



## **DETERMINANTS OF GREENHOUSE GASES EMISSIONS DISCLOSURE ACCORDING TO GRI GUIDELINES IN BRAZILIAN COMPANIES**

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### **ABSTRACT**

This study aimed to identify the determinant factors of Greenhouse Gases (GHG) emissions disclosure in Brazilian companies. Therefore, a documental research was conducted, in which we analyzed sustainability reports, provided by Global Reporting Initiative (GRI) data and accounting statements of listed on stock exchange Brazilian companies that published sustainability reports and accounting statements for the year 2016. This is a descriptive research with quantitative approach. Preliminarily, we identified information about greenhouse gases emissions disclosed by the sample companies by using a check-list developed from GRI guidelines about emissions. Then, we applied the multiple linear regression analysis technique to identify the disclosure determinant factors. Results showed that the companies researched presented, in average, a low level of emissions information disclosure.



The regression analysis showed that the variables participation in potentially polluting sectors, participation in the GHG protocol, New Market governance level and sustainability report publication in the GRI model were positively associated with greenhouse gases emissions disclosure, while the company size variable did not show association with statistical significance. Therefore, the results allow us to infer that these variables can be considered determinant factors of greenhouse gases emissions disclosure. In function of research limitations related to sample size, shortage of other variables influencing the disclosure of greenhouse gas emissions, as well as research over the years, it is suggested future research considering a sample with companies from other countries, including other variables and a longitudinal study to compare disclosure in different institutional contexts over the years.

**Keywords:** Greenhouse Gases; Emissions; Brazilian Companies

## 1. INTRODUCTION

The raising awareness about the impact of businesses gives support for the increase of the growing concern with environmental questions regarding business actions. This concern revolves around factors that demonstrate the adverse effects in the environment. Greenhouse Gases (GHG) emissions indicate a substantial contribution to global warming (FEARNSIDE, 2000).

In this perspective, GHG emissions gain importance when related to the business context. This way, companies are pressured to produce and disclose to their stakeholders information about the impacts caused by their actions in the environment.

According to He et al. (2013), companies intensify the information disclosure about emission in response to the challenges of climate changes and their respective environmental impact. For Griffin, Lont and Sun (2017), investors consider emissions as a negative component of the business equity. Thus, the disclosure of such information must be performed so that the stakeholders make decisions with due knowledge of the impacts of that activity on the environment.

Information about greenhouse gases emissions are usually disclosed in the companies' sustainability reports, and, in Brazil, the Global Reporting Initiative (GRI)

report model presents guidelines about which greenhouse gases emissions information should be evidenced by the companies.

Among the GRI environmental category guidelines, there are specific disclosure demands of gases emissions for companies who opt to elaborate their reports according to this report model.

According to De Klerk and Villiers (2012), GRI guidelines form the structure more broadly used for non-financial reports. Furthermore, the GRI model gives standardized guidelines for company reports in the sense of disclose both positive and negative aspects of the environmental performance (HAHN; LULFS, 2014). This way, the present study will use GRI guidelines as parameter for information disclosure about gases emissions.

Luo and Tang (2014) claim that emissions disclosures have become increasingly important as information for the stakeholders decision-making process. Furthermore, emissions disclosures gain importance even to investors (LEE et al., 2013; BLANCO et al., 2017; GRIFFIN et al., 2017) and creditors, since they can evaluate the environmental risks of the companies with which they negotiate (KLEIMEIER; VIEHS, 2018). This way, we can demonstrate the relevance of studying greenhouse gases emissions disclosure in the Brazilian context.

The Prado-Lorenzo et al. (2009) study approached emissions disclosure according to GRI guidelines, but, because of the year the study was conducted, the authors used old GRI guidelines (G3). In the old GRI guidelines (G3) there were few indicators regarding gases emissions and they were put together with effluents and residues indicators.

From 2013 on, with the emission of new GRI guidelines (G4), new indicators were added and adapted to better represent the companies' gases emissions before their stakeholders. In this study, the greenhouse gases emissions disclosure vision is presented under the GRI guidelines perspective (G4) using companies with high polluting level and low polluting level listed in Brasil, Bolsa, Balcão (B3).

Grael and Gotthardt (2016) consider that environmental regulations and legal mechanisms in the country's institutional context are relevant instruments in emissions disclosure. In Brazil, beyond the GHG program, which is a tool used to understand, quantify and manage emissions, the Law 10.165/2000 differentiates companies according to their polluting potential, dividing them in small, medium and large polluting potential sectors. This legal instrument differentiates Brazil from other

countries that do not adopt this division of sectors with an instrument with legal force. For this reason, based on Jaggi et al. (2017), and Grauel and Gotthardt (2016), the most polluting Brazilian companies are more exposed and can be forced to be more transparent about environmental issues.

Various studies have investigated this topic from the perspective of the accounting and reduction of emissions (HASLAM et al., 2014; CORDEIRO et al., 2016; AKAN et al., 2017; IMONIANA et al., 2017; LIN et al., 2018; MARTIRE et al., 2018), as well as gases emissions disclosure by companies (TAURINGANA; CHITHAMBO, 2015; BORGHEI et al., 2016; VOGT et al., 2016; BECKER; BAUER, 2017; PENCLE, 2017; BORGHEI et al., 2018; BROADSTOCK et al., 2018).

In Brazil, however, there are no studies about emissions disclosure according to GRI guidelines (G4) that identify if companies of the most polluting sectors are more transparent than those of less aggressive sectors regarding their emissions. Therefore, the study is justified because it is different from the contributions of existing studies, because of the country's differentiated institutional environment due to its legislation regarding companies in more polluting sectors and less polluting sectors.

In face of this, we formulated the following research question: **Which are the determinant factors of information disclosure about Brazilian companies' greenhouse gases emissions?** Thus, the research objective was: **To identify the determinant factors of information disclosure about Brazilian companies' GHG emissions.**

To reach such goal, we observed if the disclosure of greenhouse gases emissions information is associated with factors such as company size, participation in potentially polluting areas, participation in the GHG Protocol, governance level, and sustainability report publication in the GRI model.

## **2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT**

### **2.1. Greenhouse Gases Emissions Disclosure**

The pollution caused by emissions represents the greatest environmental risk to human health. This can result from adverse reactions at birth to respiratory diseases in older people due to exposure to various emissions such as particulate matter and other gases (WHO, 2016).



According to Hansen et al. (2000), accelerated global warming is driven primarily by large amounts of GHG emissions and a scenery with emission reductions could lead to a possible decline in global warming rates, reducing the dangers of climate change in countries.

Samimi and Zarinabadi (2012) define GHG as a set of gases that maintain the amount of solar energy in the atmosphere and causes it to get warmer, such as Nitrogen Dioxide (NO<sub>2</sub>), Carbon Dioxide (CO<sub>2</sub>) and Methane (CH<sub>4</sub>). The disclosure and transparency of such gases become important in the business context in that they directly impact global warming.

In Brazil, the Greenhouse Gas Emission Estimate System (SEEG) shows the evolution of emissions from all business sectors and shows that from 1990 to 2005 there was a considerable increase in the number of emissions, decreasing from 2006 and increasing in 2013 to 2016 (SEEG, 2018). Thus, it is perceived that the disclosure of such emissions is now considered as important in the various sectors of the economy.

The term disclosure means to spread or publicize information that might be useful to reduce the information asymmetry, and one of its strands is called discretionary-based disclosure, which is the base for the voluntary disclosure theory (VERRECCHIA, 2001).

From the perspective of accounting, Borghei et al. (2016) add that, in the absence of norms and regulations, and considering the increasing demand for important information to their stakeholders, some organizations have opted to evidence additional items via voluntary disclosure, such as information about carbon and gases emissions.

In this perspective, Lee et al. (2013) assert that voluntary disclosures of carbon emissions are considered rational companies' choices aiming to attend the stakeholders' pressures as threats to the organization's legitimacy.

Blanco et al. (2017) revealed that the main factor in gases emissions disclosure refers to the investors' demands, illustrating the pressure of this stakeholder for such information. Furthermore, the disclosure was also motivated, but less so, by regulation, environmental concern, better business patterns, transparency and reputation. Thus, the evidencing of information by companies goes beyond eminently financial items, and also includes aspects concerning environment such as gases emissions.

The Peters and Romi (2014) study connects environmental corporate governance, by means of the presence of an environmental committee in the company, with gases emissions disclosures. For the authors, the presence of an environmental committee and a sustainability director is positively associated with more emissions disclosures. Furthermore, the authors claim that, despite they are non-financial information, emissions disclosures express the exposition to environmental risks and are related to the company's future rentability.

Similarly, for Jaggi et al. (2017), establishing environmental committees in the companies encourages administrators to implement and adopt higher levels of information disclosure about carbon emissions in the atmosphere. Besides, the authors consider that the participation of institutional investors that usually have long-term interest in the company force the administrators to adopt a more transparent posture regarding information disclosure of carbon emissions due to the demand for such information by the investors.

Regarding the institutional environment of countries signatory of the emissions reduction deal, Freedman and Jaggi (2011) demonstrated that companies of countries belonging to the emissions reduction agreement of the Kyoto Protocol presented information disclosures about emissions with higher frequency. The authors consider that, in the absence of accession to the pact by the country, it might be necessary obligatory mechanisms to enforce the companies to improve their disclosures about emissions and pollution.

And regarding the costs of companies' loans, Kleimeier and Viehs (2018) claim that voluntary disclosures of carbon emissions can generate a reduction of bank loans spreads, indicating that the corporate financing costs are lower for companies that give voluntary disclosures about carbon emissions due to the information provision about the companies' environmental risks.

In a vision that puts emissions disclosure as a negative response catalyzer for the market, Lee et al. (2013) conclude that it might be possible that the market responds negatively to the carbon emissions disclosures considered bad news. In this sense, the authors' study also grants relevance to the emissions disclosure, since it demonstrates the utility of carbon emissions information to the point of causing investors to react.

In the Brazilian context, Vogt et al. (2016) explored how Brazilian companies showcase information about environmental emissions. The authors claimed that

most Brazilian companies' emissions disclosures are descriptive and quantitative information, and they verified that Brazilian companies do not tend to disclose information about reducing emissions, i.e., positive information about emissions.

In Brazil, the GRI standard sustainability report model prevails, which, according to Hahn and Lulfs (2014), provides global guidelines for voluntary disclosure of sustainability-related aspects.

GRI guidelines for voluntary disclosure cover the emissions aspect within the environmental category. This aspect includes the disclosure of greenhouse gases emissions, substances that destroy the ozone layer, and other atmospheric emissions, sorted as: Direct emissions, which come from their own operations; Indirect emissions, those who come from power acquisition; and Other indirect emissions, which are related to emissions that occur outside the organization, but are linked to the company (GRI, 2013).

Although GRI guidelines do not have legal force to oblige companies to follow their standards, in opting for this model, the organization must follow its guidelines in order to offer standard information to the stakeholders.

## **2.2. Empirical Studies and Hypotheses Development**

Prado-Lorenzo et al. (2009) conducted a study to identify the determinant factors of GHG emissions disclosure using a sample with reports from the year 2005 of companies all around the world using GRI G3 guidelines. The authors found out that the size of the company positively influences the GHG emissions disclosures.

Blanco et al. (2017) used the content analysis of annual reports to evaluate voluntary disclosure of gases emissions in registered Australian companies (with more intensive levels) and non-registered in the NGER (National Greenhouse and Energy Reporting) of the years 2009 and 2011. The study results showed that the disclosure level in 2011 was significantly higher than in 2009. Besides, they found out that non-registered companies had a significantly higher disclosure than registered ones, which is consistent with the voluntary disclosure theory, since non-registered companies disclosed more because they had less negative information and more positive ones.

In 2015, the 21st Conference of the Parties (COP-21) took place, which was a global agreement on climate change adopted in Paris focused on the reduction of GHG emissions, where too took place the 11th Meeting of the Parties to the Kyoto



Protocol (MOP-11) about climate changes. With a sample of the largest companies in the chemical products, oil and gas, energy, motor vehicles and accident insurance, Freedman and Jaggi (2005) investigated the disclosure of companies from countries that ratified the Kyoto Protocol in comparison with other companies. The authors showed that companies from countries that adhered the Kyoto Protocol have higher levels of pollution and greenhouse gases emission disclosure, and also that larger companies tend to be more transparent about such information.

In this same context, Liu and Yang (2018) investigated if companies more sensible to greenhouse gases emissions disclosed more information of such nature in their annual reports and independent reports, and how they respond to legal and mandatory mechanisms of greenhouse gases reduction such as The Climate Change Act in the United Kingdom. The authors identified that emissions disclosures increased along the years, as a response to the United Kingdom's legal mechanisms.

Hahn and Lulfs (2014) study presents GRI guidelines for making sustainability reports as a standard that pressures the company into disclosing environmental information, emissions and other aspects regarding environmental, social and economic aspects, either they are positive or negative (GALLEGO-ÁLVAREZ et al., 2018). Therefore, GRI-modeled reports tend to present information disclosure about greenhouse gases emissions because of the guidelines' pressure for environmental information transparency.

Grael and Gotthardt (2016) studied the relevance of the national context when there is normalization and environmental regulations in carbon emissions disclosure. Results showed that environmental regulations are explanatory factors and very relevant in the carbon emissions disclosures by the companies. For the authors, voluntary disclosure is more evident in emerging countries with stronger environmental regulations.

More recently, Borghei et al. (2018) conducted a study to demonstrate the cost-benefit ratio of emissions disclosure, examining the impact of greenhouse gases voluntary disclosure over the company's accounting performance. Using a sample with Australian companies, the authors confirmed that greenhouse gases emissions disclosure is positively related to the accounting performance, which is consistent with the cost-benefit structure of the voluntary disclosure, since



companies support the costs of the disclosure to obtain the benefits of being more transparent companies regarding emissions.

De Abreu, Albuquerque and Oliveira (2016) examined the influence of institutional pressures in the carbon emissions controls disclosure in oil and gas companies. A sample of 35 sustainability reports of American, European and Asian companies was used. It found out that companies are mainly exposed to pressures from the normative cornerstone, pointing to the adoption of a high-level disclosure with a proper internalized behavior as a code of conduct to be observed. Besides, results also presented evidence to support that companies are subject to low coercive pressures due to the lack of legislation and inspection about carbon emissions disclosure.

With a sample of Australian companies, Elsayih et al. (2018) conducted a study aiming to identify the association between corporative governance mechanisms and carbon emissions voluntary disclosure from 2009 to 2012. The authors found out that some corporative governance mechanisms positively associated with information disclosure and transparency about carbon emissions.

In the same line, Kılıç and Kuzey (2018) also investigated corporative governance impacts on the carbon emissions voluntary disclosures in annual and sustainability reports of Turkish companies listed in the Istanbul stock market. The study results showed that companies with corporative governance mechanisms such as board independence are more likely to disclose carbon emissions. Besides, the authors evidenced that the existence of a sustainability committee positively influences carbon emissions disclosure and its length.

Faisal et al. (2018) noticed that some factors such as profitability, leverage and company size were positively associated with greenhouse gases emissions disclosure. For the authors, this emissions disclosure is used by companies as a way of reducing the many stakeholders' pressures.

Regarding feminine participation in the board, Hollindale et al. (2016) investigated if the participation of women in administration boards of Australian companies was related to the disclosure and quality of reports about greenhouse gases emissions. The study results indicated that companies with feminine participation in administration boards conducted more disclosures regarding greenhouse gases emissions, as well as higher quality disclosures.

Companies belonging to more polluting sectors covered by emissions regulation programs present higher carbon emissions disclosures (RANKIN et al., 2011), at the same time meeting the expectations of investors interested in environmental impact information, specifically about emissions.

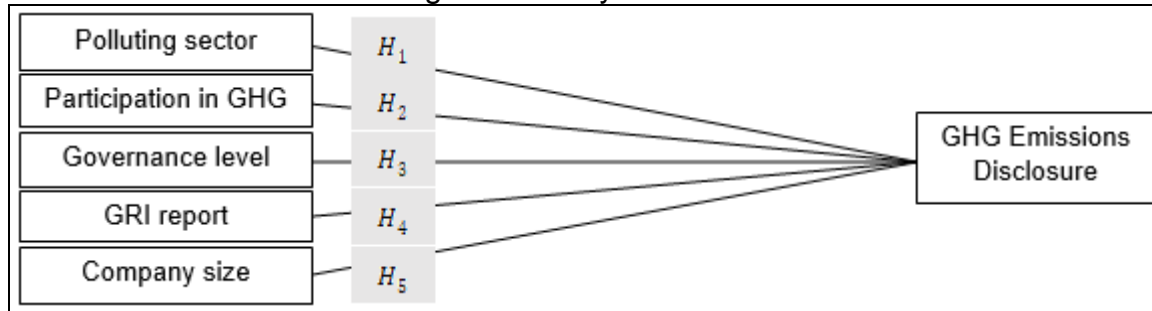
In the Jaggi et al. (2017) study, the authors claimed that companies of high-polluting sectors and sectors that are more sensible to carbon emission are under greater pressure to disclose information about carbon emissions when compared with others. Besides, the authors confirmed that that companies of high-polluting sectors and sectors that are more sensible to carbon emission are more encouraged to be more transparent and try to become legitimate before their stakeholders.

Thus, the present study formulated five research hypotheses, considering that previous studies pointed to many factors associated with carbon and greenhouse gases emissions disclosure, such as: sectors with higher levels of pollution and legal environmental regulation instruments, the company's register and participation in environmental efficiency programs, corporative governance mechanisms and diversity inclusion in administration boards, adoption of an environmental report standard with pressure to disclose, performance and company size. Therefore, we present five study hypotheses:

- $H_1$  – *Companies listed in potentially polluting sectors present higher information disclosure about greenhouse gases emissions.*
- $H_2$  – *Companies included in the GHG Protocol Brazilian Program of Emissions Public Registry present higher levels of information disclosure about greenhouse gases emissions.*
- $H_3$  – *Companies with higher governance levels present higher levels of information disclosure about greenhouse gases emissions.*
- $H_4$  – *Companies that follow the GRI sustainability reports guidelines present higher levels of information disclosure about greenhouse gases emissions.*
- $H_5$  – *Big companies present higher levels of information disclosure about greenhouse gases emissions.*

Figure 1 synthetizes the study's framework, whose description and theoretical and empirical justifications were previously presented to build the research hypotheses.

Figure 1: Study framework



Source: Elaborated by the authors

The proposed hypotheses are considered factors that influence the GHG emissions disclosure, considering B3-listed companies of the Brazilian institutional environment.

### 3. METHODOLOGY

The present study is characterized as a bibliographical, descriptive and documental research, considering that bibliographical analyses were conducted, as well as documental analyses in reports of the sample companies. The nature of the research is qualified as quantitative, since it was used the multiple linear regression statistical technique to test the determinant factors in the greenhouse gases emissions disclosure.

To compose the sample, we used every B3-listed companies with sustainability report publication for the year 2016. We observed Law 10.165/2000, that regulates the National Environmental Policy. This law classifies economic activities of various sectors acting in Brazil as of low, medium or high polluting potential, and, in this study, we used the companies listed in sectors considered of high polluting potential, in comparison to the medium and low polluting potential companies.

According to Law 10.165/2000, 16 segments considered of high polluting potential listed in B3 were enumerated: Metallic minerals; Copper and steel artefacts; Steel industry; Cleaning products; Personal use products; Paper and cellulose; Fertilizers and pesticides; Petrochemicals; Various chemicals; Exploration and/or refinery; Medication and other products; Air transportation; Railway transportation; Water transportation; Road transportation. The remaining sectors of the B3 list were considered of medium and low polluting potential.

According to the data collected from GRI in July 2018, 104 B3-listed companies with sustainability reports in the GRI model or not for the year of the

research were initially identified. Of these, 27 were excluded for not presenting all the necessary information for analysis regarding the year of 2016, resulting in a final sample of 77 companies.

The data collect was conducted using the Bardin (2011) content analysis technique, using key-words research in the sustainability reports of the researched companies to compose the dependent variable of the study, greenhouse gases emissions disclosure. To collect the independent variables data, we accessed the companies' websites, the Gases Emissions Public Registry, the B3, as well as GRI information and accounting statements of the sample companies. The collect was conducted during July and September 2018 about the analysis period of the 2016 social exercise.

In the variable dependent data collect, the search for key-words was conducted to build a greenhouse gases emissions disclosure level (DIVGEE) according to a check-list built following GRI guidelines about the emissions aspect. This way, a check-list consisting of 26 disclosure items was elaborated, according to Frame 1.

Frame 1: Information items to be disclosed about emissions according to GRI guidelines

GRI Indicators Group	Disclosure items
Greenhouse Gases (GHG) Direct Emissions	1. Direct brut emissions of GHG in tons of CO2 (Scope 1) 2. Gases included in the direct brut emissions calculation 3. Norms, methodologies and premises adopted for the direct brut emissions
Greenhouse Gases (GHG) Indirect Emissions From Power Acquisition	4. Indirect GHG emissions from power acquisition in tons of CO2 (Scope 2) 5. Gases included in the indirect emissions calculation 6. Norms, methodologies and premises adopted for the indirect emissions
Other Greenhouse Gases (GHG) Indirect Emissions	7. Other indirect emissions of GHG in tons of CO2 (Scope 3) 8. Gases included in the other indirect emissions calculation 9. Norms, methodologies and premises adopted for the other indirect emissions
Greenhouse Gases (GHG) Emissions Intensity	10. GHG emissions intensity rate 11. Types of GHG emissions included in the intensity level: direct (Scope 1), indirect (Scope 2) or other indirect emissions (Scope 3) 12. Gases included in the intensity rate calculation of the GHG emissions
Greenhouse Gases (GHG) Emissions Reduction	13. GHG emissions reductions volume obtained as a direct result of emissions reduction initiatives, in equivalent CO2 tons 14. Gases included in the GHG emissions reductions volume calculation 15. Norms, methodologies and premises adopted for the GHG emissions reductions 16. If the GHG emissions reductions were obtained for direct emissions (Scope 1), indirect emissions (Scope 2) or other emissions (Scope 3)
Emissions of Substances that Destroy the Ozone	17. Production, importations and exportations of SDO in equivalent CFC-11 tons 18. Substances included in the production, importations and exportations of

Layer (SDO)	SDO calculation 19. Norms, methodologies and premises adopted for the production, importations and exportations of SDO
Emissions of NOX, SOX and Other Significant Atmospheric Emissions	20. Volume of atmospheric emissions for the NOx category 21. Volume of atmospheric emissions for the Sox category 22. Volume of atmospheric emissions for the Persistent organic pollutants (POP) category 23. Volume of atmospheric emissions for the Volatile organic composts (VOC) category 24. Volume of atmospheric emissions for the Dangerous atmospheric pollutants (DAP) category 25. Volume of atmospheric emissions for the Particulate matter (PM) category 26. Norms, methodologies and premises adopted for the atmospheric emissions volume

Source: Adapted from the GRI G4 guidelines model (2013)

Dichotomous information about items to be disclosed by the sample companies were considered, with the attribution of score “1” in the case of the company that disclosed such item according to the check-list, and “0” for when the company did not disclose such item.

In face of this, the study’s dependent variable (DIVGEE) was built from the sum of the greenhouse gases emissions information disclosures. As for the independent variables, the proxies and calculations of Frame 2 were used.

Frame 2: Definition and operationalization of the independent variables

Independent/control variable	Proxy used	Calculation formula	Theoretical substantiation
Participation in potentially polluting sectors (Pol Dummy)	Dummy variable according to the list of high polluting potential sectors	“1” when the company is listed in the high polluting potential sectors, and “0” if it is not	Rankin et al. (2011), Jaggi et al. (2017), Liu and Yang (2018)
Participation in the GHG (GHG Dummy)	Dummy according to the participation in the GHG protocol	“1” when the company is part of the GHG protocol program, and “0” if it is not	Blanco et al. (2017), Liu and Yang (2018)
Governance Level 1 (GovN1 Dummy)	Dummy variable for the Level 1 of governance according to the B3	“1” when the company has corporative governance Level 1, and “0” if it has not	Elsayih et al. (2018), Kılıç and Kuzey (2018)
Governance Level 2 (GovN2 Dummy)	Dummy variable for the Level 2 of governance according to the B3	“1” when the company has corporative governance Level 2, and “0” if it has not	Elsayih et al. (2018), Kılıç and Kuzey (2018)
New market (GovNM Dummy)	Dummy variable for the New Market governance level according to the B3	“1” when the company has corporative governance Level New Market, and “0” if it has not	Elsayih et al. (2018), Kılıç and Kuzey (2018)
Report publication in the GRI model (GRI Dummy)	Dummy variable according to the sustainability report publication in the GRI model	“1” when the company publishes the sustainability report in the GRI model, and “0” if it does not	Hahn and Lulfs (2014) and Gallego-Álvarez et al. (2018)
Company size (TAM)	Total asset	Natural logarithm of the Total asset	Prado-Lorenzo et al. (2009) and Faisal et al. (2018)

Source: Elaborated by the authors

The *dummies* variables governance levels (GovN1 *Dummy*, GovN2 *Dummy*, GovNM *Dummy*) had as reference the B3 traditional governance segment GovTrad *Dummy* (*Dummy* excluded from the model to avoid multicollinearity).

Because of the research's objective, the following model of multiple linear regression was built, with greenhouse gases emissions disclosure as dependent variable:

$$\text{DIVGEE} = \beta_0 + \beta_1 \text{Pol } \textit{Dummy} + \beta_2 \text{GHG } \textit{Dummy} + \beta_3 \text{GovN1 } \textit{Dummy} + \beta_4 \text{GovN2 } \textit{Dummy} + \beta_5 \text{GovNM } \textit{Dummy} + \beta_6 \text{GRI } \textit{Dummy} + \beta_7 \text{TAM} + \varepsilon \quad (1)$$

For the data analysis, the multiple linear regression statistical analysis technique was used to verify influencing factors in the greenhouse gases information disclosure, considering the confidence level of 90, 95 and 99%. The data were analyzed with the help of "R" software (R CORE TEAM, 2018) version 3.1.5.

#### 4. RESULTS ANALYSIS

To reach the objective of this work, 26 disclosure items regarding greenhouse gases emission were analyzed, according to the check-list elaborated according to GRI guidelines.

Regarding the disclosed items, we verified that the sample companies disclosed, in average, 5.52 of a total of 26 items about greenhouse gases emissions, with a standard deviation of 5.67. this demonstrates a low disclosure average, since it represents only 21.2% of the total items that should be disclosed. In face of this, we can assert that companies end up not evidencing important items for both the stakeholders and the investors, considering the emissions information is important for investors (BLANCO et al., 2017; GRIFFIN et al., 2017), and for the decision-making process of the many stakeholders (LUO; TANG, 2014).

We noticed that the company that disclosed the most greenhouse gases emissions information evidenced 24 of a total of 26 items, which represents more than 92% of those that should be disclosed; meanwhile, some companies of the sample disclosed none of the items. This demonstrates that at least one company presented a high level of disclosure, meeting the expectations of investors (GRIFFIN et al., 2017) and stakeholders (LUO; TANG, 2014), while others did not present any disclosure. Besides, it was possible to notice that the items most disclosed by the companies were direct brut emissions (scope 1), and indirect emissions (scope 2).

Table 1 presents the Shapiro-Wilk normality test, with the alternative hypothesis being that the residues are abnormal.

Table 1: Shapiro-Wilk normality test

Shapiro-Wilk normality test	
W statistic	P-value
0.975	0.136
Alternative hypothesis: the residues are abnormal	
Source: Elaborated by the authors	

The Shapiro-Wilk normality test presented the expected result, since, as it can be seen in Table 1, it does not reject the null hypothesis that the residues are normal to the significance level of 5%, considering that the p-value of the test was higher than 0.05, i.e., the researched sample comes from a normal population.

Then, Table 2 presents the Breusch-Pagan Test for para homoscedasticity, with the alternative hypothesis being that the variance is not constant.

Table 2: Breusch-Pagan Test for homoscedasticity

Breusch-Pagan Test for homoscedasticity	
BP Test	P-value
10.315	0.171
Alternative hypothesis: the variance is not constant	
Source: Elaborated by the authors	

According to Table 2, there is evidence not to reject the null hypothesis of constant variance to the significance level of 5%, considering that the p-value of the test was higher than 0.05, which allows us to assert the homoscedasticity of the data

Aiming to identify the ratio between the independent variables and the dependent variable (greenhouse gases emissions disclosure) the multiple linear regression analysis was applied. Thus, determinant factors of greenhouse gases emissions disclosure were identified, as can be seen in Table 3.

Table 3 demonstrates that the regression model is significant to the level of 1%.  $R^2$  demonstrates that the independent variables set explains 43.2% of the dependent variable, greenhouse gases emissions disclosure level (DIVGEE). The  $R^2$  result indicates that the model is a good adjustment to explain the greenhouse gases emissions disclosure.

Regarding the collinearity statistics, we can see that the ratios between independent variables (*Pol Dummy*, *GHG Dummy*, *GovN1 Dummy*, *GovN2 Dummy*, *GovNM Dummy*, *GRI Dummy* and *TAM*) and the dependent variable (*DIVGEE*) did

not present problems with multicollinearity, since the VIF (Variance Inflation Factor) values were low.

Table 3: Regression model

Variable	Coefficients	Standard error	T statistic	P-value	Collinearity statistic
					VIF
(Constant)	-3.013	5.451	-0.553	0.582	-
Pol <i>Dummy</i>	2.950	1.286	2.293	0.024**	1.089
GHG <i>Dummy</i>	5.409	1.246	4.340	0.000***	1.485
GovN1 <i>Dummy</i>	0.321	1.878	0.171	0.864	1.525
GovN2 <i>Dummy</i>	2.586	1.928	1.341	0.184	1.468
GovNM <i>Dummy</i>	2.548	1.328	1.918	0.059*	1.686
GRI <i>Dummy</i>	2.939	1.487	1.976	0.052*	1.188
TAM	0.063	0.348	0.183	0.855	1.482
R <sup>2</sup> = 0.432		F = 0.000		N <sup>o</sup> of observations: 77	

Significance level: \*\*\* 0.01; \*\* 0.05; \* 0.1

Dependent variable: DIVGEE

Source: Elaborated by the authors

The regression analysis indicated that greenhouse gases emissions disclosure (DIVGEE) positively associates with the Participation in potentially polluting sectors variable (Pol *Dummy*) to the significance level of 5%, as it can be seen in the positive beta coefficient and p-value lower than 0.05, respectively. This association demonstrates that companies present in sectors considered to be potentially polluting tend to present higher levels of greenhouse gases emissions disclosure if compared to companies that do not belong to these sectors. This result corroborates the results of the Jaggi et al. (2017) and Rankin et al. (2011) studies.

The companies' participation in more polluting sectors might generate a larger exposure of the company and propitiate a higher transparency level about environmental issues and greenhouse gases emissions (JAGGI et al. 2017), and, in Brazil, such exposure might be propelled because of the pressure put on by the legislation that puts companies in sectors considered high pollutant, and can also refer to the meeting of investors' expectations regarding environmental information and GHG emissions disclosure from companies of more polluting sectors (RANKIN et al., 2011; GRIFFIN et al., 2017), considering that the emissions disclosure is positively related to the financial performance (BORGHEI et al., 2018), profitability and company leverage (FAISAL et al., 2018).

Although the legislation separates business sectors and puts companies in a highly pollutant rate, it does not demand the disclosing of environmental and emissions information, but it ends up pressuring companies to be more responsible





and transparent before the society and stakeholders in general. Thus, the environmental regulation brought by the law that separates companies between high, medium and low polluting potential becomes relevant in the Brazilian institutional context regarding emissions and pollution reduction information disclosure (GRAUEL; GOTTHARDT, 2016).

Therefore, results suggest the acceptance of the study's hypothesis  $H_1$ , confirming that companies listed in potentially polluting sectors tend to present higher levels of greenhouse gases emissions disclosure, thus this being considered a determinant factor for the information disclosure of such nature.

Regarding the participation in the GHG protocol (GHG *Dummy*), it was also found a positive association with the significance level of 1%, considering the positive beta coefficient and p-value lower than 0.01. This indicates that companies that take part of the Brazilian GHG Protocol Program have the tendency to disclose more information about greenhouse gases emissions in relation to companies that are not part of the program.

Results corroborate the studies of Rankin et al. (2011) and Liu e Yang (2018), considering that, despite not having legal force, environmental programs such as GHG and others generate higher visibility for the company, that tends to increase its disclosure by joining these programs. The higher level of disclosure by companies that are part of the GHG program might also be related to pressures for a proper behavior as code of conduct (DE ABREU et al., 2016) to be followed by the companies that take part of the GHG protocol program.

This way, results provide evidence to support the study's  $H_2$  hypothesis that companies that are included in the GHG Protocol Brazilian Program of Emissions Public Registry tend to present higher levels of information disclosure about greenhouse gases emissions.

Concerning the corporative governance levels variables, variables Level 1 (GovN1 *Dummy*), Level 2 (GovN2 *Dummy*) and New Market (GovNM *Dummy*) were tested, in comparison with the B3 corporative governance Traditional Level. This way, Level 1 (GovN1 *Dummy*) and Level 2 (GovN2 *Dummy*) variables did not present significant results.

The New Market variable (GovNM *Dummy*) presented positive and significant association only to the 10% level. This way, we can say that companies of the B3

New Market segment tend to present higher levels of information disclosure concerning greenhouse gases emissions. The presence of higher corporate governance standards as a positive influence in the carbon and greenhouse gas emissions disclosure was also evidenced by Kılıç and Kuzey (2018), with Turkish companies, and by Elsayih et al. (2018) in Australia, corroborating the results of this study.

Results demonstrate that companies with higher governance standards are motivated to adopt a more transparent posture before their investors and other stakeholders, in order to reduce asymmetry of information according to the discretionary disclosure proposed by Verrecchia (2001), since the New Market governance segment demands a higher level of transparency from the companies. Thus, the higher governance level can also be considered a determinant factor, alongside financial information disclosure, in the environmental and greenhouse gases emissions information disclosure, supporting the study's  $H_3$  hypothesis.

When testing the ratio with the sustainability report publication in the GRI model variable (GRI *Dummy*), we found positive and significant association to the level of 10%.

This result allows to infer that companies that publish their reports according to the GRI standard tend to present higher levels of GHG emissions information disclosure, corroborating Hahn and Lulfs (2014), who consider GRI guidelines a standard that pressures the companies that adopt it to disclose environmental and emissions information. This result allows to support the acceptance of the study's  $H_4$  hypothesis.

Concerning the company size variable (TAM), the regression did not present significant ration. This way, it is not possible to deduce that larger companies tend to present a lower level of GHG emissions information disclosure. This result does not allow to support the acceptance of the study's  $H_5$  hypothesis that larger companies tend to present higher levels of GHG emissions information disclosure.

## 5. CONCLUSIONS

The present study aimed to identify the determinant factors of B3-listed Brazilian companies' GHG emissions information disclosure, using a sample of 77 companies that had their accounting information and sustainability reports made publicly available. For such, a bibliographical and documental research was

conducted with secondary data of accounting statements and sustainability reports of the sample's companies.

Based on the research data, it was verified that the companies researched presented, in average, a low level of GHG emissions information disclosure according to the check-list made, failing to provide relevant information to the investors and stakeholders.

The study's starting point was the proposition of hypotheses  $H_1$ ,  $H_2$ ,  $H_3$ ,  $H_4$  and  $H_5$ , developed according to the theory and previous studies about the association between GHG emissions information disclosure and participation in potentially polluting sectors, participation in the GHG Protocol Program, governance level, compliance to GRI guidelines for sustainability reports, and company size, respectively.

It was found, using the regression analysis, that the participation in potentially polluting sectors (*Pol Dummy*), participation in the GHG Protocol (*GHG Dummy*), New Market governance level (*GovNM Dummy*) and sustainability report in the GRI model (*GRI Dummy*) variables associated positively with greenhouse gases emissions information disclosure, considering the researched companies. This result allows to deduce that companies of more polluting sectors, companies that take part of environmental programs such as the GHG protocol, companies of higher corporate governance levels and companies who publish sustainability reports in the GRI model tend to present higher levels of greenhouse gases emissions information disclosure.

The research results support the acceptance of hypotheses  $H_1$ ,  $H_2$ ,  $H_3$  and  $H_4$ , considering that positive associations of the variables that can be considered determinant factors of the B3-listed Brazilian companies' greenhouse gases emissions information disclosure. The results found were not consistent with the acceptance of the study's hypothesis  $H_5$ , since it was not found any association between greenhouse gases emissions information disclosure and company size, which does not allow to infer that company size is a determinant factor in the disclosure of such information.

The findings can be considered consistent with the greenhouse gases emissions information disclosure aimed to the compensation of its impact in society, as well as to meet the concerned public's expectations in order to gain legitimacy.

Therefore, companies from more polluting sectors adopt a posture of higher disclosure as a way to explain to their stakeholders that, despite being considered more pollutant, they try to repair damages and be more transparent before the interested public, as well as being pushed, in Brazil, by the pressure of legislation that separates companies into sectors according to their polluting potential, since, the country's environmental regulation becomes a relevant factor for the disclosure increase.

Pressures to adopt a proper behavior and a code of conduct can also be observed by companies that take part of environmental programs such as the GHG protocol, as well as factors regarding reduction of informational asymmetry through corporative governance, as in the case of companies of New Market who presented higher levels of disclosed in comparison with companies with a lower governance standard.

Despite the importance of the results found in the research, some limitations can be pointed out, such as the study sample size, which limits the generalization of results for other countries, the lack of other variables that might also be demonstrated as GHG emissions information disclosure influencers, and lack of a longitudinal study to investigate the results throughout the years.

As suggestions for future researches, we recommend the conduction of a longitudinal study through the years, the conduction of a study with companies from other countries to compare the disclosure in different environments with different institutional characteristics of legislation, norms and cultures, as well as the inclusion of other variables associated with corporate governance that reveal themselves to influence disclosure such as female board membership, CEO duality, and board independence.

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