

FACTORS INFLUENCING THE GREENHOUSE GASES DISCLOSURE: AN INSTITUTIONAL PERSPECTIVE

1. Introduction

Climate change has produced environmental, social, political, economic and psychological changes in society (Miles-Novelo & Anderson, 2019). In relation to environmental issues, global warming cause the melting of polar ice caps, increase the average temperature of the planet, reduce the biodiversity of fauna and flora, increase the sea level, increase severity and frequency of droughts as well as hurricanes and floods (Raftery, Zimmer, Frierson, Startz, & Liu, 2017). In this context, scientific evidence has shown that carbon emissions are the main cause of this global warming (Luo, Lan, & Tang, 2012).

Although carbon emissions are the main cause of global warming, the disclosure of greenhouse gases, especially carbon, is not yet regulated in many countries (Luo, 2019). Thus, national differences in corporate social responsibility can be associated to the different degrees of socioeconomic in the country, institutional pressures and laws that require disclosure (Abreu, Cunha, & Barlow, 2015; Jamali & Neville, 2011; Matten & Moon, 2008). According to Soares, Pinheiro, Abreu and Marino (2018), a better national financial system can promote greater socio-environmental transparency of companies.

Companies disclose environmental information, including their atmospheric emissions due to the institutions pressure imposed on them (Jensen & Berg, 2012; Luo, Tang, & Lan, 2013). Thus, the formal and informal institutions of the countries affect the responsible behavior of companies and impose certain expectations (Pucheta-Martínez & Gallego-Álvarez, 2019). Given the relevance and influence of the national context in environmental disclosure, several studies have analyzed how the institutional environment of countries can affect the environmental disclosure of their companies (Coluccia, Fontana, & Solimene, 2018; García-Sánchez, Rodríguez-Ariza, & Frías-Aceituno, 2013; Oliveira, Rodrigues Júnior, Lima, & de Freitas, 2018; Soares, Abreu, Rebouças, & Marino, 2020).

However, previous studies have found some limitations, being one of the limitations the lack of research that works only on the disclosure of greenhouse gases (Luo, 2019; Luo et al., 2012). In addition, Soares et al. (2020) analyzed a sample of 127 Brazilian companies and 132 Canadian companies, focusing only on environmentally sensitive sectors. Oliveira et al. (2018) investigated the influence of the national business system on the disclosure of gender information. Other studies, such as García-Sánchez et al. (2013) and Soares et al. (2018) analyzed only one aspect of the national business system, the cultural system and the financial system, respectively.

In this sense, it is still unclear the role of the national business system in the disclosure of environmental information, especially in emerging countries such as Brazil, China and India (Oliveira et al., 2018). According to Luo (2019), studies should analyse the effect of institutional pressures on the disclosure of greenhouse gases. Therefore, the present study has as a guiding question: *What is the effect of the national business system on the disclosure of information on greenhouse gases?* To this end, the research aims to investigate the effect of the national business system of the ten largest economies in the world's 10-largest economies on the disclosure of greenhouse gas information from their companies.

In order to achieve the goal, the present study analyzed a sample of 1,072 companies from the world's ten largest economies in 2018, listed in the Forbes 2000 companies ranking and with information available in the 2018 Carbon Disclosure Project database. The research represented the institutional environment of the countries through their national business systems (independent variables) and the disclosure of greenhouse gases was collected based on the Carbon Disclosure Project website. The data were analyzed using statistical techniques,

such as descriptive and inferential statistics, correlation between variables and hierarchical data analysis.

This research contributes to the expansion of institutional approaches on corporate social responsibility, since most studies analyze the impact of internal factors in environmental disclosure (Walker, Zhang, & Ni, 2019). At the managerial level, the study presents the implications of how national institutions can interfere in corporate decisions. Thus, suggesting that companies based in countries with a better national business system should invest more resources for a more complete and standardized disclosure of greenhouse gases. Moreover, developed countries have greater institutional pressure for the disclosure of information on greenhouse gases.

2. Literature review and hypotheses

2.1 Institutional Theory and Corporate Social Responsibility

Due to globalization and the technological advances produced by it, organizations have been operating in very dynamic environments. Thus, managers are worried to analyze the macroeconomic forces that affect organizational performance in addition to the internal indicators. Therefore, environments can influence business performance. The Institutional theory states that the environment affects the companies and its activities, in addition to rebuilding itself at all times (Meyer & Rowan, 1977).

From an institutional point of view, companies are led to incorporate institutionalized practices into the society if they aim to increase their legitimacy and prospects (North, 1991). Thus, this theory suggests that the structure and functioning of companies are a socially constructed reality (Rosenzweig & Singh, 1991), since organizations act in functions of rules, procedures, beliefs and values present in a given institutional environment (DiMaggio & Powell, 1983). Furthermore, the institutional environment of a country shapes its society and legitimizes institutions.

The term institution has been used massively in works that address institutional theory. According to Scott (1987), institutions are cognitive, regulatory and normative structures and activities. Thus, from the perspective of this author, institutions are mechanisms for resolving conflicts based on rules and punishments. In addition, March and Olsen (1989) defined that institutions are formed by formal elements (rules and customs) and informal elements (culture and behavioral aspects). The economic pillar of Institutional Theory, Williamson (1981) believes that institutions are companies, markets and contractual relationships.

Several studies have investigated how institutional environments have influenced organizational practices of corporate social responsibility. The companies, in the traditional conception, believed that their organizational performance depended exclusively on the rational and efficient efforts of managers (Zucker, 1987). However, today, environmental performance, for example, is the result of a number of factors, including the companies political, cultural and symbolic interactions with the institutional environment.

Based on this context, different institutional environments can influence the environmental practices of companies, that is, national institutions are responsible for differences in corporate attitudes regarding social responsibility (Campbell, 2006). Thus, companies based in developed countries tend to have a greater performance in corporate social responsibility, due to the increase of institutional pressure (Coluccia et al., 2018). In these environments, companies have a commitment not only to direct stakeholders (customers, managers and investors), but also to indirect stakeholders (community, media, NGOs, state).

The work of Tilt (2016) states that corporate social responsibility practices are determined by the institutional aspects of the country in which the company operates. Thus,

companies will disclose more information related to their atmospheric emissions, according to the political, social and economic characteristics of the country in which they operate. In addition, the legal system adopted in the country (Amor-Esteban, García-Sánchez, & Galindo-Villardón, 2018), the cultural system (Stankov, 2015), the kind of capitalism (Pucheta-Martínez, Gallego-Álvarez, & Bel-Oms, 2019), the financial system (Soares et al., 2018), and the national business system (Jensen & Berg, 2012) corporate social responsibility, including, therefore, the disclosure of greenhouse gas information.

The term national business system was first used by Whitley (1999) to define the set of historically constructed institutional characteristics. The national business system is composed by the political, financial, educational, labor, cultural and economic aspects of a country (Whitley, 2003). In this sense, the social and environmental practices of a company are determined by the national business system of the country in which it is headquartered (Ioannou & Serafeim, 2012; Matten & Moon, 2008).

2.2 Hypotheses developed

Corruption is a relevant factor in the political system (Oliveira et al., 2018), being characterized by misuse of a position or authority for personal interests. Corrupt governments have fewer resources to invest in education, welfare, economic development and infrastructure (Langseth, Stapenhurst, & Pope, 1997). Moreover, in countries with lower corruption level, companies are expected to make a greater commitment to social and environmental responsibility (Brown & Knudsen, 2015). However, companies with a higher corruption level have weak courts, controlled institutions and regulatory agencies, contributing to the non-effective adoption of environmental policies (Ashforth, Gioia, Robinson, & Trevino, 2008). Soares et al. (2020) found that better public governance positively affects social and environmental disclosure in Brazil. The work of Oliveira et al. (2018) found that the country's international transparency does not affect the disclosure of gender information in Latin America. While Ioannou and Serafeim (2012) found that a lower level of corruption in the country positively affects social and environmental disclosure.

H1: A lower level of corruption positively influences the disclosure of information on greenhouse gases.

The financial system is another pillar of the national business system, which can affect the performance of companies in social and environmental responsibility. Countries that have stock market-based financial markets such as Australia, United States and United Kingdom tend to disclose more information to investors, such as financial and corporate governance reports, than environmental reports (Walker et al., 2019). Large companies can access credit faster than smaller companies (Jensen & Berg, 2012). Moreover, these large companies have a wider range of stakeholders, who impose pressure on them for greater socio-environmental performance (Lourenço & Branco, 2013). Therefore, the ease access to credit can be considered a variable of influence on environmental disclosure. The work of Soares et al. (2018) found that in Australia, Brazil, Canada and India, the level of financial system focused on the capital market is positively related to environmental disclosure. Other studies have also found the an influence of the financial system in environmental disclosure (Ioannou & Serafeim, 2012; Jensen & Berg, 2012).

H2: Easier access to credit positively influences the disclosure of information on greenhouse gases.

The work system is characterized by the relation between employees and employers (Whitley, 2003). Ioannou and Serafeim (2012) state that in countries where there is a greater

presence of trade unions, companies carry out a greater disclosure of corporate social responsibility. Thus, coordinated market countries such as Germany, Denmark, the Netherlands and Norway tend to encourage their companies to make decisions considering the expectations of all stakeholders, including workers (Pucheta-Martínez, Gallego-Álvarez, & Bel-Oms, 2019). The good relationship between unions and owners will reflect on more complete environmental reports (Jensen & Berg, 2012). Oliveira et al. (2018) found that a better relationship between employees and employers positively influences the disclosure of gender information, meeting other results, such as Jensen and Berg (2012) e Ioannou and Serafeim (2012). While Soares et al. (2020) found that, in Brazil, the work system positively affects social and environmental disclosure, but it has no influence in Canada.

H3: Increased cooperation between employees and employers positively influences the disclosure of information on greenhouse gases.

The educational system is characterized by the qualification of the employees available in the market, including quality of education and training (Ioannou & Serafeim, 2012). In this sense, an important aspect of the national business system is the quality of the countries education system, since it can interfere in the policies of the sustainable development (Matten & Moon, 2008). Countries that have a greater involvement with research and academic knowledge tend to have companies with a similar innovation capabilities (Jensen & Berg, 2012), which may favor action on environmental issues, such as the disclosure of information on greenhouse gases. Moreover, a higher level of education in the country can favor greater business transparency (Barkemeyer, Preuss, & Ohana, 2018). According to Soares et al. (2020), the environmental disclosure of Brazilian and Canadian companies, in the sectors of oil and gas, basic materials and utilities, is not affected by the educational system. The study of Ioannou and Serafeim (2012) found that a better education system positively affects the corporate social performance of companies in 42 countries.

H4: A higher quality of the educational system positively influences the disclosure of information on greenhouse gases.

Culture is commonly defined as the social construction of reality or as the software of the mind (Hofstede, 2011). A factor of the country's cultural system is the distance to power. According to Hofstede (1983), the distance to power describes the perception of the social hierarchy in terms of equality and inequality. Thus, societies with a higher level of power concentration tend to have greater social inequality and less business transparency (García-Sánchez et al., 2013). The study of Garcia-Sanchez, Cuadrado-Ballesteros and Frias-Aceituno (2016) found that there is a negative influence of distance to power in the disclosure of corporate social responsibility. Other studies, such as Oliveira et al. (2018) and Pucheta-Martínez and Gallego-Álvarez (2019) did not find a statistically significant relationship between distance to power and disclosure. According to Barkemeyer et al. (2018), countries with a lower level of distance to power and no paternalistic structures have companies with a greater commitment to business communication, including the disclosure of information on atmospheric emissions.

H5: A greater distance to power negatively influences the disclosure of information on greenhouse gases.

The economic system is represented by the degree of economic development for the nation (Whitley, 1998). Moreover, for Belal (2000) the quantity and quality of the disclosure of corporate social responsibility information are influenced by the level of economic development of the country. In this sense, the economic system is a relevant determinant in

environmental disclosure. Emerging countries have poor disclosure when compared to environmental reports from developed countries in Europe (Matten & Moon, 2008). Islam and Deegan (2008) find that corporate transparency is higher in companies based in developed countries, since in these institutional environments there are greater pressures from the state, through the application of standards, for sustainability. Oliveira et al. (2018) found that the more developed a country is, the more its companies disclose gender information about their employees. The findings of Jensen and Berg (2012) also show that greater economic development positively affects their socio-environmental disclosure, which includes practices for disseminating information on greenhouse gas emissions.

H6: Further economic development positively influences the disclosure of information on greenhouse gases.

3. Methodology

This study is characterized as descriptive and explanatory, since it measures, describes and explains the relationship and behavior of phenomena. It has a quantitative nature, employing resources and statistical techniques for data collection and processing, in addition to measuring the relationship between variables: national business system and disclosure of greenhouse gases. Therefore, the research was based on bibliographic and documentary review, since the Carbon Disclosure Project database and the annual reports of organizations like the World Bank, World Economic Forum and Transparency International were used. Thus, secondary data were used, i.e., the data were collected and published for other purposes (Sampieri, Collado, & Lucio, 2013).

The research initially considered the population of all companies from the ten largest economies in the world (United States, China, Japan, Germany, India, United Kingdom, France, Italy, Brazil and Canada) presented in the Global 2000 companies list from the 2018 Forbes magazine. In this list, there were 1,402 companies from the ten countries, that is, 70.10% of the 2000 largest companies in the world were headquartered in the ten largest economies in Gross Domestic Product. After this selection, it was analyzed which of these companies had information about the disclosure of their atmospheric emissions. It was found that 1,072 companies responded to the Carbon Disclosure Project questionnaire. Thus, the sample of this research was in 1,072 companies, representing 53.60% of the population of 2,000 companies. Table 1 presents the sample information.

Table 1. Sample of companies analyzed.

Countries	Population (companies)	Sample (companies)	Sample/Population (%)	Number of observations
Brazil	20	16	80%	112
Canada	56	47	83,92%	329
China	251	117	46,61%	819
France	57	47	82,45%	329
Germany	52	47	90,38%	329
India	57	47	82,45%	329
Italy	27	23	85,18%	161
Japan	223	196	87,89%	1,372
United Kingdom	83	76	91,56%	532
United States	576	456	79,16%	3,192
Total	1,402	1,072	76,46%	7,504

Source: The authors.

For each of the 1,072 companies, seven observations were made, one observation for the disclosure of greenhouse gases and six observations for each indicator of the national business system of the countries: political system, financial system, labor system, educational system, cultural system and economic system. The ten largest economies in the world have been chosen, as the countries with the largest economies are the main sources of power and determine much of the world's negotiations. The study investigates the year 2018, by availability of information on the webpage of the Carbon Disclosure Project. When the research was ongoing, the 2019 data had not been released yet.

From this perspective, the Carbon Disclosure Project is a global, non-governmental, non-profit organization that aims to provide a channel for companies to disclose their greenhouse gas emissions and other issues related to climate change. Companies are invited to participate in the survey and answer a questionnaire, which is made available to the public. For measurement purposes, the Carbon Disclosure Project also discloses a score for each firm, according to their responses and transparency when answering the questionnaire. This score is expressed in letters, which are A+, A-, B+, B-, C+, C-, D+, D- and F. Companies that carry out a more complete disclosure of their atmospheric emissions receive the A+ or A- grades. On the other hand, companies that disclose incomplete information receive D+, D- or F grades.

The study of Kouloukoui et al. (2019) assigned numerical values for each of these letters, in order to facilitate the performance of statistical tests and discover the influence of aspects such as company size and sector of action in the disclosure of greenhouse gases. Thus, it was assigned the value 100 for A+, 95 for A-, 85 for B+, 80 for B-, 60 for C+, 40 for C-, 20 for D+, 5 for D- and 1 for F. The dependent variable of this study is measured on a scale of 100, when the company carries out a more detailed disclosure of information about its greenhouse gas emission, to 1 when the company carries out a less detailed disclosure. For the dependent variable, 1,072 observations were made, one for each company in the sample. Table 2 shows the assigned value for each letter of the Carbon Disclosure Project.

Table 2. Values assigned to the disclosure level.

Carbon Disclosure Project Grade (CDP)	A+	A-	B+	B-	C+	C-	D+	D-	F
Score (%)	100	95	85	80	60	40	20	5	1

Source: The authors.

The independent variables used in this study are the characteristics of the national business system of each country, composed by six systems: political system, financial system, labor system, educational system, cultural system and economic system. For each of these systems, an indicator was selected, being them: perception of corruption, easiness access to credit, cooperation between employees and employers, quality of the education system, distance to power and degree of economic development. For these independent variables, 6,432 observations were made, with data extracted from reports of World Bank, World Economic Forum, Transparency International and the Hofstede website. The indicators and their sources are presented in Table 3.

Table 3. Indicators analyzed

National System	Hypotheses	Indicator	Source
Political System	H1	Perception of corruption	Transparency International (2018)
Financial System	H2	Easier access to credit	World Economic Forum (2018)

Labor System	H3	Cooperation between employees and employers	World Economic Forum (2018)
Educational System	H4	Quality of the education system	World Economic Forum (2018)
Cultural System	H5	Distance to power	Hofstede (2018)
Economic System	H6	Degree of economic development	World Bank (2018)

Source: The authors.

After its collection in an Excel software spreadsheet, the data were submitted to descriptive statistics, in order to obtain the central trend and dispersion indexes of the sample. Thus, the numbers of minimum, mean, median, maximum and standard deviation were determined. This information is important, since it improves the representation of the data and facilitates the choice of the most appropriate statistics to test the hypotheses developed. Then, a correlation was performed between the variables analyzed, in order to test whether there are linear dependencies between the variables. In order to find the power of influence of the national business system in the disclosure of greenhouse gases, hierarchical regression of data was used, exemplified by the following conceptual model.

$$Disclosure_{GEE} = \beta_0 + \beta_1 pol + \beta_2 fin + \beta_3 lab + \beta_4 edu + \beta_5 cul + \beta_6 eco + \mu$$

This conceptual model was operationalized by IBM statistical package for the social sciences software, version 22. In this econometric model, the dependent variable is expressed by "Disclosure_GEE". Moreover, $\beta_1 pol$ represents the political system, $\beta_2 fin$ represents the financial system, $\beta_3 lab$ represents the labor system, $\beta_4 edu$ represents the educational system, $\beta_5 cul$ represents the cultural system, $\beta_6 eco$ represents the economic system and μ represents the residue or error of the proposed model. It is noteworthy that hierarchical regression of data was chosen, since as the study analyzes one year (2018) and it would not be relevant to perform a regression of data in panel, which considers the effect of years on the dependent variable.

4. Analysis of results

Table 4 presents the values of the independent variables of the study: perception of corruption, easier access to credit, cooperation between employees and employers, quality of the education system, distance to power and degree of economic development.

Table 4. Description of independent variables.

Country/Indicator	POL	FIN	LAB	EDU	CUL	ECO
Brazil	35	3,6	4	2,6	69	0
Canada	81	4,9	5,4	5,4	39	1
China	39	4,5	4,6	4,5	80	0
France	72	4,1	3,9	4,3	68	1
Germany	80	5,2	5,3	5,4	35	1
India	41	4,5	4,5	4,6	77	0
Italy	52	3	4	3,7	50	1
Japan	73	5,2	5,7	4,4	54	1
United Kingdom	80	4,4	5,3	4,7	35	1
United States	71	5,5	5,4	5,6	40	1

Source: The authors.

Based on Table 4 one can observe that, in general, developed countries have a better national business system than emerging countries. Thus, it is observed that Brazil, China and India have more corrupt institutions than Germany, Canada, the United States, France, Italy, Japan and the United Kingdom. Regarding the ease of access to credit, companies located in Brazil and Italy have more difficulties to raise financial resources than companies in the rest of the sample. While, regarding the labor system, it is possible to diagnose that there is a better relationship between employees and employers in Germany, Canada, the United States, Japan and the United Kingdom than in Brazil, France, India and Italy.

Moreover, it is noticed that, in 2018, the country of the sample that had the worst education system was Brazil, while the best education system was present in the United States. The education system closest to the Brazilian was the Italian, being it 29.72% better than the Brazilian educational system. While regarding the distance to power, it is perceived that Brazil, China, France and India accept more the inequalities of concentration of power than Germany, Canada, the United States, Italy, Japan and the United Kingdom. Finally, countries such as Germany, Canada, the United States, France, Italy, Japan and the United Kingdom are considered developed, while Brazil, China and India are considered emerging.

Table 5 shows the descriptive statistics for the dependent variable, i.e., the disclosure of greenhouse gas emissions on the Carbon Disclosure Project webpage, measured through the carbon disclosure project (Kouloukoui et al., 2019). Through this table, it can be inferred that the minimum disclosure is equivalent to 1, that is, the letter F of the degree of disclosure. It is also noticed that French companies, on average, released more information about their atmospheric emissions than companies in other countries. UK companies ranked second in terms of disclosure. By contrast, Chinese and Indian companies were less transparent in the disclosure of greenhouse gases than German, Brazilian, Canadian, American, French, Italian, Japanese and British companies.

Table 5. Descriptive statistics of the companies analyzed.

Country	n	Minimum	Mean	Median	Maximum	Standard Deviation
Brazil	16	1	63.19	72.5	95	31.54
Canada	47	1	42.38	60	100	34.90
China	117	1	1.89	1	20	3.55
France	47	1	74.38	95	100	34.52
Germany	47	1	62.43	85	100	36.21
India	47	1	26,15	1	100	36.86
Italy	23	1	49.35	60	100	44.43
Japan	196	1	59.59	85	100	37.81
United Kingdom	76	1	68.22	85	100	33.46
United States	456	1	43.78	60	100	38.34

Source: The authors.

In relation to the mean term, it is observed that Chinese and Indian companies have the numerical value 1 as the median. This means that in the distribution of the sample of companies in these countries, more than half disclosed only the minimum information. On the other hand, companies based in Germany, France, Japan and the United Kingdom had an average term of 85, 95, 85 and 85, respectively. In other words, companies in these countries have strived to carry out a more complete greenhouse gas disclosure, given that the maximum disclosure value is 100. Regarding the maximum disclosure value, only Brazil and China had no companies in 2018 that disclosed as much as possible information about their greenhouse gas emissions.

The data for the standard deviation show that the variation of the data in relation to the mean. Italian companies have a lower standard of disclosure of their atmospheric emissions, when compared to companies in the other countries. This is proven by the highest standard deviation value in this country. Thus, in Italy, there are large differences in the disclosure of greenhouse gases, that is, there are companies that disclose little information about their emissions and other companies that disclose a lot of information about their atmospheric emissions. In contrast, Chinese companies have a similar disclosure, since it presents a smaller deviation around the average. Chinese companies have a low level of greenhouse gas disclosure.

The high level of disclosure for French companies may be associated to the adoption of a law called Grenelle Acts, which requires large companies, since April 2012, to draw up an annual sustainability report (Kaya, 2016). In this way, companies are under pressure to be more transparent about their environmental policies than Chinese companies, since in China, disclosure is carried out voluntarily (Li, Khalili, & Cheng, 2019). In addition, companies based in European developed countries carry out a more explicit environmental disclosure, that is, more detailed than American companies, which carry out a more implicit disclosure (Matten & Moon, 2008).

In Brazil, the disclosure of greenhouse gases was higher than some developed countries, such as Germany, Canada, the United States, Italy and Japan. Thus, reflecting the commitment of Brazilian companies to social and environmental transparency. However, it is worth mentioning the supposed reasons for this disclosure. First, only 16 Brazilian companies answered the Carbon Disclosure Project questionnaire and were mentioned on the Global 2000 companies list. Thus, it can be inferred that only companies with a high engagement for corporate social responsibility participated in this questionnaire, which may reflect a high level of greenhouse gases disclosure. Thus, not considering all Brazilian companies.

In addition, companies from emerging countries, including Brazil, can carry out a more complete disclosure in order to legitimize their business actions and attract more foreign investment, since in emerging markets there is less ease of access to credit. The companies carry out the disclosure of environmental information in response to social pressure, in order to legitimize their long-term operations and execute the social contract voluntarily (Cho & Patten, 2007). The work of Luo (2019) analysed the spread of greenhouse gases. The results showed that, from 2009 to 2015, German and British companies made a greater disclosure than Chinese, Canadian and Japanese companies.

Table 6 presents a linear analysis between the dependent variable and the independent variables, i.e., Pearson's correlation coefficients for the variables studied. The data show that the level of corruption, cooperation between employees and employers and the degree of economic development of the country has a positive correlation with the disclosure of greenhouse gases. The values are significant at 0.01, that is, they are significant at 99%. The distance to power has a negative and significant relationship of 0.01 with the disclosure of information on greenhouse gases. No significant figures were found between easier access to credit and disclosure of atmospheric emissions as well as for quality of the education system and atmospheric emissions.

Table 6. Correlations between variables.

Indicators	DISC	POL	FIN	LAB	EDU	CUL	ECO
DISC	1.00**						
POL	0.36**	1.00**					
FIN	0.02	0.49**	1.00**				
LAB	0.13**	0.66**	0.80**	1.00**			
EDU	-0.04	0.45**	0.78**	0.49**	1.00**		

CUL	-0.25**	-0.84**	-0.55**	-0.64**	-0.66**	1.00**
ECO	0.35**	0.94**	0.47**	0.60**	0.44**	-0.84**

Source: The authors.

Thus, there was a positive and significant correlation of 36% between the disclosure and the level of corruption of the country's institutions. While for the cooperation between employees and employers, there is a weak, but, positive and significant correlation. Regarding the economic system, the data show that there is a 35% correlation between the country's degree of development and the disclosure of greenhouse gases from its companies. For the cultural system, a negative and significant correlation of 25% was found between distance to power and disclosure of emissions. These results may suggest that in countries with greater equality of income and power, companies are motivated to make a more complete disclosure. Therefore, countries that are less hierarchical have companies with a greater environmental commitment.

The data also make it possible to infer that as the level of corruption of a country's institutions decreases, the more companies in the country disclose information about their greenhouse gas emissions. Thus, countries where corruption is very high, companies do not have an incentive to act for sustainable development (Lattemann, Fetscherin, Alon, Li, & Schneider, 2009; Oliveira et al., 2018). In addition, it is found that companies located in countries with higher economic development tend to disclose more information about their atmospheric emissions. On the other hand, underdeveloped countries have weak institutions, resulting in less concern about the disclosure of environmental information (Driffield, Jones, & Crotty, 2013; Surroca, Tribó, & Zahra, 2013)

In general, Table 7 shows that the correlations between the variables analyzed are weak or moderate, having only the variable that measures the degree of development of the country (ECO) strong correlations with the other variables of the study. After the correlations, the Shapiro-Wilk and Kolmogorov-Smirnov tests were performed in order to prove the normality of the sample values. The normality of the residuals is an essential assumption for the results of the adjustment of the linear regression model to be reliable. Table 7 presents the results obtained for hierarchical data regression.

Table 7. Hierarchical regression of data.

Dependent variable: Disclosure of greenhouse gases				
Method: Hierarchical data regression				
Sample: 1,072 companies from 10 countries				
Total of observations:	7,504			
Variable	coefficient β	t-statistic	p-value	expected signal
POL	0.486	5.296	0.000	+
FIN	0.395	4.212	0.000	+
LAB	-0.390	-5.052	0.000	+
EDU	-0.565	-7.296	0.000	+
CUL	-0.321	-3.865	0.000	-
ECO	-0.074	-0.769	0.442	+
Model Summary				
R	0.461	Z	47.85	
R2 adjusted	0.208			

Source: The authors.

The data show that there is an influence of the national business system in the disclosure of information regarding greenhouse gases. Thus, a lower perception of the

country's level of corruption and greater easier access to credit positively influence disclosure. Increased cooperation between employees and employers, a higher quality of the education system and greater distance to power have a negative effect on the spread of atmospheric emissions. For this analyzed sample, the degree of economic development of a country has no influence on the corporate disclosure of information on greenhouse gases.

In technical terms, since the values of t are different from 0.05, the results point to the genuine effect, that is, there is an agreement between β and t . The R is the correlation between the observed values for X (perception of corruption, easier access to credit, cooperation between employees and employers, quality of the education system, distance to power and degree of economic development) and the predicted Y value (disclosure of greenhouse gas information) by the multiple regression model. Thus, large R values represent a high correlation between the predicted and observed values of the output variable. Therefore, it can be inferred that there is a moderate probability that the national business system influences the disclosure of greenhouse gases.

There is a positive effect of the country's level of corruption on the disclosure of greenhouse gases information. Thus, companies based in countries with a high level of corruption can be discouraged from adopting greater socio-environmental performance. On the other hand, companies are more likely to disclose more environmental information in countries with a better level of democracy, more effective government services, higher quality regulations and low levels of corruption and nepotism (De Villiers & Marques, 2016). Previous research have found these same findings (Ioannou & Serafeim, 2012; Oliveira et al., 2018; Soares et al., 2020). Moreover, the disclosure of atmospheric emissions is a mirror of the quality of the country's political system.

The data showed that greater easier access to credit positively affects the disclosure of greenhouse gases information. Therefore, countries where financial institutions favor the creation of new businesses and growth of existing businesses tend to have companies with better performance in the disclosure of greenhouse gases. Thus, countries with a strong banking system and a developed capital market have companies that adopt a more responsible environmental behavior. These results were similar with those presented by Soares et al. (2018) e Soares et al. (2020). The financial system can play a key role in the environmental practices of companies, furthermore, those located in countries with bank-based financial systems tend to take into account all stakeholders, favoring greenhouse gases disclosure practices (Jensen & Berg, 2012; Matten & Moon, 2008).

While regarding the labor system, the data revealed that there is a negative influence of better cooperation between employees and employers in the disclosure of greenhouse gases. This finding contradicts the results of Oliveira et al. (2018). Countries with better cooperation between employees and employers tend to have companies with less disclosure. Countries such as the United States and Canada have a good relationship between employees and employers. However, their companies do not have a detailed disclosure of greenhouse gases. Countries that follow the common law legal system, such as the United States and Canada, tend to have companies that value the disclosure of information to investors, such as financial and corporate governance data (Miniaoui, Chibani, & Hussainey, 2019; Walker et al., 2019). Therefore, for the managers of the companies analyzed, it may be more profitable to invest in employees in order to have more satisfied workers, which can generate more profitability and benefits to investors.

The quality of the country's educational system negatively affects the disclosure of greenhouse gases from its companies. Soares et al. (2020) and Walker et al. (2019) also found a negative effect of the education system on disclosure. According Soares et al. (2020), in countries where the education system is government-centered, companies tend to develop more implicit environmental disclosure. Greening and Turban (2000) believe that companies

can disclose more environmental information to attract a greater number of skilled employees. However, in a country where skilled labor is abundant, companies do not have the need to compete for skilled employees. Thus, the quality of the educational system is not a determining factor for the disclosure of greenhouse gases.

Cultural differences can impact different levels of environmental information disclosure (Pucheta-Martínez & Gallego-Álvarez, 2019; Scott, 2008). The results confirm this, since it was found that the country's cultural system affects the disclosure of atmospheric emissions from companies. Thus, companies located in more stratified societies with different levels of power tend to poorly disseminate information about their greenhouse gas emissions.

Furthermore, individuals in these societies accept the unequal distribution of power, have less interest in social rights (Garcia-Sanchez et al., 2016) and care less about environmental issues. Managers of companies located in countries with high distance to power may be less encouraged to disclose their environmental damage, since there is no social pressure and a strong participation of stakeholders in business decisions. These findings converge to the results of previous studies (Barkemeyer et al., 2018; Garcia-Sanchez et al., 2016).

While the degree of economic development for the country, it was found that there is no influence of this variable on the disclosure of greenhouse gases, not confirming Hypothesis 6. The p-value has a value above the acceptable. However, the research found that the political system positively affects disclosure, the financial system positively affects the disclosure of greenhouse gases, the labor system and the educational system negatively influences the disclosure of information on atmospheric emissions. Finally, the country's cultural system has a negative effect on disclosure.

5. Conclusions and managerial implications

This research aimed to investigate the effect of the national business system of the world ten largest economies regarding the disclosure of greenhouse gases information from their companies. In order to achieve this goal, the work analyzed the disclosure of greenhouse gas information from 1,072 companies from 2018. The national business system of the countries was analyzed through variables such as: level of corruption, easier access to credit, cooperation between employees and employers, quality of the education system, distance to power and degree of economic development.

The results show that the disclosure of greenhouse gases can be a reflection of the country's national business system. In less corrupt countries, companies disclose more information about their atmospheric emissions, with Hypothesis 1 being found. In addition, the easier access to credit positively affects the disclosure of greenhouse gases. Otherwise, in countries where financing takes place more easily, companies tend to have greater transparency of their air pollutants. Thus, proving Hypothesis 2. However, it was found that cooperation between employees and employers and quality of the education system negatively affect disclosure. Therefore, it is not possible to prove Hypothesis 3 and 4.

In relation to the cultural system, the data revealed that the distance to power has a negative effect on the disclosure of greenhouse gases. Thus, companies, based in more hierarchical economies and where people accept more inequalities of power, tend to disclose less information about their atmospheric emissions. Thus, Hypothesis 5 was confirmed. Finally, it was not possible to verify the influence of the economic system, measured through the degree of economic development of the country, in the disclosure of greenhouse gases. The statistical results were not significant, than Hypothesis 6 was not confirmed.

These results may contribute to the expansion of studies on the national business system and disclosure of greenhouse gases, since there is still a lack of studies that address the interference of institutional environments in the sustainability practices of companies.

Moreover, the study intends to contribute managerially, demonstrating that different institutional environments can provide different environmental disclosure practices. Furthermore, multinationals should analyze the country's institutional environment before settling in, verifying how formal and informal institutions work in relation to sustainability.

Therefore, managers should be aware that in developed countries the practices of greenhouse gases disclosure are clearer. In addition, in these countries there is greater social pressure for the company to act with greater environmental transparency. Therefore, when installing themselves in these environments, managers should allocate more resources in the disclosure of environmental reports and sustainability practices that meet the interests of all stakeholders. On the other hand, emerging countries may have less power for institutions to pressure companies to act more responsibly. However, it is up to managers from these countries to promote environmental debate, in order for their companies to be references to other companies and to foster a more critical thinking in these societies.

The findings obtained in this study should be interpreted with caution, given its limitations. Once that, the sample was composed by companies that have answered the Carbon Disclosure Project questionnaire and are present in Forbes magazine's Global 2000 companies list. Thus, the results cannot be generalized to all companies in the countries. In addition, this research covers the year 2018, therefore, the results may differ when analyzing other years, especially in 2008, when a global financial crisis was faced and 2020 when the global pandemic of Covid19 was confronted. In view of these limitations, it is suggested that future studies can expand the sample used and the number of countries studied, as well as investigate the disclosure of greenhouse gases in other years and add other variables to represent the national business system.

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