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The determinants mostly disclosed by companies that are members of the Carbon Disclosure Project

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Abstract Concerns about climate change as a result of anthropic actions have led to an increase in the volume of information disclosed about it in the reports of companies that are members of the Carbon Disclosure Project (CDP). In this context, the factors most disclosed remain obscure due to both the complexity of climate change impacts and the stakeholders' different interests. This study aims to identify which factors are most disclosed in the reports of companies that are members of CDP. For this purpose, it is necessary to investigate if the factors indicated by managers and experts are the main ones disclosed in the reports of Brazilian companies that are members of CDP, as well as to identify which companies stand out in climate change disclosure based on these factors. To this end, 463 reports submitted by 48 companies between 2014 and 2016 were examined and 32 factors were investigated using the NVivo® software. Some companies submitted reports with unified titles, which reduced the sample. The results indicate that certain factors—prevention of pollution, prevention of loss, management of environmental assets, volume of greenhouse gas (GHG) emissions, and climate change strategy—account for 50.03% of the total volume of information disclosed about climate change. The main lesson learned from this research is

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that climate change mitigation strategy is strongly supported by the evidence of corporate annual reports, and it has relation with the following determinant factors: pollution prevention, loss prevention, environmental asset management, GHG emissions, and the strategy chosen by the companies to deal with climate change. Due to the low volume of research related to loss prevention and pollution prevention, we have identified that little attention has been paid to these items. Based on our results, we recommend that climate change mitigation strategies begin to consider these determinant factors in their structure because both have a strong influence in demonstrating how companies are managing these factors for stakeholders. Therefore, companies can benefit from this data to manage their resources for the maintenance of the social contract (legitimacy) through the factors most disclosed, especially companies with lower scores on the scale of ranking presented. Hence, stakeholders can have access to more information on strategies that mitigate climate change and help companies improve the disclosure of the actions that contribute to reduction of GHG emissions.

Keywords Disclosure · Climate change · Carbon Disclosure Project (CDP)

1 Introduction

Given the increasing importance of concerns about the impacts of climate change on the environment, this issue has become a productive field for the investigation of social-environmental disclosure. It is especially productive regarding the increase in the transparency of actions taken by large companies (both national and international) to cope with climate change (Dos Reis et al. 2015; Begum and Pereira 2015).

Climate change disclosure has been regarded as one of the main consistent communication instruments, it has been used in the process of responding to pressure from the government, society and the market (Barbieri 2011). Some studies—Farias (2008), Murcia (2008), Rover et al. (2012), Fernandes (2012), Antal and Van Den Bergh (2013), Burgwal and Vieira (2014), Silva et al. (2015a, b), and Braam et al. (2016)—have identified a great volume of environmental disclosure, frequently measured by the amount of the words related to this theme in both mandatory and voluntary disclosure instruments.

Additionally, voluntary actions to deal with climate change can be incorporated into business principles and, in some cases, into productive chains as a model of transparent business (Ihlen and Roper 2014). One of these voluntary actions is the provision of the information required annually by the Carbon Disclosure Project (CDP). CDP is an international organization based in the United Kingdom that reunites global investors and aims to increase the companies' transparency regarding GHG emissions and treatment. When companies fill in the CDP form, they are not only providing information but also subscribing new practices of voluntary disclosure in order to meet the stakeholders' needs for information on climate change (Reid and Toffel 2009; Luo et al. 2012).

Disclosure of the actions taken to deal with climate change leads into this direction, where companies have developed mechanisms for disclosing their actions to the market (stakeholders). Determinants factors are elements that represent characteristics present in the companies, which are evidenced in the annual reports and, as a result, they influence the process of legitimacy of the practices made by the companies in which they produce their products and services.

Thus, it is important to identify the main determinant factors of the practices of voluntary disclosure in order to make better contributions to the process of climate change disclosure. Studies such as Rover et al. (2012), Ribeiro and Guzmán (2008), Antal and Van Den Bergh (2013), Burgwal and Vieira (2014), Silva et al. (2015a, b), and Lopes et al. (2017) have presented the main factors of environmental disclosure—company size, activity sector, the managers' independence, and environmental performance. Hence, there is an increase in the number of investigations to identify the practices of climate change disclosure and its determinant factors (Silva et al. 2015a, b; Braamet al. 2016). Most of the literature focuses on voluntary environmental reporting of large companies (Amran et al. 2014), but few studies specifically approach the disclosure of information related to climate change.

It has been found that the implementation of disclosure policies into accounting practices enables stakeholders to form an opinion about companies and it enables legitimacy of both the company and its expectation of holding their position in the market (Deegan 2002; Dias Filho 2012; Begum and Pereira 2015). It is through the adoption of sustainable actions and through the disclosure of social-environmental information that large companies (responsible for great volume of carbon emissions) show their effort to legitimize themselves before society (Deegan 2002; Eugénio 2010). Large companies and large consumers of natural resources have historically been responsible for most of the global environmental problems.

Hence, the publication of social-environmental information through management reports has become a means of reducing uncertainty over the companies' results in the market, which is increasingly concerned with how companies deal with climate change (Eugénio 2010; Dias Filho 2012). Thus, the efforts to certify the quality of social-environmental responsibility are developed strategically by companies (Begum and Pereira 2015) in order to maintain the extraction of natural resources needed for their activities, revealing important aspects of its legitimacy in society (Eugénio 2010; Dias Filho 2012).

As a means of committing themselves to maintaining their reliability before external users, companies have increased the volume of information provided to the market. One example of this is voluntary participation in answering the CDP questionnaire. On the other hand, as posited by Iatridis (2013), researchers have sought to measure the volume of this disclosure in order to assess its efficiency in the provision of the necessary information to stakeholders because the quality of information increases the investors' trust in the profitability of their investments. Concerning climate change disclosure, Amran et al. (2014) found that the level of disclosure of such information in Asian and Pacific countries is still low, influenced by determinant factors such as activity sector, environmental certification, and country of origin.

Based on these assumptions, this study presents the following research question: Which factors are most disclosed in the reports of Brazilian companies that are members of CDP? Therefore, the aim of this study is to identify which factors are thes most disclosed in the reports of companies that are members of CDP. For this purpose, we investigate if the factors of climate change indicated by managers and experts are the main ones disclosed in the reports of Brazilian companies that are members of CDP, as well as to identify which companies stand out in climate change disclosure based on these factors.

This study responds to the demand identified by Antal and Van Den Bergh (2013), Amran et al. (2014), and Braamet al. (2016) for studies on aspects that determine corporate practices of disclosure. The aim is to help companies improve the quality of information presented in their reports, in this case, about climate change. This study is also a contribution to the research in this field together with other studies, such as that of Farias (2008), Rover et al. (2012), Fernandes (2012), Burgwal and Vieira (2014), Kos (2014), Silva et al. (2015a, b), and

Braamet al. (2016), since it identifies the factors most disclosed by examining the reports of companies that are members of CDP Brazil. Besides, this study expands the discussion on the factors presented by Doná et al. (2015), who investigated five factors restricted to the annual reports provided by companies on Bovespa, the Brazilian stock exchange.

According to the legitimacy theory, companies disclose their actions with a focus on the maintenance of the social contract, which is essential for companies to continue in the market (Deegan 2002; Eugénio 2010; Dias Filho 2012; Barakatet al. 2016). Thus, contributions from the legitimacy theory are taken in this study regarding the perspective of the stakeholders' power in influencing companies through their decisions (Barakatet al. 2016), which directly affect the continuity, or not, of the social contract. This subject interests stakeholders, since they want to know which corporate actions have been taken to cope with climate change. From the identification of the factors mostly disclosed, it is possible to inform the type and volume of information most disclosed, which in turn could indicate a higher level of legitimacy.

Taking the social contract proposed by the legitimacy theory as a model, the factors of climate change disclosure are a means of helping companies in the process of social legitimacy. Companies can take the factors most disclosed as a reference to draw up their annual reports based in own strategy of mitigation of climate change. This is a contribution to the process of climate change disclosure, since stakeholders acknowledge significant incidence of the factors found in the reports (Faria et al. 2016). From the identification of the factors in this process, one can have a basic guide of elements to disclose in their own annual reports. This dissemination strategy contributes to the company's development of climate change mitigation practices so that it will have results to be able to show in its annual reports. These elements are essential for maintaining the social contract as proposed by the legitimacy theory.

2 Legitimacy theory

In this new world context, where ecological awareness has set guidelines that encourage companies to develop by reducing the volume of pollution, society has demanded companies to adopt a new posture, that is, to pursue economic growth together with environmental responsibility so that the increasing impacts of climate change may be reduced. On the other hand, aiming at the company's longevity, the incorporation of social-environmental concerns into transactions and business is a means of ensuring the company's maintenance in the market. Thus, as a mechanism for disclosing the actions that contribute to climate change mitigation and for the protection of the company's image as socially responsible, companies need to disclose this set of information through environmental reports (Machado and Ott 2015).

Disclosure is the process of publicizing the company's economic and financial information, as well as non-financial information, to respond to international demands from several kinds of users of disclosed accounting information (Hendriksen and Van Breda 2007; Pires and Silveira 2008). The result of this capacity of incorporating values from the environment around them requires the analysis of the efforts companies make to be regarded as organizations that work in conformity with the stakeholders' expectations. Pereira et al. (2010) argue that one of the reasons for the increase in the disclosure of environmental information is the company's pursuit of legitimacy before society as a way of mitigating the impact of its activities on the environment and on its social image.

A company's capacity of adapting itself to new contexts, faced with the society's perspectives, is measured by its necessity of insertion and maintenance in the market. With the valuation of sustainable themes, corporate behavior has faced new challenges in order to respond to expectations in the market, which expects a management posture that cares for the environment in business and discloses their actions to be regarded as legitimate before society. In this context, according to Suchman (1995), legitimacy is a general perception or assumption that the companies' actions are desirable, proper, or suitable within a certain social system of norms, values, beliefs, and definitions.

This concept has been frequently used in studies in Brazil (Barakatet al. 2016), assuming the existing social contract between society and companies, which have a moral obligation to be socially responsible with the environment around them (O'Donovan 2002; Dias Filho 2012; Eugénio 2010; Machado and Ott 2015). If they are not socially responsible, society can break this contract and the company's survival is threatened by the increase in social pressure (Deegan 2002; Correa et al. 2015). According to the legitimacy theory, voluntary disclosure is an attempt to demonstrate the company's commitment to being environmentally responsible and to developing its activities in conformity with the society's values related to information disclosure. Therefore, companies attempt to legitimize themselves not only before society but also before the companies with which they do business. Organizations regarded as legitimate tend to have greater possibility of surviving and greater capacity to raise resources than those that are not legitimate (Rossoni 2016). Legitimate companies enjoy more credibility in the market, increasing the stakeholders' trust in their shares.

Additionally, it is important to highlight that the legitimacy theory has a sociological perspective, which is manifested in the company's concern with consolidating its actions in society through the compliance and respect to the principles related to environment, citizenship, customs, and legal order of that society. Companies do this by disclosing their economic activities, their use of human and material resources, and their impacts on the environment, which is a way of consolidating their institutional image and reducing social pressure (Conceição et al. 2012).

Stakeholders search for information that can afford assessment and judgment (1) of the means companies use to achieve their business goals, (2) of how they use the resources coming from social concession, as well as (3) of their compliance with ethical and legal principles established by society (Conceição et al. 2012). Legitimacy theory expounds the companies' strategic pursuit of disclosing practices regarded as socially responsible. In this pursuit, they adopt specific initiatives to ensure that their commitment is regarded as legitimate and so obtain all the benefits necessary for maintaining their activities. Initially, they legitimize themselves by complying their practices with the norms and standard behavior of the environment around them (Deegan 2002; Dias Filho 2012). According to Machado and Ott (2015), in Brazil, they do this by reporting actions that can popularize their annual reports templates, attract supporters of their management style, attract members to develop environmental actions, and show they produce environmentally appropriate results. For this reason, this study identifies the factors of the practices of climate change disclosure, that is, of standard behavior, enabling both an ex ante and an ex post analysis.

As social institutions, companies operate via the established social contract, and, in order to maintain themselves in the market, they need to offer products, goods, and services that meet collective needs, safeguarding the limits established for this practice (Conceição et al. 2012). Thus, if the maintenance of a company depends on its capacity to meet the expectations of society, the company is expected to work hard so that its activities may be accepted and

regarded as legitimate (Deegan 2002). This process of acceptance is directly related to the disclosure of the company's actions (and their outcomes) in the reports delivered to stakeholders, and so, they are important sources of information and assessment of the company's efforts to gain legitimacy (Dias Filho 2012).

In this context, disclosure can help companies project the necessary image before society for maintenance of the social contract (Eugénio 2010; Machado and Ott 2015). Thus, the identification of the determinant factors in the annual reports can indicate which mechanisms are used for maintenance of the social contract related to climate change disclosure. The factors also determine how the process of legitimacy occurs through the company's actions of disclosure faced with climate change. Therefore, the factors show the company's profile of disclosure, which can reveal the practices stakeholders value in a company to cope with climate change. This process can occur through an ex ante analysis (Fig. 1), which enables the identification of the factors. An ex post perspective (Fig. 1) is also proposed so that companies are informed about the most significant factors, classified according to the volume of information provided in the reports.

Thus, the factors are a means of contributing to legitimacy of climate change disclosure.

According to Barros and Monteiro (2012), the phenomenon of disclosure means a response to structural changes and more transparent interaction with stakeholders. Disclosure of environmental information, including that concerning climate change, is regarded as one of the main ways companies can project a socially responsible image to legitimize their behavior before stakeholders. Through the main determinant factors, companies can increase and manage their volume of information since they are the factors mostly valued by stakeholders. Thus, they will search for information about climate change in the reports. It is important to identify which factors stand out in the disclosure by ranking them and, hence, help the companies' better meet the stakeholders' interests. It is posited that organizations increase disclosure on business sustainability when they perceive they can get benefits that will make it easier to achieve their corporate and economic goals (Conceição et al. 2012).

3 Factors of climate change disclosure

The results from the first phase of our study, in Faria et al. (2016), show a diversity of determinant factors of climate change disclosure. Firstly, a bibliographical research was carried out in order to identify the determinant factors of voluntary disclosure concerning the actions taken to cope with climate change. Based on this collection, it was possible to build up a construct of 32 factors (Table 1). From this construct, we created a five-point Likert scale questionnaire (one for "not decisive" and five for "strongly decisive") for each of the 32 factors. The questionnaire was sent electronically to the managers of 88 companies that are members of CDP, according to the 2014 report. This process was carried out through a collecting tool available on the Internet. The same questionnaire was sent to the experts. There

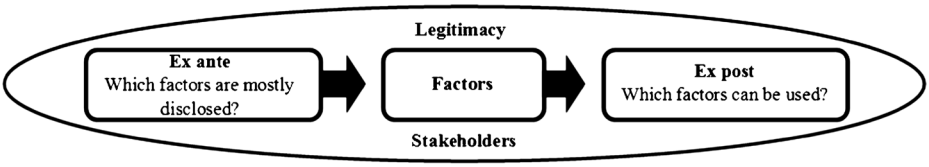


Fig. 1 Perspective of the factors determinants and theory of legitimacy

were 66 respondents in total: 34 managers out of 88 and 32 experts out of 67. Data tabulation was also carried out electronically and the data was transferred to the Statistical Package for the Social Sciences® (SPSS) version 20 for the statistical processing of data.

It was also necessary to process the data statistically with Mann-Whitney test so that the results of the two samples could be compared and then the difference between the means found

Table 1 Determinants factors, references, and weight given by managers and experts

Factor	References	Weight
Climate change strategy	Birnk (2013), Freitas et al.(2014), Begum and Pereira (2015)	4.4274
Pressure from stakeholders	Freitas et al.(2014), Alperstedt et al. (2010), Luo et al. (2012), Moreira (2013), Freitas et al. (2014)	4.2307
Management of environmental risk	Hendriksen and Van Breda (2007), Barbieri (2011), Silva et al. (2015a, b), Pavesiet al. (2016)	4.1847
Level of regulation	Alperstedt et al. (2010), Reis (2011), Sullivan and Gouldson (2012), Silva and Da Costa Lima (2013), Moreira (2013), Freitas et al. (2014).	4.1829
Transparency score CDP	CDP (2014)	4.1296
Corporate strategy	Brouhle and Harrington (2009), Barbieri (2011)	4.1020
Media (pressure/reputation)	Alperstedt et al. (2010), Moreira (2013), Freitas et al. (2014)	4.0671
Volume of GHG emissions	Balatbat and Wang (2010)	4.0533
Performance score CDP	CDP (2014)	4.0386
Management of environmental assets	Barbieri (2011), Iatridis (2013)	4.0165
Participation in ISE	Cruz (2015)	3.9118
Activity sector (high/low impact)	Gonçalves (2011), Luo et al. (2012), Burgwal and Vieira (2014)	3.9118
Participation in GRI	Prado-Lorenzo et al. (2009)	3.8998
Projects CDM/carbon credits	Macêdoet al.(2014)	3.7472
Statutory obligation	Alperstedt et al. (2010), Farias (2013)	3.7197
Dow Jones Index	Moreira (2013)	3.6792
Environmental management system	Barbieri (2011), Amran et al. (2014), Colareset al. (2015)	3.5983
Prevention of pollution	Barbieri (2011)	3.5175
Supply chain	Wittneben and Kiyar (2009)	3.4871
Economic performance	Farias (2008), Corrêa (2009), Ziegler et al. (2011), Gonçalves (2011), Moreira (2013)	3.4072
Level of dependence on the stock market	Hendriksen and Van Breda (2007), Prado-Lorenzo et al. (2009), Luo et al. (2012), Iatridis (2013)	3.2996
Environmental auditing	Gonçalves (2011), Rover et al.(2012)	3.2776
Size of the company	Ribeiro and Guzmán (2008), Gonçalves (2011), Rover et al. (2012), Murcia (2008), Iatridis (2013), Lee (2012), Burgwal and Vieira (2014)	3.2564
Competition	Alperstedt et al. (2010), Moreira (2013)	3.2390
Prevention of loss	Barbieri (2011)	3.2096
Comparability of reports between activity sectors	Hendriksen and Van Breda (2007), Delmas and Toffel (2008), Sullivan and Gouldson (2012), Garcia and Orsato (2013)	3.1949
Environmental certification	Barbieri (2011), Amran et al. (2014), Colareset al. (2015)	3.0267
Internationalization	Stanny and Ely (2008), Gonçalves (2011), Batista et al. (2016)	3.0055
Types of answer CDP quest	CDP (2014)	2.9200
Independence of managers	Amran et al. (2014)	2.7105
Auditing by Big Four	Rover et al.(2012), Murcia (2008), Iatridis (2013), Silva et al. (2015a, b)	2.6296
Duality CEO × chairman	Amran et al. (2014)	2.0147

Source: Faria, Andrade, and Gomes (2016)

out. From this difference, it was possible to check out which means were statistically similar for managers and experts, demonstrating agreement of each factor in both groups. After that, each factor mean was used, and from this single scale, it was possible to identify the most and least decisive factors of climate change. The initial step for the statistical data processing is the analysis of the data itself. In order to compare the managers' and experts' results, it was necessary to use a statistical tool capable of carrying out this job and capable of informing whether differences between the means were statistically significant.

When choosing the statistical method, it is necessary to previously normalize the samples since parametric tests are more efficient when samples are already normalized, otherwise, non-parametric tests should be used (Field 2009; Marôco 2011). The tests used were Kolmogorov-Smirnov (KS test) and Shapiro-Wilk (SW test), both recommended in the literature (Field 2009; Marôco 2011) for validating normalization. The results show that this data was not normalized, thus non-parametric tests were used. Mann-Whitney test was used for being the equivalent *t* test (Student's) for samples with normal distribution. Non-parametric tests use the median as a reference to calculate. Based on the five-point scale created, the median is 2.5, a reference value for indicating that 50% of the data might be above or below (Marôco 2011).

The aim of this test was to compare the means according to the medians of each factor and show which ones have a significant statistical difference between the two groups. Factors that were similar, that is, with no significant difference ($p > 0.05$), confirmed that there are similarities between the managers' and the experts' opinions regarding certain factors. From these results, it was also possible to check out different levels of importance of factors in this sample. This difference was based on the means (Table 1), which were obtained through the scale elaborated. According to the five-point Likert scale, managers and experts not only validated the literature but also provided information for identifying similar means. They also gave an importance score to each factor in the process of climate change disclosure. All of this enabled the scaling of the factors according to their means calculated with the Mann-Whitney test.

Regarding the environmental auditing factor, this study is supported by Gonçalves (2011), who assessed 83 companies listed on BM&FBOVESPA and identified that companies that carry out environmental auditing tend to disclose more information to stakeholders in their reports. Rover et al. (2012) corroborate this finding, especially regarding voluntary disclosure. According to Murcia (2008), Rover et al. (2012), Iatridis (2013), and Silva et al. (2015a, b), who studied companies audited by the biggest auditing companies in the world, known as the Big Four (KPMG, Price, Ernest Young, and Deloitte), the studied companies disclosed higher levels of quality environmental information in general and about climate change as well.

Environmental certification, another factor, is a mechanism of ensuring the implementation quality of an Environmental Management System (EMS). ISO 14.001 is applicable to any organization that wants to improve its EMS and has been regarded as a factor of climate change disclosure according to Villas Boas (2012), Colareset al. (2015), and Amran et al. (2014). Concerning comparability, Hendriksen and Van Breda (2007) posit that the lack of standardization of the environmental reports affects comparability between companies by the investors, especially at the moment of analysis. This also has a negative influence on comparability of information related to climate change. Delmas and Toffel (2008) and Sullivan and Gouldson (2012) assert that companies fail in the process of disclosing when they do not facilitate comparability between reports and create their own models of disclosure.

Competition is a determinant factor that the companies deal with it every day. Alperstedt et al. (2010) demonstrate that competition is taken into account in corporate strategy concerning environmental aspects in order to guide the company in the constant process of

improving disclosure faced with competitors. Another factor is economic development as asserted by Farias (2008), who identified that economic development indirectly affects environmental disclosure in the his study of 87 Brazilian companies. Ziegler et al. (2011), Gonçalves (2011), and Moreira (2013) corroborate the positive results of the relationship between economic development and environmental disclosure.

Regarding the companies' internationalization, especially in the process of trading with other countries, Stanny and Ely (2008) identified a positive relationship between companies that are members of CDP in the USA and the level of climate change disclosure. Gonçalves (2011) and Batista et al. (2016) confirm these results even though they did not study only the companies of CDP. Another factor to be investigated is the development of an image and reputation, which positively influence voluntary disclosure of social-environmental information (Moreira 2013). On this matter, Lopes et al. (2017) add that environmental disclosure makes a positive contribution to reputation and value creation. In their investigation, Freitas et al. (2014) prove that there is a direct relationship and they state that pressure from the media is a factor of climate change disclosure for the Brazilian companies in their sample.

In this context, there is also the level of dependence on the stock market, which is characterized by the percentage of capital a company trades on the stock exchange. Companies that trade greater amounts of capital are more dependent and therefore tend to disclose more information to stakeholders (Hendriksen and Van Breda 2007). Prado-Lorenzo et al. (2009) had already confirmed this with companies that are members of Global Reporting Initiative (GRI) and Luo et al. (2012) with 500 companies of CDP. Both studies investigated climate change disclosure. Similarly, the government has an important role in the process of disclosure as an encourager through its own legislation, quite often with the power to punish those who do not comply with it (Silva and Da Costa Lima 2013). Thus, the greater the level of specific regulation is, the greater the volume of disclosure tends to be (Reis 2011).

Even with disclosure required by the government, disclosure can also be initiated through the company's own statutory regulation. Alperstedt et al. (2010) demonstrated that adequacy to in-house standard norms is a factor of disclosure within corporate environmental strategy. Additionally, the pressure from stakeholders on companies is a determinant factor of climate change disclosure (Freitas et al. 2014) since there is an increasing awareness of the risks of climate change to business. Similar to the performance, the sector of activity appears to be one of the main determinant factors of climate change disclosure, especially for the most polluting companies (Gonçalves 2011; Lopes et al. 2017). Companies in the sectors of oil and gas, energy, cellulose, chemicals, transport, and metals and minerals are regarded as the most polluting ones. Therefore, they tend to disclose more information in order to maintain transparency of their operations and meet the stakeholders' demands (Brouhle and Harrington 2009; Lee 2012), as well as to comply with the social contract.

Murcia (2008), Gonçalves (2011), Rover et al. (2012), and Iatridis (2013) confirm that the company's size is a factor for the increase in voluntary environmental disclosure presented to stakeholders. Ribeiro and Guzmán (2008) also confirm this about Portuguese autarchies and Burgwal and Vieira (2014) about Dutch commercial companies. On the other hand, the results of Batista et al. (2016) and Silva et al. (2015a, b) show a low correlation between these variables. However, in the literature, few studies correlate the company's size to climate change disclosure. One of them is Amran, Periasamy, and Zulkafli, who did not identify any significant positive correlation.

It was not possible to find studies that correlate a transparency score and a performance score (both calculated by CDP) for climate change disclosure. Every year, the companies'

answers are analyzed and scored based on two parallel scoring systems. The transparency score assesses the integrity and quality of answers given by companies according to CDP parameters. The aim is to provide a summary of the extent to which companies answered the questions by CDP in a structured way (CDP 2014). Companies are encouraged to achieve a high transparency score, as it shows that the company provided complete information about the processes of management of risks and about the results of measurement and management of emissions. It also shows that the company provided complete information about its strategy to cope with climate change, increasing its potential to attract investment.

Allied with CDP data and without any reference in the literature of other studies, the company's type of response related to the annual questionnaire can be regarded as a determinant factor. It is taken in account due to the variability of answers CDP makes available in the process. They are (1) answered, when the questionnaire is completely answered; (2) provided information, which means the company provided information about it but did not answer the questionnaire; (3) declined, the company decided not to answer the questionnaire; (4) not answered, the company neither answered nor provided information; and (5) not included, which means the company was not invited by CDP to answer the questionnaire. Variation in the answers affects both transparency and performance scores, but it is not the only variable taken into account by CDP to give a score. Therefore, it is relevant to assess the type of response given by companies individually.

Finally, other factors of voluntary environmental disclosure were identified and can also be related to climate change. These are the duality exerted by the same person in the position of a Chairman and CEO (Amran et al. 2014), corporate strategy (Brouhle and Harrington 2009; Barbieri 2011), management of environmental assets (Barbieri 2011; Iatridis 2013), management of environmental risks (Hendriksen and Van Breda 2007; Barbieri 2011; Silva et al. 2015a, b; Pavesiet al. 2016), and independence of the managers concerning their power to make decisions in the company (Amran et al. 2014). These are some of the factors available in the literature. Others can be added, such as participation in GRI (Prado-Lorenzo el al. 2009), participation in Dow Jones Index (Moreira 2013), participation in Corporate Sustainability Index (ISE) Brazil (Cruz 2015), actions for prevention of pollution and disposal, and existence of EMS (Barbieri 2011), the existence of CDM and Carbon Credit projects (Macêdoet al. 2014), supply chain requirements (Wittneben and Kiyar 2009), and volume of GHG emissions (Balatbat and Wang 2010).

Based on all of this, the following hypothesis can be raised: the factors provided by Faria, Andrade, and Gomes (2016) are disclosed in the reports of the companies that are members of CDP. Thus, hypothesis 1 uses the following statistical method:

> H1: the factors provided by Faria et al. (2016) are disclosed in the reports of the companies that are members of CDP.

$$H0 : M1 > 0$$
$$H1 : M1 = 0$$

Where

H0 null hypothesis, presence of factor in the reports.
H1 alternative hypothesis, absence of factor in the reports.
M1 the mean of coverage percentage of each factor in the reports.

For this purpose, it was necessary to analyze the mean of coverage percentage of each factor and regard H0 as valid if all 32 factors provided have a mean above zero. In other words, all the determinant factors provided in our first study will be supported through documentary research in all the reports of the Brazilian companies from CDP. H1, alternatively, will be supported if some of the 32 factors have a mean equal to zero. This hypothesis was tested with the 32 factors. The instrument used for quantitative measurement was the coverage percentage calculated by NVivo®. This software enables the textual analysis of documents, which is a fundamental procedure for the identification of the determinant factors.

Spreadsheets were used to tabulate and organize the data of each search so that all the information was organized to meet our specific objectives. Each coverage percentage calculated was further analyzed through the weighting of each factor identified in the first phase of our research. In the study of the first phase, there is a scale of the factors most disclosed, which was elaborated from the opinions of 34 managers of companies that are members of CDP and of 32 experts, who participated in that study.

Based on Brouhle and Harrington (2009), Gonçalves (2011), Lee (2012), Luo et al. (2012), Burgwal and Vieira (2014), and Lopes et al. (2017), who show the activity sector as the main factor of climate change disclosure, and based on the information available, the following hypothesis could be raised: companies from the most polluting sectors disclose more information on climate change. Thus, hypothesis 2 uses the following statistical method:

> H2: companies from the most polluting sectors disclose more information on climate change.

$$H0 : M1 \geq M2$$
$$H1 : M1 < M2$$

Where

H0 null hypothesis, polluting companies disclose above or equal to the mean.
H1 alternative hypothesis, any company discloses above or equal to the mean.
M1 the mean of coverage percentage of each factor per activity sector.
M2 the mean of coverage percentage of all sectors investigated.

Due to the impact caused by the most polluting companies on the environment through extraction, the generation of residues, GHG emissions (which have an impact on climate change), and others, these companies tend to disclose more information in order to strengthen the social contract. This is the reason why this sector was chosen to support H2; the available data will confirm this hypothesis or not.

4 Method

To achieve the aim of this study, a descriptive research of quantitative approach was carried out. Data collecting was carried out from the literature, and those companies whose data was not accessible for a certain reason (participation in the process of merger, for instance) were

excluded from the sample. The 32 factors (Table 1) identified in the first phase of our research were used as a reference for searching information in the reports of 48 companies that are members of CDP. CDP itself was used as a reference for the selection of the companies, since it is an international organization (based in the UK) that brings together global investors and attempts to increase the companies' transparency by asking the biggest ones in the world to fill in an annual questionnaire. CDP aims to disclose information on the opportunities and risks posed by climate change, on the strategies that have been taken to address climate change and information on the companies' GHG emissions, without disregarding the best economic results. By being members of CDP, companies not only provide information but also prove their commitment to new and external practices of disclosure, despite being deregulated, in an attempt to meet the stakeholders' needs related to environmental issues (Reid and Toffel 2009; Luo et al. 2012).

The present study used the official reports made available on the companies' websites to provide information to the stakeholders of 48 companies between 2014 and 2016. These companies were selected, because they are members of CDP. This was regarded as a criterion for selection since only large companies (both national and international) are invited to answer the CDP questionnaire, that is, the selection was based on the volume of carbon emissions of these companies. They are also responsible for 1.98% of the global GHG emissions and 83.33% of them answer the GRI questionnaire. Another fact is that 16 (33.33%) of the 48 companies are listed on the New York Stock Exchange (NYSE). This demonstrates the global scale influence of the responses of the companies' in the present study.

The reports used were administration report (AR), standardized financial statements (SFS), sustainability reports (SR), and reference forms (RF). It should be pointed out that some companies presented RS in AR, and in the same way, some other companies presented SFS in AR. In these cases, the reports were calculated once, since it was only one file with both reports, but they were analyzed individually. In total, the database encompassed 463 reports, which were analyzed using NVivo® 11. These documents were used due to the legitimacy attributed to them in the literature and because they are obligatory instruments of communication between the company and stakeholders. It should be mentioned that, although AR, SFS, and RF are obligatory, SR is voluntary in Brazil and climate change disclosure is not an obligatory item in all the reports.

NVivo® is a system of document analysis that has tools for textual analysis of reports, audio transcripts, images, and other means of communication. In this phase, it was necessary to insert all the reports into the system by company and with individual identification so that the data source could be tracked through the search engine available in NVivo®. This system enables the search, selection, analysis of correlation, and storage of fragments of the documents through the Node tool. The Nodes represent themes, topics, concepts, ideas, opinions, or experience identified in the search through which it is possible to annotate (group) all the occurrences of an item of a search. Through this process, it was possible to later look for a Node and identify all the occurrences in the documents related to the specific term attributed to a certain Node.

The 32 factors (Table 1) were used to create the Nodes in the system in order to annotate all the occurrences found in the search in NVivo®. The search for the factors was carried out using the tool "Text search," which based on the term attributed to the Nodes generates a report with all the occurrences of the searched term. To increase the quality level of the search, the sub-function "With derived words" was used. This uses the root of each word and expands the search by also identifying variations of a given word.

After inserting the reports into NVivo®, the search was carried out individually with the factor as a term, that is, each factor (total of 32) was searched individually for each company (total of 48), adding up to 1536 searches on database. As an intermediate result, NVivo® generates a report for each search, which is called a "Word tree." This report displays the five preceding and the fives succeeding terms of the searched term, found out in the text of each source (reports) inserted into the system. From the word tree generated for each of the 32 factors and for each of the 48 companies, the system enables individual search of the results and displays access to the source report (several reports can be displayed simultaneously).

The documentary analysis scrutinized each text found by the system in order to identify its relationship to the determinant factor. This analysis took into account the content of the factor versus the content of the fragment found, discarding the terms presented in the reports that, in the context, did not have any relationship to climate change disclosure. The system enables both the selection of the fragments approved and their storage in their related Nodes (factor). Hence, it was possible to identify in the 463 reports the occurrence and number of factors in them, as well as to group them according to the Nodes created in the system. The system also provides reports with the fragments selected, generating the coverage percentage of each Node (factor) in each report of each company.

The coverage percentage is the relative representativeness of the number of words found in the total amount of each selected fragment. This is done based on the total number of words in each report. Since each selected fragment was analyzed in detail concerning its relationship to climate change disclosure, the coverage percentage shows the number of words that disclose information on climate change. Coverage percentages were weighted and grouped (1) by factors for assessment of their level of disclosure in the analyzed documents; (2) by type of report for identification of the means most used to provide information; and (3) by activity sector and by company for the identification of companies, as well as for the ranking of these companies and the sectors that disclosed more information on climate change based on the factors investigated.

In order to demonstrate the score structure (dependent variable) created to classify companies according to the relationship between the coverage percentage and relevance mean, identified in the first phase of our res earch (independent variables), the following structure was adopted:

$$\text{Score} = \frac{\sum x_i P_i}{\sum P_i}$$

Where

Score	is the arithmetic weighted mean (dependent variable).
x_i	is the coverage percentage of factors of each company (independent variable).
p_i	is the weight of the factors identified in the first phase of our research (independent variable).

In order to present the logic chain of actions taken to collect the data in this study, we designed an operational model of research, displayed in Fig. 2.

Through this investigation, the factors that contribute to the process of legitimacy of companies on climate change disclosure were identified. A limitation of this study was related to the results of Deegan and Rankin (1996), who showed that companies tend to disclose

information that favor their corporate image and thus tend to omit negative information that could affect their legitimacy before society. These aspects were regarded as a limitation even though the samples of Deegan and Rankin (1996) did not exclusively encompass companies of CDP. In addition, the method itself is a necessary limitation for research since other methods could reveal new information on this theme and then contribute to the discussion on climate change disclosure.

5 Results

These results show the factors most disclosed in the reports of Brazilian companies that are members of CDP. The coverage percentage of each factor, calculated by NVivo®, is displayed in column "% Cov." in Table 2. It presents the quantitative representativeness of words derived from the factors related to climate change. In total, 2.8746% of the content in the 463 reports is related to climate change disclosure, based on the factors investigated. Sustainability report stands out with a representation of 1.3086% of the total as it is regarded as the main mechanism used by companies to this end. This is followed by administration report, standardized financial statements, and reference forms.

According to the data in Table 2, in hypothesis 1—the factors provided by Faria et al. (2016) are disclosed in the reports of companies that are members of CDP—H1 (the alternative hypothesis) was supported due to the absence in the reports of evidence concerning climate change disclosure in 3 of the 32 factors found in our first study (first phase).

In Table 2, the column "Score" displays the result of the score structure, that is, the data was generated through the weighting of coverage percentage of each factor by the weight of each factor. Their weight was identified in our first study (Table 1), delivered at a congress. It was measured through the five-point scale (where five means the highest score, that is, *strongly decisive*) from the opinions of 34 managers of companies that are members of CDP Brazil and 32 accredited experts on this subject in Brazil. Hence, a ranking score was identified and the factors of climate change most disclosed by Brazilian companies that are members of CDP

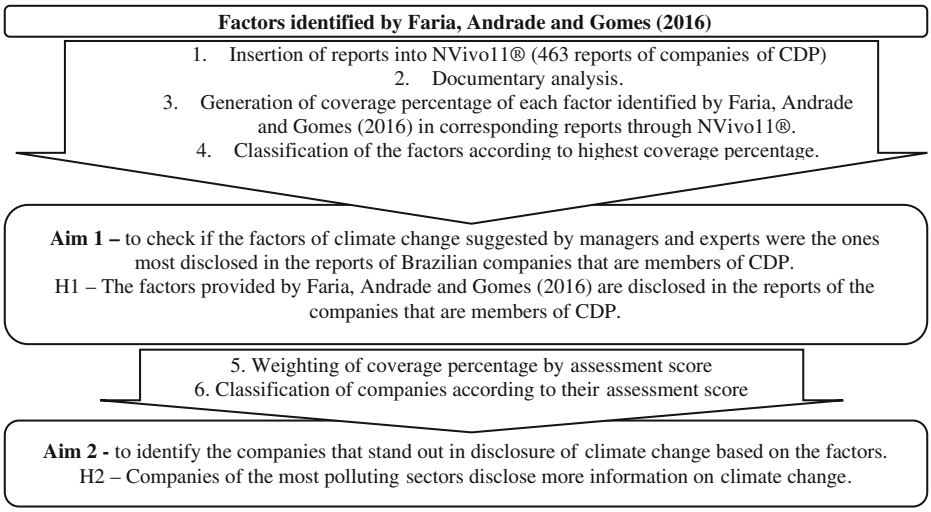


Fig. 2 Operational model of research

Table 2 Assessment of coverage percentage and weighted score (total and by report)

Factors	Total		SR		AR		SFS		RF	
	% Cov.[1]	Score[2]	% Cov.	Score	% Cov.	Score	% Cov.	Score	% Cov.	Score
Prevention of pollution	0.3535	1.2434	0.1525	0.5364	0.1534	0.5396	0.0216	0.0760	0.0260	0.0915
Prevention of loss	*0.3356*	*1.0770*	0.1508	0.4840	0.1587	0.5094	0.0144	0.0462	0.0117	0.0374
Management of environmental assets	0.2687	1.0792	0.1552	0.6234	0.0525	0.2109	0.0333	0.1338	0.0277	0.1113
Volume of GHG emissions	0.2683	1.0875	0.1382	0.5602	0.0981	0.3976	0.0198	0.0803	0.0122	0.0495
Climate change strategy	0.2120	0.9386	0.0969	0.4290	0.0426	0.1886	0.0444	0.1966	0.0281	0.1244
System of environmental management	0.1950	0.7015	0.1072	0.3857	0.0440	0.1583	0.0172	0.0619	0.0266	0.0955
Management of environmental risks	0.1680	0.7028	0.0728	0.3046	0.0347	0.1452	0.0444	0.1858	0.0161	0.0672
Sector (high/low impact)	0.1562	0.6110	0.1083	0.4236	0.0191	0.0747	0.0028	0.0110	0.0260	0.1017
Corporate strategy	0.1281	0.5255	0.0478	0.1961	0.0330	0.1354	0.0223	0.0915	0.0250	0.1026
Level of regulation	0.1124	0.4699	0.0336	0.1403	0.0151	0.0632	0.0126	0.0527	0.0511	0.2137
Environmental certification	0.1053	0.3187	0.0390	0.1180	0.0368	0.1114	0.0168	0.0508	0.0127	0.0384
Pressure from stakeholders	0.0944	0.3994	0.0558	0.2361	0.0219	0.0927	0.0127	0.0537	0.0040	0.0169
Participation in ISE	0.0903	0.3530	0.0278	0.1086	0.0313	0.1222	0.0221	0.0865	0.0092	0.0358
Environmental auditing	0.0518	0.1696	0.0147	0.0482	0.0360	0.1180	0.0003	0.0010	0.0008	0.0025
Depend. on stock market	0.0505	0.1667	0.0097	0.0320	0.0227	0.0749	0.0087	0.0287	0.0094	0.0310
Supply chain	0.0489	0.1705	0.0257	0.0896	0.0150	0.0523	0.0041	0.0143	0.0041	0.0143
Economic performance	0.0488	0.1663	0.0130	0.0443	0.0302	0.1029	0.0050	0.0170	0.0006	0.0020
Media (pressure/-reputation)	0.0370	0.1505	0.0120	0.0488	0.0163	0.0663	0.0070	0.0285	0.0017	0.0069
Projects of CDM	0.0369	0.1383	0.0158	0.0592	0.0078	0.0292	0.0084	0.0315	0.0049	0.0184
Participation in GRI	0.0313	0.1219	0.0184	0.0718	0.0077	0.0300	0.0014	0.0055	0.0038	0.0146
Size of company	0.0262	0.0853	0.0098	0.0319	0.0112	0.0365	0.0016	0.0052	0.0036	0.0117
Particip. Dow Jones Index	0.0248	0.0913	0.0016	0.0057	0.0152	0.0559	0.0065	0.0239	0.0016	0.0057
Independ. of managers	0.0176	0.0477	0.0013	0.0035	0.0101	0.0274	0.0019	0.0051	0.0043	0.0117
Transp. score CDP	0.0104	0.0429	0.0008	0.0033	0.0066	0.0273	0.0016	0.0066	0.0014	0.0058
Perform. score CDP	0.0020	0.0081	–	–	0.0020	0.0081	–	–	–	–
Type of answer CDP	0.0003	0.0009	–	–	–	–	–	–	0.0003	0.0009
Competition	0.0002	0.0006	–	–	–	–	–	–	0.0002	0.0006
Internationalization	0.0002	0.0006	–	–	–	–	–	–	0.0002	0.0006
Statutory obligation	0.0002	0.0007	–	–	–	–	–	–	0.0002	0.0007
Auditing by Big Four	–	–	–	–	–	–	–	–	–	–
Comparability of sectors	–	–	–	–	–	–	–	–	–	–
Dual. CEO × chairman	–	–	–	–	–	–	–	–	–	–

Table 2 (continued)

Factors	Total		SR		AR		SFS		RF	
	% Cov.[1]	Score[2]	% Cov.	Score	% Cov.	Score	% Cov.	Score	% Cov.	Score
Total	2.8746	10.8695	1.3086	4.9844	0.9220	3.3779	0.3309	1.2939	0.3132	1.2133

SR sustainability reports, *AR* administration report, *SFS* standardized financial statements, *RF* reference forms

[1] Coverage percentage calculated by NVivo11®

[2] Final score from determinant factor (% Cov × weight, given by managers and experts)

were revealed. Some of the factors stood out, such as prevention of pollution, volume of GHG emissions, management of environmental assets, and prevention of loss and climate change strategy, presented by their position in the ranking. In addition, a sustainability report was the instrument most used by companies to disclose information on climate change, accounting for 1.3086% of the coverage and general score of 4.9844 (45.86%) of total score.

From this data, and with the use of spreadsheets, it was possible to measure the score of each company in the sample (Table 3); this enabled the identification of the companies that achieved the highest scores in this sample.

Furthermore, it was possible to identify the score of each activity sector (Graph 1), enabling the analysis of H2, which states that companies of the most polluting sectors disclose more information on climate change. It was also possible to identify which sectors stood out regarding their score on climate change disclosure based on the factors.

Based on this data, H2 is not supported by the validation of the alternative hypothesis since the sector of Electronic Retailing scored above the mean (0.2240) and is not regarded as a highly polluting sector. It stood out amongst the companies that disclosed more information on climate change based on the factors identified in the document research. In the ranking, it was followed by the recognizably polluting sectors such as Transportation, Metals and Minerals, and Cellulose. It is important to highlight that such sectors follow the classification presented by CDP, that is, it was extracted from the register data of those companies.

6 Discussion

Table 1 displays the 32 factors identified in the literature that were validated by 34 managers and 32 experts. This result demonstrates the importance of investigating the factors in the reports of companies that are members of CDP. Statistical methods have confirmed that these factors are decisive in the process of climate change disclosure. Table 1 also displays the level of importance attributed to the factors. This enabled a better assessment of the stakeholders' interests according to the managers and experts. Based on all of this, it can be said that there is a social interest in the identification of the factors with the highest scores. This was the reason for investigating and measuring the coverage percentage of the factors in 463 reports provided by the companies between 2014 and 2016.

Through the word count analysis, which included only the words whose content was related to climate change, it was possible to identify the factors most disclosed in the reports. The analysis of each factor was carried out through NVivo®11. The results in Table 2 display the

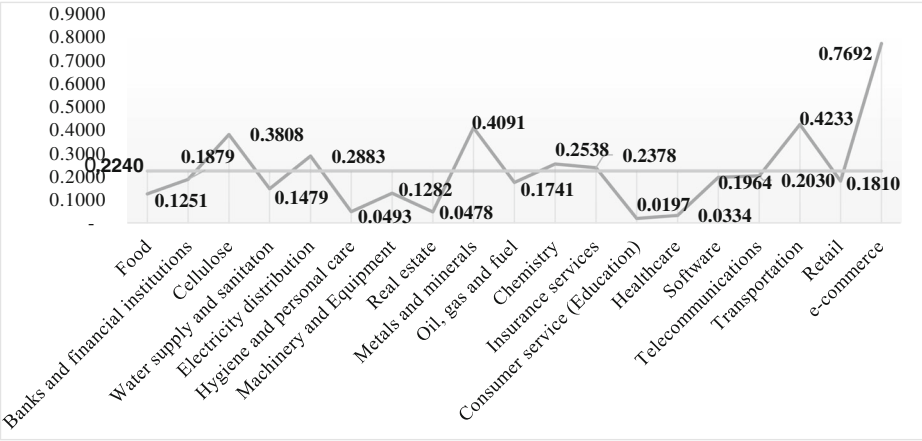
Table 3 Ranking of companies that disclosed more. Name, sector, and score

No. Most polluting	Name	Sector	Score[1]	No. Least polluting	Name	Sector	Score
1	Fibria	Cellulose	0.4444	23	BRF Brasil Foods	Food	0.1762
2	Klabin	Cellulose	0.3989	24	JBS	Food	0.1324
3	Duratex	Cellulose	0.2991	25	Marfrig	Food	0.0668
4	CPFL Energia	Electricity distribution	0.5140	26	Banco Bradesco	Banks and financial institutions	0.4311
5	AES Tietê	Electricity distribution	0.4255	27	BICBanco	Banks and financial institutions	0.2361
6	CELESC	Electricity distribution	0.4150	28	Banco do Brasil	Banks and financial institutions	0.2047
7	Cia Energ. SP—CESP	Electricity distribution	0.4066	29	BM&F Bovespa	Banks and financial institutions	0.1658
8	Cemig	Electricity distribution	0.3094	30	Itaú S.A. Investimentos	Banks and financial institutions	0.1408
9	AES Eletropaulo	Electricity distribution	0.3008	31	Santander Brasil	Banks and financial institutions	0.1239
10	Light	Electricity distribution	0.2417	32	ItaúUnibanco Holding	Banks and financial institutions	0.0127
11	Eletrobrás	Electricity distribution	0.2107	33	Copasa	Water supply and sanitation	0.1479
12	Cia Paraense de Energia—COPEL	Electricity distribution	0.1757	34	Natura	Hygiene and personal care	0.0493
13	Duke Paranapanema	Electricity distribution	0.0864	35	WEG	Machinery and equipment	0.1282
14	CCR	Electricity distribution	0.0849	36	Cyrela Brazil Realty	Real estate	0.0932
15	VALE	Metals and minerals	0.4091	37	BRMALLS Participações	Real estate	0.0025
16	COSAN	Oil, gas, and fuel	0.3232	38	Porto Seguro	Insurance services	0.2378
17	Petrobrás	Oil, gas, and fuel	0.2836	39	AnhangueraKroton	Consumer service (education)	0.0197
18	EDP	Oil, gas, and fuel	0.0807	40	Grupo Fleury	Health care	0.0654
19	UltraparParticipações	Oil, gas, and fuel	0.0089	41	Odontoprev	Health care	0.0014
20	Braskem	Chemicals	0.2538	42	Cielo	Software	0.1964
21	ALL	Transportation	0.6562	43	TIM Participações	Telecommunications	0.2383
22	Ecorodovias	Transportation	0.1903	44	Oi S.A.	Telecommunications	0.1678
				45	Cia Bras. De Dist. (CBD)	Retailing	0.3663
				46	Lojas Renner	Retailing	0.1442
				47	Lojas Americanas	Retailing	0.0325
				48	B2W	Electronic retailing	0.7692

[1] Calculated by the sum of the scores by sector

volume of text (each factor) in relation to the total volume of information related to climate change disclosure. This is one more parameter for validation of the factors indicated in the literature and corroborated by the managers and experts.

Prevention of pollution (Barbieri 2011) was the factor most disclosed, confirmed by coverage percentage and with the highest score compared with the other factors. Despite not agreeing with the findings in Faria et al. (2016), this factor was identified as a priority in the present study, demonstrating that the companies' actions to prevent pollution are a mechanism



Graph 1 Score by companies grouped by sector

often disclosed in the reports. This result is positive from the perspective that prevention also affects natural resources, from the extraction to the generation of pollution, which has an impact on climate change. Prevention of loss holds second position according to coverage percentage and fourth position according to its score. This variation resulted from the assessment weighting that positions the factors. It attributes a higher degree of validation to the position without disregarding the factor position as, by preventing loss, companies also reduce waste and increase their use of raw materials, this reducing the costs of production, especially by recycling. All of this contributes to climate change mitigation.

The large volume of information on the prevention of loss and prevention of pollution, as disclosed in the reports, shows the managers' awareness that this information has a positive influence on stakeholders and, therefore, companies render account of these actions. In addition, there is an increasing focus on prevention of pollution as a means of preventing loss, making best use of materials and reducing costs in the internal chain through the increase in production and reduction of costs with waste disposal. This is a disclosure practice that has been taken by companies and that can be regarded as a mechanism of legitimacy before stakeholders (Deegan 2002; Barbieri 2011; Dias Filho 2012).

The management of environmental assets, advocated by Barbieri (2011) and Iatridis (2013), is also supported as a relevant factor, achieving the third position in both assessments. Hence, we can infer that companies have acknowledged the effects of the management of environmental assets on climate change disclosure, strengthening the relations of internal organization and the companies' participation in this global process. The benefits of the management of environmental assets are presented in their reports in the context of coping with climate change. This happens because more efficient management of these assets is also an opportunity for their better use and maintenance of the assets faced with the challenges posed by CC to companies. Therefore, based on our results, we recommend that the management of environmental assets be part of the corporate mitigation strategies of climate change.

Even though the factor volume of GHG emissions, advocated by Balatbat and Wang (2010), did not achieve statistically significant means in our first study, carried out with managers and experts, it achieved fourth position in coverage percentage and, after weighting, reached second position. We emphasize that the volume of GHG emissions should be part of

climate change mitigation strategies by improving their inventory systems and thus better know and combat GHG generation.

Completing the group of the five main factors (with 50.03% of the total coverage and 49.92% of the total score), climate change strategy comes in the fifth position, unlike in our first study, where it achieved the highest mean amongst managers and experts. Despite this, this result shows the ample perspective of this determinant factor for climate change disclosure since disclosure of standardized information is a key component of corporate strategy to cope with climate change (Birnk 2013; Freitas et al. 2014; Begum and Pereira 2015). Companies have sought to disclose their strategies related to climate change, demonstrating previous organization, investment, deployment of specialists, and other actions that enable the robust development of strategies and disclosure in their reports. It is also important to highlight that some factors—pressure from stakeholders, Management of environmental risks, Level of regulation, and Transparency score in CDP—listed amongst the five main factors in our first study, are disclosed less frequently in the reports, showing variation of focus between the managers'/experts' opinions and the information disclosed in the reports. The other factors had lower hierarchy representativeness in both studies and, therefore, are suggested for future studies.

Based on the partial support of hypothesis 1, it can be asserted that climate change disclosure is influenced by the factors identified previously, except those (3 out of 32) that did not contribute to this process according to the investigated sampled. Hence, concerning climate change disclosure, companies can direct their effort, spent on collecting this kind of information, to other factors regarded as more relevant according to the present study. Rejection of hypothesis 2 contributes to the study of legitimacy because it demonstrates that it is not only the most polluting companies that disclose more information in order to obtain legitimacy. This is also true for those companies that acknowledge the influence of their operation in society and that care for the maintenance of the social contract, which is predicted in one the branches of the legitimacy theory. This was identified in the sector of electronic retailing, which stood out in comparison with the other sectors.

The sustainability report was the most used report, accounting for 45.52% (index of 1.3086%) of the total occurrences. This shows a representative voluntary perspective compared with obligatory information required in the other reports. The need for qualitative and quantitative improvement of social-environmental information disclosed by companies, as advocated by Santos Sampaio et al. (2012), has been met in this sample since companies have disclosed more information on climate change in a voluntary instrument. This result also provides further information for regulatory bodies related to the regulation of the models of sustainability reports, such as the National Agency of Electric Power, Securities and Exchange Commission of Brazil, and BM&FBOVESPA. These regulatory bodies can increase national regulations by accessing information rarely disclosed in the reports, based on the determinant factors with low compliance.

The factors with the highest coverage percentage in the reports (ex ante), in the perspective presented in Fig. 1, show that companies attempt to legitimize themselves through these factors and understand that the market values this information on climate change disclosure. Therefore, the disclosure of information on prevention of pollution, volume of GHG emissions, management of environmental assets, prevention of loss, and climate change strategy is a means of helping companies in the process of social legitimacy, in compliance with their social contract in the environment around them. Based on our results, it can be posited that, in an ex post perspective (Fig. 2), companies can use this identification of the factors most

disclosed to improve their process of disclosure to stakeholders and thus provide high quality information regarding the actions taken to mitigate climate change.

The ranking of companies is another mechanism that contributes to familiarity with the legitimacy of companies that are members of CDP through climate change disclosure, because companies with high scores may be more legitimate. Attention is given to the companies with the highest scores: B2W, from the sector of electronic retailing; ALL, from transportation; CPFL Energia, from electricity distribution; Fibria, from cellulose; and Banco Bradesco, from banks and financial institutions. B2W, which stood out in this study, was created at the end of 2006 with the merger of e-commerce websites (Submarino, Shoptime, Americanas.com), becoming a leader in Latin America. In addition, it recently received both the LEED® certificate (Leadership in Energy and Environmental Design), in the silver category, and Chico Mendes Social and Environmental Award.

Based on this data, with the identification of the factors that achieved the highest scores, it is possible to inform which factors contribute to disclosure. Given the global representativeness of the companies in our sample, this information can be used for future disclosure by the adoption of the factors most disclosed as a means to legitimacy. For those companies with low scores, this information can help them improve the process of disclosure in their reports, making use of the companies with the best scores in the context of climate change disclosure as a reference. It should be pointed out that GHG emissions affect the whole planet since the gases do not respect national borders. This way, mitigation effects can be better disclosed through the factors identified in this study. It should be remembered that the companies investigated accounted for 1.98% of the global GHG emissions Base Year 2015 and for 14.59% in Brazil in the same year.

This study is not intended to neither exhaust the subject nor propose a model of legitimacy scale since we recognize the complexity of this assessment with a wide range of the stakeholders' interests (Barakatet al. 2016). Besides providing a basic frame for analysis, the role of the legitimacy theory in this context is to help the understanding of how the identification of the factors of climate change disclosure can contribute to the process of legitimacy related to climate change disclosure and the mitigation factors. This interests stakeholders in the whole world given the amplitude and high impact these companies have on the environment daily.

To help to maintain their legitimacy (social contract) with the society companies' need to know which are the most disclosed determinant factors, for the survival depends on their legitimacy. On the other side, the society needs more information to legitimize these companies, allowing them to survive or not, rescinding the social contract by imposing fines, strikes, protests, etc. Thus, the companies' can have access to information and can direct their attention to strategies of climate change mitigation to increase the volume and quality of information on climate change so that they can increase their legitimacy in the international market.

7 Conclusion

The main lesson learned from this research is that a climate change mitigation strategy is strongly supported by the evidence of corporate annual reports and it has relation with the following determinant factors: pollution prevention, loss prevention, environmental asset management, GHG emissions, and the strategy chosen by the companies to deal with climate change. Due to the low volume of research related to loss prevention and pollution prevention,

we have identified that little attention has been given to these items. Based on our results, we recommend that climate change mitigation strategies begin to consider these factors in their structure because both have a strong influence in demonstrating how companies are managing these factors for stakeholders.

Another important contribution of this research is that the management of environmental assets is definitely part of the climate change mitigation strategy. Therefore, managers should pay special attention to environmental assets by developing practices that maximize their returns in order to mitigate the impacts of climate change. The occurrence of disasters linked to climate change strategically affect the continuity of companies through impacts on the production chain.

In addition, we have shown that stakeholders are very attentive to the volume of GHG emissions and this reinforces previous research stating that climate change mitigation strategies must be associated with the study and reduction of this volume of gases. Our contribution is to reinforce this factor as an important item in climate change mitigation strategies, and we recommend that companies direct even more attention to the volume generated by improving their inventory systems and thus more effectively combating GHG generation.

In an effort to guide international and national investment and policy, we recommend that climate change strategy be disseminated beyond business but also with a focus on society as a whole and in all countries in a broad and joint effort to mitigate change climate change. We also recommend that more documentary studies be performed, since the method used in our research revealed that the determinant factors most evident in the reports, prevention of pollution and loss prevention, have not been extensively studied in the literature. The method used here was able to bring new contributions to improve climate change mitigation and adaptation strategies.

The aim of this study was to identify which factors are most disclosed in the reports of companies that are members of CDP. The study of 463 reports of companies that are members of CDP Brazil showed variations in the ranking of the factors in comparison with our first study, and, at the same time, it confirmed these factors as mechanisms for social legitimacy in our sample.

As the continuity of a company depends on its capacity to act in according with the society's expectations, it is expected that companies attempt to have their activities accepted and regarded as legitimate (Deegan 2002). The most evident determinants also show that companies are acting in accordance with the expectations of society, because the companies prefer to highlight information more relevant to social acceptance. In addition, the process of acceptance of information by society directly involves the disclosure of actions (and their results) in the reports delivered to stakeholders, so they are important sources of information and assessment of the company's efforts to legitimize themselves (Dias Filho 2012). Based on the actions disclosed and their results (documentary research), it was possible to identify which factors were most disclosed in the reports and get familiar with the factors mostly used as mechanisms of legitimacy by the companies in our sample. The disclosure of information on climate change in these reports means that companies use them to legitimize themselves in the market. The most disclosed factors show the ways companies take to legitimacy concerning climate change disclosure and contribute to enabling companies to consider them in climate change mitigation strategies.

In addition, it should be emphasized that the sector of electronic retailing stood out in the volume of disclosure, a finding absent in the literature. Companies of the most polluting sectors, such as transportation, metals and minerals, cellulose, electricity generation and

chemicals are usually mentioned. The sustainability report was the instrument most used by companies for disclosure of this information, accounting for 45.52% of the total coverage calculated in the reports investigated, and it is the main instrument companies use to divulge their strategy of mitigation of the climatic changes.

Finally, this work contributes to the improvement of the quality of business reports because it points to some factors not considered in the literature and reinforces to the market what the most important factors are that must be present in the strategies to mitigate climate change. This study can help improve the information presented in the companies' reports about climate change disclosure to indicate the most disclosed factors found in the reports of companies that are members of CDP, GRI, and NYSE. Based on the variation identified in the hierarchical positions of the factors and based on the information presented in the reports, we suggest future studies to identify the reasons for such variations.

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