 1 and 2

Model		Non-standard coefficients		Standard coefficients	T	Sig.
		B	Standard Model	B		
1	(Constante)	21,584	3,649		5,914	0,000
	DESA	1,036	0,155	0,656	6,673	0,000
2	(Constante)	17,319	3,96		4,373	0,000
	DESA	1,01	0,15	0,639	6,728	0,000
	NA	4,97	2,119	0,223	2,345	0,022

Note. Source: Prepared by the authors.

Before Table 10, we have that the environmental performance (DESA) ($\beta = 0,639$; t = 6,728; p < 0,001] and nature of the activity (NA) ($\beta = 0,223$; t = 2,345; p < 0,05) são explicativas do *disclosure* ambiental das empresas universo deste estudo. Observa-se também que os pesos beta das variáveis possuem impacto substancial no modelo de regressão, bem como são estatisticamente significantes, uma vez que, por meio do teste t, pode-se rejeitar, com nível de significância de 0,05, a hipótese de que os coeficientes são iguais a zero.

The regression equation for the model is: $Y_i = 17.319 + 0.639 (DESA) + 0.223 (NA) + e_i$, so that, for each 1% change in DESA and NA, a change of 0.639% and 0.223% in environmental disclosure is expected, respectively.

In view of these results, environmental performance (DESA), which refers to the degree of corporate environmental performance, is the model's most relevant explanatory variable. The other model variable, Nature of Activity (NA), can also be associated with the environmental disclosure of the companies in the studied sample.

4.1 Discussion

Through Table 11, the results of the hypothesis tests are presented, regardless of the relationship between the independent variables (DESA, TAM and NA) and the dependent variable (DISA).

Table 11. Summary of hypothesis tests

H1	Does not reject
H2	Rejects
H3	Does not reject

Note. Source: Prepared by the authors.

Therefore, the findings in relation to H1 and H3 were accepted, as the results suggest that both the environmental performance and the nature of the companies' activity are positively related and explain the environmental disclosure of the companies analyzed here. In relation to H2, there is a rejection, since the size of the companies is not related to the environmental disclosure of the companies in the analyzed context.

The observation of the non-statistically significant correlation between company size (TAM) and environmental disclosure (DISA) differs from previous findings that show a significant relationship between company size and the extent of environmental disclosure. Authors such as Patten (2002) and Wronski (2018) emphasize that company size is a factor that can lead to greater public pressure regarding environmental concerns and, consequently, affect environmental disclosure.

As for the nature of the activity to explain the extent of environmental disclosure, it is consistent with previous results that argue that companies in more environmentally sensitive sectors disclose more than less polluting companies (Patten, 2002; Cormier, Gordon, & Magnan, 2004; Brammer & Pavelin, 2006; Galani, Gravas, & Stavropoulos, 2012). In a similar sense, Ilinitch et al. (1998) and Wronski (2018) suggest that industry classification is a factor that can lead to greater potential public pressure regarding environmental concerns. The authors document that the nature of a company's activity has a relationship with and explanatory power for the extent of environmental disclosure.

With regard to environmental performance, explaining 43% of the extent of environmental disclosure goes against Patten's research (2002), the results indicated that there is a significant negative relationship between performance and disclosure. However, it is similar to the results found by Farias and Farias (2009), Corrêa et al. (2010), Fontana et al. (2015), Ahmadi and Bouri (2017), Ren et al. (2020), in which it was observed that variations in environmental disclosure can be explained by those occurring in environmental performance. Such results reinforce the view in which companies' strategies, reflected in their environmental performance, can explain the extent of environmental disclosure by these companies.

These results confirm what Corrêa et al. (2010) precepts, that companies with superior environmental performance tend to be closer to reality in voluntary disclosure channels, as predicted in the Stakeholder Theory (interested parties). Also being in line with the statement by Al-Tuwaijri et al. (2004), who argue that companies with good environmental performance tend to disclose "hard" environmental information, verifiable and difficult to imitate. Unlike weak environmental performers, who may be inclined to report "soft", these contain general information and are not easy to verify environmental

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disclosures (Clarkson, Overell, & Chapple, 2011). In summary, Clarkson et al. (2008) stipulate that the provision of voluntary environmental information tends to improve investors' perceptions and reduce uncertainty, thus increasing the company's valuation.

The starting point for observing the explanation of environmental disclosure through environmental performance is the social responsibility of companies, in the sense that their positive performance in relation to the environment can be validated through their environmental disclosure (Farias & Farias, 2009). It can also be supported by what highlights the discretionary disclosure model of Verrecchia (2001), through which it is understood that a good environmental performance reduces the exposure of companies to future environmental costs, therefore, the disclosure of such information can be perceived as good news by the investor.

5. Final Considerations

In recent decades, discussions about environmental issues and their relationship with organizations have evolved nationally and internationally, due to the uncontrolled use and scarcity of natural resources. Thus, arousing the interest of both academics in carrying out studies on the subject, and companies that aim to reduce their impacts on the environment and act in a sustainable way.

In view of the above, this study aimed to analyze the relationship between corporate environmental performance and corporate environmental disclosures of companies listed on B3 that released their sustainability reports in 2019, taking into account the SDGs, with regard to the environmental dimension. For this purpose, Multiple Linear Regression Analysis was used.

The regression results indicate that there is a positive (moderate to strong) and significant (p-value < 0.01) relationship between the DESA and DISA variables, indicating a priori that the greater the degree of corporate environmental performance, the greater will be the level of corporate environmental disclosure. Furthermore, environmental performance explains 43% of the disclosure of environmental information by companies in the universe studied. The other model variable, Nature of Activity (NA), can also be associated with environmental disclosure, explaining 4.9%.

In view of this, it is concluded that the environmental performance of companies listed on B3 and that released their sustainability reports in 2019 taking into account the SDGs, regarding the environmental dimension, are related to the environmental disclosure of such companies. Corroborating also with the understanding of Al-Tuwaijri

et al. (2004), if it is understood that good environmental performance reduces the company's exposure to future environmental costs, the disclosure of this information should be seen as good news by investors. Therefore, companies with good environmental performance should disclose more environmental information (in quantity and quality) than companies with worse environmental performance.

As for the contribution of this research, it is believed that it was possible to verify and quantify the relationship between environmental performance and environmental disclosure of companies that released their sustainability reports in 2019, taking into account the SDGs. Another important contribution of this study refers to the evidence that the size variable, commonly related to environmental disclosure in previous studies, did not show a statistically significant relationship. This finding is in line with previous literature, which emphasizes that there is a relationship between company size and environmental disclosure.

Authors such as Clarkson et al. (2008) stipulate that the disclosure of information is important for the perception of stakeholders and that the provision of voluntary environmental information tends to improve investor perceptions and reduce uncertainty, increasing the evaluation and legitimacy of the company. Thus, this study presents practical contributions due to the importance of disclosing environmental accounting information to stakeholders and legitimizing the ideas advocated by the sustainability tripod in a global economic context that is more adherent to the 17 SDGs.

It should be noted that the results obtained are limited to the companies that make up the sample of this study, since not all companies listed on B3 released their sustainability reports in 2019, taking into account the SDGs. The limitations are also related to the selected indicators, the analysis period of just one year and the accuracy of the information provided by the companies in their Sustainability Reports and related to the selected analysis techniques, different techniques can generate different results.

As a recommendation for future work, it is suggested to carry out a study with companies from another country, in particular, developed ones, to carry out a comparison between such countries with regard to the relationship between environmental performance and environmental disclosure, using the same indicators. In addition, it is suggested to extend the period of analysis, in order to verify whether the results would remain the same or change according to time, in addition to the application of different methods for analyzing the indicators, such as, for example, a multicriteria decision support approach, from Operational Research.

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