ENVIRONMENTAL IMPACTS MANAGEMENT: DETERMINANT FACTORS ON WASTE DISCLOSURE, EMISSIONS, EFFLUENTS AND OTHER IMPACTS OF BRAZILIAN COMPANIES

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ABSTRACT
Trying to understand the mechanism of environmental disclosure from the business perspective, this article aims to identify determinant factors on environmental disclosure by the Brazilian companies listed on the stock exchange. In order to achieve this goal, it was possible to observe the annual and sustainability reports of the 50 companies that make up the index IBRX50 of BM & FBOVESPA, between 2009 and 2011. First, there is a measure on the level of disclosure about waste, emissions, effluents and other impacts of each company (EGI-RA and EGI-RS). The modeling to determine the level of disclosure can be constructed from the literature review and guidelines of the Global Report Initiative. It was possible to determine from previous studies, after measuring the level of disclosure, factors that describe what the companies reported, and they might be considered as determining factors. (1) Participate in the ISE, (2) be considered potentially polluting; (3) possess environmental information on the site, (4) have better performance in the ROE, (5) have better performance in ROA. Results reveal that the sustainability information is used by only 22% of the companies surveyed. The highest performance level of disclosure is related to emissions and waste. It was possible to get ccorrelations between levels of disclosure on environmental and economic performance (together), but it was not likely to verify the disclosure correlation with economic performance.

Key words: Determinant factors. Environmental disclosure. Impacts management.

Área Temática: Contabilidade para Usuários Externos

1 INTRODUCTION

The organizations environmental transparency gained prominence, in the international scene, as a response to social demands related to the depletion of natural resources and environmental impacts resulting from business activity and its effects on climate, biodiversity and human health. The scientific community recognizes the importance of assessing the level of corporate environmental data in order to provide sustainable development. Because of this recognition, they develop researches on environmental pieces of information, building instruments to support decisions on environmental disclosure.

The researches on environmental disclosure are designed to identify the environmental information profile and recognize determinant factors of disclosure and correlation of performance levels of disclosure with organizational performance (financial economic and environmental). The researches results demonstrate the importance of assessing the information levels progress since one is in the process of global changes with respect to the concern about environmental sustainability and its effects in the organizational management, society and environment.

In this context, this research aims to identify determinant factors of the environmental disclosure level of Brazilian companies from different economy sectors and listed in the stock exchange. In order to analyze the determinant factors of environmental disclosure, there was a selection of 50 companies that make up the IBRX-50 index and their annual and sustainability reports were analyzed between 2009 and 2011.

2 THEORETICAL FRAMEWORK

From the international literature review, it is possible to verify that environmental disclosure is an instrument or evaluation process of disclosure to know how organizations influence and are influenced by the environment, according to Figure 1.

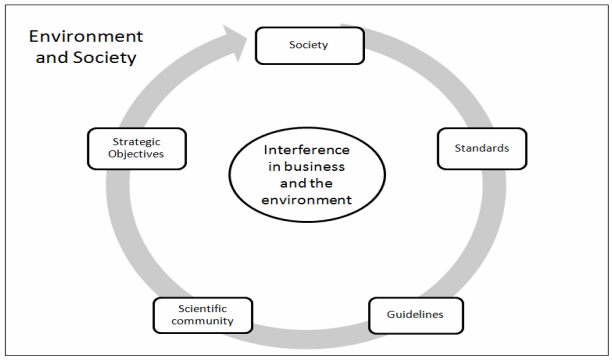


Figure 1: Environmental disclosure
Source: Own elaboration

The evaluation process of environmental information allows for the identification of criteria and sub-criteria through expert knowledge, studies or law. The evaluation of criteria is done by the quantification (counting) of sentences, words or highlighted words through the use of Likert type scales, and integrating by weights attribution, mainly from type 0 to 1 (it has or does not have information). The situation diagnosis is descriptive or analytical nature (using data correlation or other statistical analyzes).

Because of this observation in the international literature, it may also be confirmed that the environmental disclosure can be a tool used to support the decisions of the person that manages the environmental information released. It is valued by the society, through laws and regulations, and by organizations, through the consequences of their strategic objectives (ROSA *et al*, 2011).

To understand the environmental evidencing, the scientific community has primarily

used three theoretical bases: legitimacy theory, stakeholder theory and disclosure theory. It also identified different criteria analyzed to determine the performance of environmental information. These criteria may be related to (1) managerial issues, such as politics, goals, professional liability, management and commitment aspects, certifications and audits. (2) Environmental performance, such as the use of natural resources (water, energy, materials and biodiversity), impacts management (emissions, effluents, waste, transportation and other impacts) and (3) legal and financial aspects.

Through the research of Rose et al (2012), it may be seen an increase in publications that seek to understand the evidencing of aspects related to performance as shown in Table 1.

This research affiliates to the theory of disclosure and analysis of impacts management because it aims to analyze determinant factors of information about waste, emissions, effluents and other impacts that are supplied by the Brazilian companies. In this sense, one adopts the taxonomy of Rosa et al (2012) as the theory of disclosure, normative and legal aspects to establish a set of evaluation criteria for environmental disclosure.

As the theory of disclosure, it is possible to say that Verrecchia (2001) organizes the researches on Accounting Disclosure, in three categories: Efficient-Based Disclosure, Disclosure and Discretionary-Based and Association-Based Disclosure. The first one aims to identify which disclosure settings are preferred by the interested parties in the information. The second one seeks to understand the reasons for disclosure made by the organizations. The third category intends to examine the relationship or association between disclosure and changes in the investors' behavior.

From Verrecchia (2001), it is developed the Environmental Disclosure taxonomy, categorizing the subject into three lines of research. (1) Environmental Disclosure Management (MED) examines the profile of the information provided. (2) Environmental Disclosure Evaluation: external and internal variables (EDE-X), examines the factors that explain the disclosure and (3) Environmental disclosure Evaluation: correlation (EDE-C), examines what is being correlated with the environmental information as shown in Figure 2.

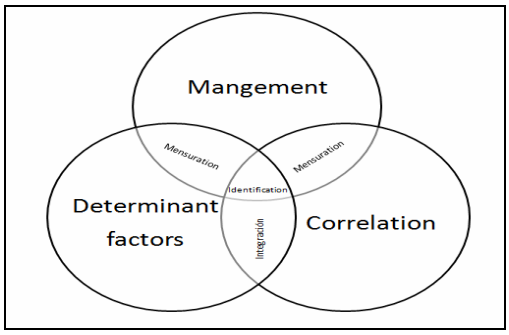


Figure 1: Research f*ramework* about *environmental disclosure.*
Source: Rosa et al, 2012

According to Figure 2, it may be observed that the three research streams have points of intersection. For example, in the studied literature, it is used internal documents of organizations, laws, norms, guidelines, empirical knowledge of experts, and in some cases, interviews to identify the criteria and sub-criteria of disclosure. Another common point is the measurement, which in many surveys, can be developed by Likert scale and the count of sentences, phrases and words. There is the intersection between researches in a way to integrate this measured information measured, i.e., by assigning weights, tabulation or correlation data. Finally, it appears that the situation diagnosis can be descriptive and analytical. It seeks to describe how the organizations report the consequences of their activities on the environment and society, and how this information meets (or not) the demands of different stakeholders.

Criteria	Hanie et al 1991	Gray et al, 1995	Hackston et al 1996	Burritt et al, 1997	Deegan et al, 1997	Buhr, 1998	Neu et al, 1998	Tilt et al 1999	Buhr, 2001	Buhr et al, 2001	Gray et al, 2001	Moneva et al, 2001	Tilt, 2001	Amaral et al, 2002	Al-T. et al, 2004	Cormier et al, 2004	Freedeman et al, 2004	Llena et al 2004	Rahaman et al, 2004	Oliveira, 2005	Bertolini et al, 2006	de Villers et al, 2006	Lopez et al, 2006	Calixto et al, 2007	Costa et al, 2007	Ribeiro, 2007	Branco et al, 2008	Freedeman et al, 2008	Perez et al, 2008	Stray, 2008	Kaezing et al, 2009	Liu et al, 2009	Monteiro et al, 2009	Saida, 2009	Sobhani et al, 2009	Velani et al, 2009	Vormedal et, 2009	Bassetto, 2010	Beck et al, 2010	Borges et al, 2010	Villers et al, 2010	Karatzoglout et al, 2010	Kerret et al, 2010	Lynch, 2010	Ottman et al, 2010	Papaspyropoulos , 2010	Shidi e Burrit, 2010
Materials																														■															■		■	■
Water								■																■						■		■		■						■			■	■		■	
Energy		■	■	■						■								■									■			■		■		■			■						■	■	■	■	
Fossil fuels (transport)																								■																							
Climate																																								■	■		■				
Conservation and preservation of natural resources																											■			■																	■
Biodiversity								■		■																								■						■			■	■	■	■	■
Effluent										■					■			■												■		■								■	■	■	■	■		■	■
Atmospheric emissions										■								■										■	■	■		■					■			■	■		■	■	■	■	■
Waste				■				■		■					■			■						■					■	■	■				■	■	■			■	■	■	■	■	■	■	
Treatment impact				■											■			■						■		■											■			■	■						■
Degraded areas								■		■																									■					■							
Impact management and emergency situations								■		■						■	■	■								■			■	■			■	■	■					■	■		■				■
Pollution																■					■			■					■					■	■												
Transport																														■								■		■						■	
Policy				■	■	■		■		■	■	■	■	■			■	■						■		■	■		■	■		■	■						■		■				■		
Objectives and targets	■					■		■					■				■												■	■		■									■				■		
Management approach								■		■		■	■					■						■					■	■		■	■														
Professional Responsibility								■	■		■		■		■		■							■					■																		
Monitoring, ACV and Supply Chain																													■	■												■					
Planning																								■		■			■				■	■										■			
Environmental Management System and Certification								■		■		■	■			■									■	■	■			■		■	■														
Investments and expenses						■		■		■		■					■	■		■	■		■	■	■	■			■			■	■							■		■				■	
Environmental accounting							■			■							■	■					■	■																	■						
Economic results		■																							■					■				■													
Insurance and concessions								■		■															■													■				■					
Voluntary actions for sustainable desernvolvimento			■					■			■		■			■																	■		■		■			■						
Training / Education				■																				■						■										■							
R & D of products and services			■	■	■	■		■		■							■								■	■			■	■	■						■			■			■		■	
Communication	■							■									■												■	■		■															
Disclosure channels																		■																							■						
Community, employees and consumers		■	■		■		■	■			■																																				
Legal compliance					■		■	■		■						■								■		■			■	■	■		■		■					■		■		■		■	■
Auditing	■							■		■							■	■						■	■	■				■				■									■				
Future legal requirement																																															
EIA / RIMA				■																													■														
Legitimacy																■			■			■																■			■						
Penalties and Pending															■									■					■												■						

Table 1: Criteria of the environmental disclosure
Fonte:

They differ mainly in relation to the research focus. Thus, the surveys are developed in order to analyze the profile of what is evidenced; analyze the variables that explain what is evidenced, and allow the correlation of evidenced information with organizational performance (economic, financial and / or environmental performance).

From this difference in the research approaches, the framework of this research on disclosure can be built as shown in Figure 1, where the disclosure is investigated from three categories.

The first category aims to examine the environmental information profile considered efficient (GRAY, 2001; STRAY, S., 2008; BRANCO; EUGÉNIO; RIBEIRO, 2008; CORMIER; GORDON; MAGNAN, 2004; DE VILLIERS; VAN STADEN, 2006; HASSELDINE; SALAMA, 2005; CAMPBELL, 2004; DEEGAN; RANKIN, 1997; FREEDMAN; STAGLIANO, 2008; HARTE; OWEN, 1991; BURRITT; WELCH, 1997; SAIDA, 2009; TILT, 2006; TILT *et al.*, 1999).

Efficient Information might be understood as the one that reveals the management and environmental performance of the organization, such as balance sheets and results, information on use of natural resources, emissions, impacts, socio-environmental responsibilities, and political-institutional issues.

Disclosure of Environmental Management can be established by the scientific community and society (represented by regulatory agencies and decision) through the criteria and established standards for reporting of environmental events. Based on this research, we organized this category into five subcategories:

(1) Level of sustainability: represents guidelines or communication standards developed by various organizations and research institutions, such as the Global Report Initiative (GRI) Company Sustainability Index (CSI), Dow Jones Index, National Award Quality, among others;

(2) Regulatory elements: include norms and deliberations issued by various government and estate agencies, as well as the criteria and sub-criteria studied by the scientific community and resulting (directly and indirectly) of normative documents. Both deliberative bodies and scientific community seek to promote the communication standardization of environmental impacts and aspects. About deliberative bodies, it is possible to indicate: *Intergovernmental Working Group of Experts on International Standards of Accounting and Reporting – United Nations (ISAR/UNCTDA); International Accounting Standards Board (IASB); Brazilian Institute of Independent Auditors of Brazil (IBRACON); Brazilian Technical Norms on Accounting (NBCT) and guidelines from the National Agency of Electric Energy (ANEEL);*

(3) Type could be defined by Guthrie and Petty (2000), and Hackson and Milne (1996), and widely spread in the scientific community nationwide. In this concept, the environmental information can be expressed in four ways, in the reports: Descriptive (D) Quantitative Non-Monetary (Q) Quantitative-monetary (M), and Quantitative Monetary and Non-Monetary (Q / M)

(4) Quality might be defined by Gray (1995b) Hackson and Milne (1996), and widely spread in the scientific community nationally and internationally. Thus, the quality has three characteristics: (N) Neutral: policy statement or claim within the statutory minimum, with no details of what or how; statement of facts whose credit/discredit is not visible to the company. (B) Good: statement beyond the minimum that include, for example, details having respectable or neutral reflection in the company; any statements reflecting credit to the company; optimistic analysis/discussion/statement. (R) Bad: any statement reflecting or that could reflect discredit for the company. It includes, for example, dismissed employees

[...] and any accidents increase;

(5) Environmental Disclosure Management (Rose et al, 2012): process used to illustrate how organizations can affect and might be affected by the environment. Where the context of information management assumes a management framework individualized and focused on meeting the demands of different stakeholders and strategic objectives of the organization itself. Therefore, its management requires a structured system of performance assessment to determine, measure and manage the environmental aspects disclosed.

The second category aims to identify factors that explain the Environmental Disclosure, that is, it questions the reasons for disclosure or not of certain information (TILT, 2001; BRANCO; EUGÉNIO; RIBEIRO, 2008; CORMIER; GORDON; MAGNAN, 2004; BUHR, 2001; BUHR; FREEDMAN, 2001; DE VILLERS; VAN STADEN, 2006; HASSELDINA; SALAMAD; TOMS, 2005; RAHAMANA; LAWRENC; ROPER, 2004; BUHR, 1998; GRAY; LAVERS, 1995a; HAKSTON; MILNE, 1996; LIU; ANBUMOZH, 2009; SAIDA, 2009).

Among the determinant factors of information disclosure on environmental nature, it is possible to include: (1) variables related to business type: sector, capital control and stock exchange listing. (2) Size variables: number of employees, volume of sales, total assets. (3) Financial variables: profitability, capitalization value of shares in the stock exchange, debt, and (4) external variables: social, political and cultural aspects, media influences, membership to non-governmental organizations, social pressures, governmental pressures, creditors pressures and audit type.

In the quantitative studies using variables to understand the level of disclosure, the Brazilian context between 2009 and 2010, according to Voss (2012), highlighted nine variables whose summary appears in Table 2: size, control origin, internationalization, profitability, debts, sector, governance, audit and shares issuance:

Source	**Main variables**								
	Size	Source control or share control	Internacionalization	ROE ou ROA	Indebtedness	Sector or activity	Corporate governance	Auditing	issuance of shares
Braga, Oliveira e Salotti (2009a)	√	√		√	√	√	√		
Ciofi (2010)									
Coelho, Ott, Pires e Alves (2010)	√	√	√	√	√		√		
Gondrige (2010)	√		√					√	
Murcia (2009)		√				√			
Murcia e Santos (2009a)	√	√	√	√	√	√	√	√	√
Murcia e Santos (2010)	√	√	√	√	√	√	√	√	√
Murcia e Souza (2009)	√	√	√			√	√	√	√
Murcia, Souza, Dill e Costa Junior (2010)	√			√	√				
Nossa (2002)	√								
Rover e Murcia (2010)	√		√	√	√				

Table 2 – Main determinant factors identified in the literature
Source: Voss (2012).

The variable "size" is more significant in the Brazilian studies, followed by the variables: internationalization, control origin, profitability and debts. Basically, the shareholding control may be understood as of foreign or domestic origin, and the internationalization tries to possess amounts negotiated in the stock exchange of other

countries.

For Liu and Anbumozh (2009), the Disclosure Environmental evaluation is applied to verify the reasons leading an organization for information about its aspects and the environmental impacts. In addition, to check the information quality reported voluntarily, according to Figure 2.

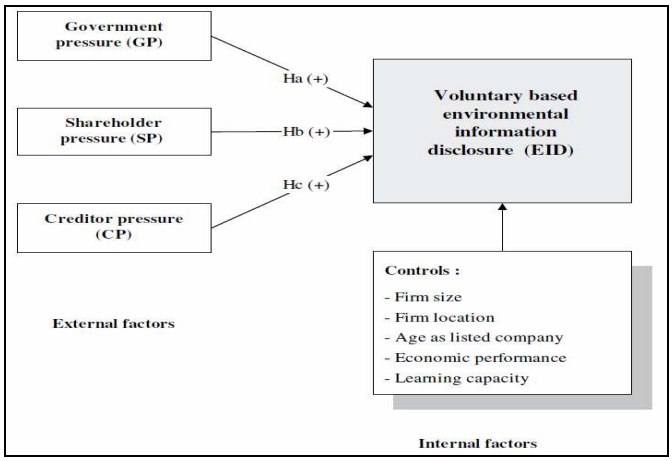


Figure 2: Analytical model about determinants of *environmental disclosure*.
Source: Liu and Anbumozh (2009)

Studies on factors that explain the Environmental Disclosure contribute to verify pieces of information in the firm external field. Thus, it allows the reports framework of such organizations according to individual and collective characteristics. They are also essential to profile the companies' clusters, from countries or regions and signal scenarios changes of economic and political sectors (BORGES, ROSA; Ensslin, 2010).

The third category aims to examine what is being correlated with the Environmental Disclosure. Thereby, the researches of Al-Tuwaijri and Christens (2004) Freedman and Patten (2004) Murray et al. (2006) Neu Warsame (1998) and Tilt et al. (1999) become indispensable tools to look for correlations or associations between the phenomenon of Environmental Disclosure and changes in performance, financial and economic enterprises results.

According to Kosztrzepa (2004), the environmental information disclosure can be done in several ways that are certainly going to help companies, and users of accounting information to make more secure and responsible decisions on organizations.

For Alberton (2003), the Return on Equity (ROE) is probably the most widely used profitability measure because it is of considerable interest to the shareholders. However, according to Grzebieluckas, Campos and Selig (2007) the relationship between environmental and economic performances regularly presents five measures: Return on Assets (ROA), Return on Equity (ROI), Return on Operating Assets (ROA) Market Value of the Firm (Q.Tobin) and Return on Shares.

The evaluation of Environmental Disclosure, for Tilt (2006), aims to confirm the relationship between the environmental information evidenced, and environmental performance of one company since one believes this relationship influences and is influenced by internal and external organizational aspects.

However, it is difficult to correlate performance with environmental data reported by the organizations (ROSA et al, 2011). Apparently, this happens because the performance, whether financial, environmental or economic, is influenced by operational, managerial, marketing or regulatory variables, which makes difficult to prove that environmental information or a number of them might alter the organization performance.

3 DEVELOPMENT OF THE RESEARCH ANALYTICAL STRUCTURE

In order to improve the results analysis, it is constructed analytical structures of environmental disclosure, determinant factors and statistical treatment as follows below.

3.1. Analytical Structure of Disclosure levels on Impacts Management (IMD)

The Analytical Structure of the Disclosure Level to the Management of Environmental Impacts can be built from the guidelines of the Global Report Initiative (GRI). From the GRI guidelines is possible to identify five categories to assess the impacts management: Emissions, Effluents, Waste, Products/Services and Transportation according to Figure 3.

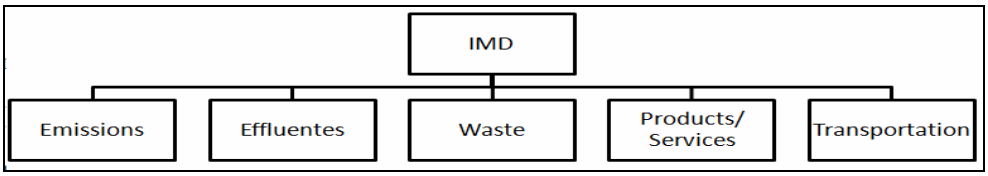


Figure 3: Analysis Criteria of Impacts Management Disclosure (IMD)
Source: Own source

Each of these five categories is composed by criteria and sub criteria that represent the elements considered relevant, in the GRI guidelines, to assess the impacts management of companies. These criteria and sub criteria may be measured by ordinal scales in order to show order between the scale levels, according to the level of performance to be measured. These scales, in turn, could be transformed from the software of semantic judgment in cardinal scales expressing the attractiveness differences between the scale levels. After this measurement, the criteria and sub-criteria can be integrated through compensation rates that express the level of importance between criteria and sub-criteria. These rates might be also determined by the software of semantic judgment, using the experts' knowledge to determine attractiveness differences. The model can be integrated through comprehensive evaluation of the alternatives that are calculated by the equation of additive aggregation, after determining the cardinal scales and compensation rates:

$$V(a) = w1*v1(a) + w2*v2(a) + w3*v3(a) + ... wn*wn(a).$$

V(a) = Global Value of the Action a;
v1(a), v2(a), ... vn(a) = Partial value of the action a in the criteria 1, 2, 3, ..., n;w1(a), w2(a)... wn(a) = Substitution Rates of the criteria 1,2,3,...,n;
n = number of model criteria.

Figure 3 shows the model structure, where is presented the criteria, sub criteria, ordinal and cardinal scales, as well as compensation rates.

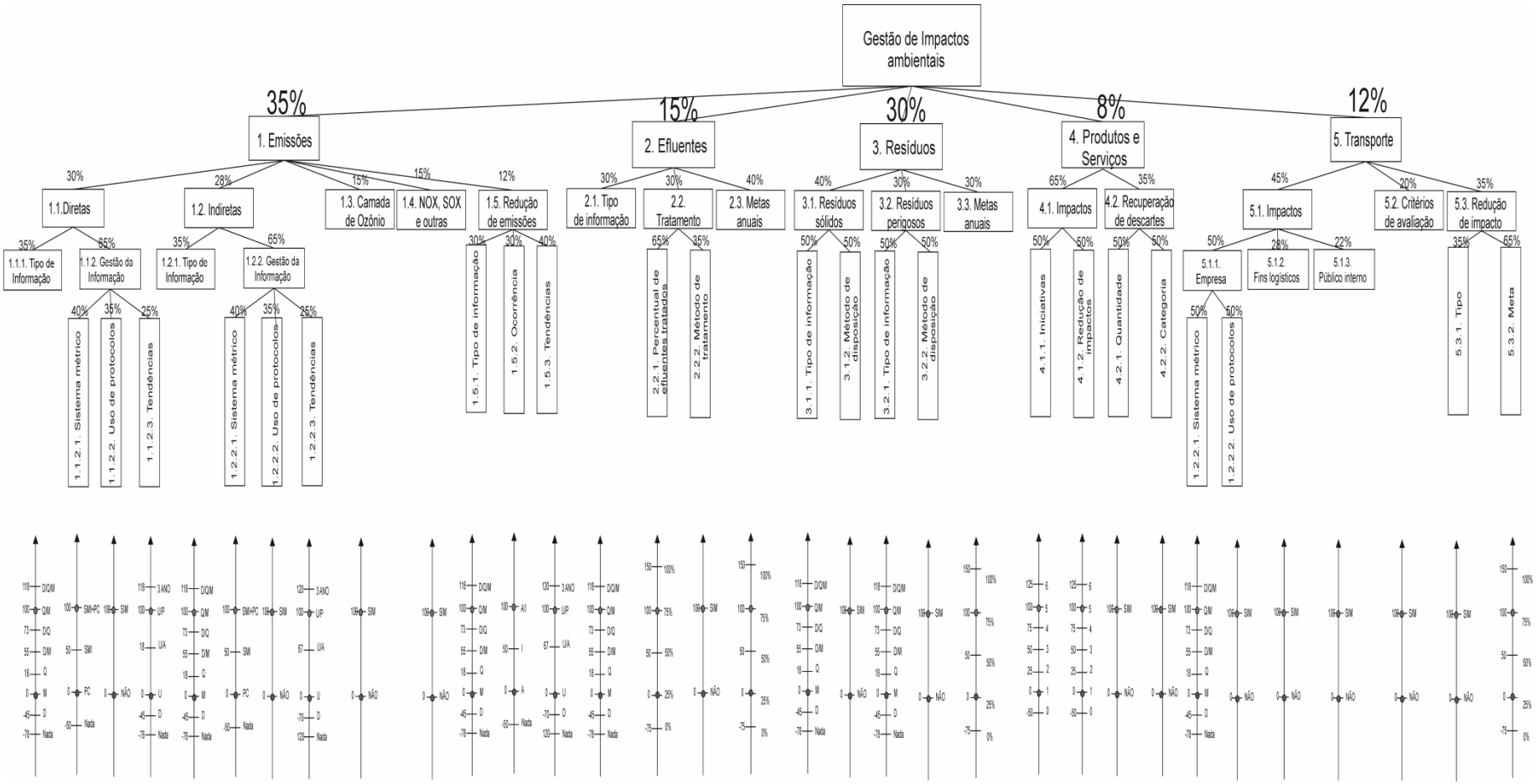


Figure 3: Structure of the evaluation model of Disclosure of Risks Management
Source: Own source

There are three levels of performance in order to analyze the result of the identified disclosure level: (1) Compromising, (2) Market, (3) Excellence, according to Figure 4.

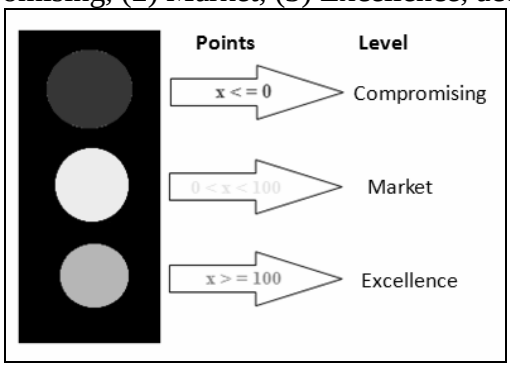


Figure 4: Interpretation of IMD results
Source: Vos et al, 2012

3.2 Analytical structure of Determinant Factors of Environmental Disclosure

From the theoretical construction of this research, it was determined the analysis indices, according to Board 2.

Índex	How to measure	Theoretical reference
Potentially Polluting (POTEN)	Companies framework according to Law 10.165/2000	Voss, Piftscher e Rosa, 2012; Rover, Borba e Murcia 2009; Murcia et al, 2008; Voss, Piftscher e Limongi, 2011; Oliveira, Machado e Beuren, 2012.
Corporate Sustainability Index (ISE)	Identification of companies belonging to the ISE	BM&FBOVESPA, 2011;, Rosa et al, 2011
Communication channels (SITE, RS)	Identification of companies that provide information about environmental impacts in the SITE and possess Sustainability Report (from 2009 to 2011).	Tilt, 2001; Branco; Eugénio; Ribeiro, 2008; Cormier; Gordon; Magnan, 2004; Buhr, 2001; Buhr; Freedman, 2001; De Villers; Van Staden, 2006; Hasseldina; Salamad; Toms, 2005; Rahamana; Lawrenc; Roper, 2004; Buhr, 1998; Gray; Lavers, 1995a; Hakston; Milne, 1996; Liu; Anbumozh, 2009; Saida, 2009
Returno on Assets (ROA)	ROA value of each company collected in the Economatic software (2009, 2010, 2011).	Alberton (2003), Grzebieluckas, Campos and Selig (2007), Al-Tuwaijri and Christens (2004), Freedman and Patten (2004), Murray et al. (2006), Neu and Warsame (1998), and Tilt et al. (1999)
Return on Equity (ROI)	ROI value of each company collected in the Economatic software (considered the average PL in 2009, 2010 and 2011)	Alberton (2003), Grzebieluckas, Campos and Selig (2007), Al-Tuwaijri and Christens (2004), Freedman and Patten (2004), Murray et al. (2006), Neu and Warsame (1998), and Tilt et al. (1999)

Board 2: Analytical structure of Determinant Factors of Environmental Disclosure
Source: Own source

3.3 Analytical structure of the statistical treatment

The analysis of canonical correlations was proposed by Hotelling (MINGOTI, 2005) and its main objective is to "study the linear relationships between two sets of variables" (MINGOTI, 2005, p.143The technique summarizes the information of each set of response variables in linear combinations, and the choice of the coefficients of these combinations are performed by taking as criterion the maximization of the correlation between the sets of response variables. These linear combinations constructed are called canonical variables while the correlation between them is called canonical correlation. This correlation measures the degree of association between two sets of variables, in this case, the indexes in the stock mentioned. Mathematically, one can say that regression is a generalization of multiple linear

regressions or this is a singular case of the first one.

Are matrices $X_{i\times j}$ and $Y_{i\times j}$, i Table of Brazilian companies and their respective indices j statements, listed on Bovespa and NYSE. In addition, the matrices $W_{k\times j}$ and $Z_{k\times j}$ the scale of British firms k and their account index j, listed on the NYSE and LSE. The aim is to establish the relationships:

$$a_1x_1 + a_2x_2 + a_3x_3 ... + a_jx_j = b_1y_1 + b_2y_2 + b_3y_3 + ... + b_jy_j$$

and

$$c_1w_1 + c_2w_2 + c_3w_3 + ... + c_jw_j = d_1z_1 + d_2z_2 + d_3z_3 + ... + d_jz_j$$

Formally, one define the first pair of canonical variables as the pair $U_1 = a_1x_1 + a_2x_2 + ...a_mx_n$ and $V_1 = b_1y_1 + b_2y_2 + ... + b_ny_n$ (in the case of this study m = n = j) where a=[a1, a2, ...,am] and b=[b1, b2, ...,bn], are vectors of constants, respectively selected. Thus, the correlation between variables U1 and V1 is a maximum and such that these two variables have variance equal to 1, i.e.: var(U1)=Var(V1)=1. The same is also true for U2 e V2, U3 and V3, ...Vk e Uk, k=1,2,...,min(m,n).

The vectors ak and bk are shown in the literature (SEBER, 1984, Anderson, 2003 and TIMM, 2002), and they should solve the following linear system:

$$\begin{cases} \left(\Sigma_{XY}\Sigma_{YY}^{-1}\Sigma_{YX} - \lambda_k\Sigma_{XX}\right)a_k = 0 \\ \left(\Sigma_{YX}\Sigma_{xx}^{-1}\Sigma_{xy} - \lambda_k\Sigma_{YY}\right)b_k = 0 \end{cases}$$

Where ∑XX is the matrix of variance X, ∑YY the matrix of variance Y, ∑XY and ∑YX are the covariance matrices and ëk is the k-th largest eigenvalue of the matrix $\Sigma_{XX}^{-1}\Sigma_{XY}\Sigma_{YY}^{-1}\Sigma_{YX}$.

This study is only going to analyze U1 and V1 to each case as they may be interpreted like indices of overall performance. The remaining latencies are not going to be discussed. On the statistical inference, there is a test to see if the matrices X, Y, W and Z are correlated or not. However, this test can only be applied when the vectors are multivariate normal. When multivariate normality is valid, it is also possible to construct statistical tests to assess the significance of the canonical variables. These tests are already present by default because the software used in the article is the Statgraphics package, in its version 5.1. The case of correlation and determination was performed by using the following formulas: $r = \sqrt{\frac{SQ(\text{mod}\,elo)}{SQTotal(corrigida)}}$, where SQ (model denotes the sum of squares for the regression model fit to the data and SQTotal is the sum of the squares in its entirety).

3.4 Population and sampling

The selection of the sample population was performed through the following criteria: (1) companies listed in the stock exchange, (2) different sectors, (3) diversified companies in terms of environmental labeling. The first criterion provides accessibility to data and reports about sustainability due to the obligation of limited companies to publish information for their stakeholders. The second criterion searches for scope and diversification because the companies from different sectors suffer many pressures from the society regarding environmental information they must provide. Consequently, it helps to meet the objective of

this research to understand factors that explain the environmental information provided by the companies. Finally, the third criterion is set to check for differences that occur in companies listed in the ISE along with others that are not listed.

Based on these characteristics, it was possible to select companies listed in the IBRX-5 index, which is the index of investment composed by the 50 most liquid Brazilian companies of the Stock Exchange of Sao Paulo (BM & FBOVESPA). The period of data collection was October 2012, according to Board 1.

3.5 Period of analysis

Since the researched sample for the publication of the Sustainability Report had more regularity, in the last three years, one chose to examine the years 2009, 2010 and 2011 in order to increase the number of observations and analyzed companies.

4 ANALYSIS OF RESULTS

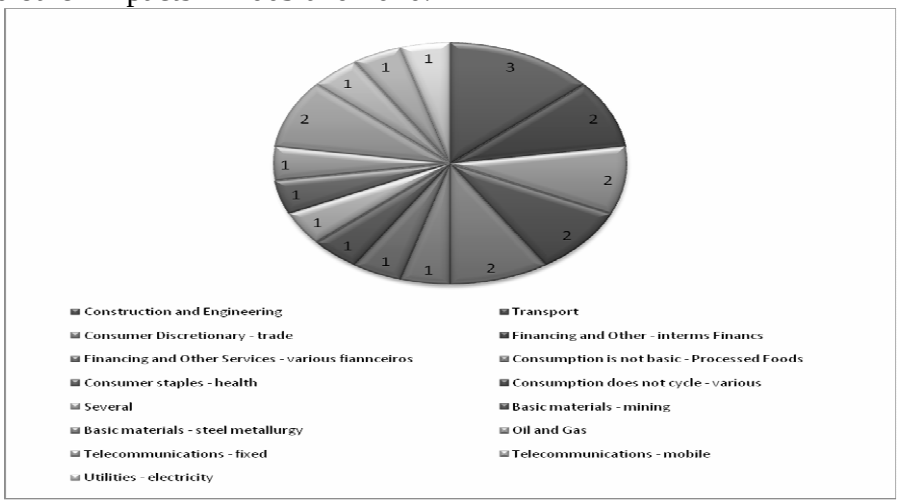
The results analysis is performed in three stages: the first one is on the disclosure level in the sustainability reports. The second one is about the disclosure level in annual reports. Finally, through the analysis of the determinant factors on disclosure related to waste, emissions, effluents, product/service and transportation.

4.1 Sustainability Report

In this analysis, it is possible to observe restrictions on the use of this communication mechanism by the 28 surveyed companies, as well as limitations on the scope of disclosure on waste, emissions, effluents and other impacts of the other 22 sample firms (44%) that use the sustainability report as a communication channel.

In relation to the use of this report, it is possible to say that only 22 companies publish their sustainability reports or are available on their websites. It represents only 44% of the sample, with 6% of Construction companies, 4% for Transportation, 4% for Trade, 4% for Banks, 4% for other financial institutions and 2% representing each of the other sectors. (Non basic consumption - Processed foods, Healthcare, Non cyclic consume, Others, Mining, Steel/metallurgy, Oil, Gas and Biofuel, Fixed Telephony, Mobile Telephony, Electric Power).

It is also noted in these results that five companies did not publish sustainability reports in the three consecutive years. The sector with the highest representation in the sample is the Construction, represented by the companies MRV, GAFISA and CYRELA REALT. The latter company presents the best performance on disclosure level of waste, emissions, effluents and other impacts in 2009 and 2010.



Graphic 1: Companies of the IBRX-50 that published the Sustainability Report in 2009 and 2011.
Source: Research Data

In Graphic 1, it is possible to verify that besides the Construction sector, in the studied sample, it also appears Transportation (AAL and CCR), Commerce (American Stores and Cia Hering), Bank (Brazil and Santander) and other financial entities (BMF & V Bovespa and CETIP).

The low level of publications about the sustainability report can be linked to the fact it is not mandatory. Therefore, remembering that the sustainability report is voluntary, the firms that publish it show concern for wider disclosure. This creates a space to describe the society and other interested parties, more comprehensive information than those required in accounting norms, regulatory agencies norms and environmental laws.

However, it is possible to believe in benefits to the company (settle market boundaries, broaden communication with different groups interested in the business environmental information, develop transparency and increase credibility). To the society (expand knowledge about the consequences of business activities on the environment, enable the monitoring on the company's trajectory on its concern and action on issues in favor of sustainable development and human health). To the environment (actions of organizations in order to reduce natural resource depletion and impacts of its processes, and consequently, help in the protection, restoration and environmental protection).

Hence, there is an opportunity for companies that do not publish or publish incomplete reports to explore further this communication channel in order to demonstrate their actions to the society on behalf of sustainable development.

In relation to the scope, it was verified the possibility for companies describe their goals reduction, present comparison patterns for emissions, effluents and waste (from their own background or market standards) and relate their descriptive analysis with quantitative and monetary information.

It also appears that there is evolution of the information level along these three years as shown in Table 3. It is possible to observe the evolution in the disclosure level on the five examined criteria (emissions, effluents, waste, products/services and transportation). In Table 3, the negative values (below 0) in red indicate that the information is in compromising levels. The positive values (between 0 and 100) in yellow indicate that the information is in market levels, and finally, the green color (over 100) represents levels of excellence.

	2009					2010					2011				
Business	Emissions	Effluents	Waste	Prod/Serv	Transportation	Emissions	Effluents	Waste	Prod/Serv	ansportati	Emissions	Effluents	Waste	Prod/Serv	ansportati
OGX PETROLEO	-45,052	-6,1	38,05	-32,5	-25,8375	-45,052	-6,1	-5,875	-8,125	-25,8375					
LOJAS AMERIC	-45,052	-65,4	-49,8	-32,5	-25,8375	-18,024	-65,4	-49,8	-32,5	-25,8375	-18,024	-65,4	-49,8	-32,5	-25,8375
CIA HERING	-45,052	-65,4	-49,8	-32,5	-25,8375	-5,769	-65,4	38,05	16,25	-25,8375	24,231	-65,4	7,775	16,25	-25,8375
BANCO DO BRASIL	-38,353	-41,5	-44,025	-32,5	-25,8375	13,57	-41,5	-44,025	-32,5	-22,125					
DASA	-25,564	21,9	51,3	-32,5	-25,8375	4,436	21,9	95,925	48,75	15	4,436	103,4	-5,875	-32,5	15
CEMIG	-12,369	-65,4	-49,8	-32,5	-25,8375	-12,369	-65,4	-15,5	-32,5	-25,8375	-12,369	-65,4	-5,875	-32,5	-25,8375
OI	-12,369	-41,5	-15,5	-32,5	-25,8375	-12,369	-41,5	-9,725	-32,5	-25,8375	-12,369	-41,5	-0,1	-32,5	-25,8375
PETROPAR S.A.	2,631	-22,6	7,775	16,25	-22,125	13,796	-22,6	18,8	51,25	2,725	13,796	-22,6	18,8	51,25	-9,525
MRV	2,81	-41,5	-44,025	-32,5	-25,8375	32,81	-41,5	-44,025	-32,5	-25,8375	44,33	-41,5	-26,525	24,375	-25,8375
GAFISA	3,899	-65,4	-44,025	-32,5	-25,8375										
HYPERMARCAS	4,436	-22,6	-15,5	-32,5	-13,2375	4,436	103,4	-15,5	0	-13,2375	21,087	103,4	-15,5	0	-13,2375
SANTANDER BR	4,842	-41,5	-33	-32,5	-25,8375	4,842	-41,5	-15,5	-32,5	-25,8375	4,842	-41,5	-9,725	-32,5	0,025
BRF FOODS	13,164	-65,4	-49,8	-32,5	-15,0375	26,359	-6,1	10,925	-8,125	-25,8375	46,659	52,4	-0,1	-8,125	-25,8375
TIM PART S/A	17,631	-55,5	-26,525	0	-25,8375	28,796	-41,5	-9,025	0	-25,8375	21,336	-41,5	-9,025	0	-22,125
GERDAU	23,067	35,9	-49,8	2,5	13,975	71,932	-22	19,25	2,5	13,975	71,932	-22	34,25	67,5	13,975
ALL AMER LAT	67,807	-19	-38,25	-32,5	-25,8375	57,052	119,9	-5,875	2,5	-25,8375	81,004	103,4	-5,875	67,5	-22,125
CCR SA	72,107	-65,4	-44,025	-32,5	-25,8375	72,107	-65,4	-12,875	-32,5	-25,8375	57,107	-65,4	-6,575	-32,5	-25,8375
CYRELA REALT	88,852	106,9	113,425	116,25	95,0625	88,852	106,9	113,425	116,25	95,0625					
LOCALIZA						-38,353	-65,4	-49,8	-32,5	-25,8375					
CETIP						-25,564	-65,4	-49,8	-8,125	-25,8375					
BMFBOVESPA											4,842	-55,5	-33	-32,5	-25,8375
VALE						17,631	-41,5	-26,525	8,125	-25,8375	29,984	-6,1	38,05	24,375	32,3125

Table 3: Evolution of the environmental disclosure in the sustainability report (2009 to 2011)
Source: Own source.

Even taking into account that the companies OGX PETRÓLEO and CYRELA

REALT did not published the sustainability report in 2011, one can see a small improvement in the information levels, which improve on average in the analyzed triennium, according to Table 4.

Média	**Emissions**	**Effluents**	**Wast**	**Prod/Serv**	**Transport**
2009	4,30	- 28,86	- 19,07	- 17,78	- 15,40
2010	13,96	- 17,31	- 2,87	-1,94	- 13,52
2011	23,93	- 10,70	- 4,32	0,98	-13,28

Table 4: Information level average on impacts management
Source: Own source.

Table 4 shows information about Emissions, Effluents and Products/Services. There were improvements in the level of disclosure, such as a slight increase in the information on greenhouse gas emissions, indirect emissions, effluents disposal and reverse logistics (for products/services). Then, it appears that this report may be used as an improvement mechanism of the information.

4.2 Annual report

The study of 50 companies reveals they do not prioritize information on environmental impacts in their annual reports. They keep this space for other infomation about their management, economic and financial performance. On average, these companies have a level of environmental disclosure performance below 100 points for the five analyzed criteria, revealing a compromising level of information. Each of these five criteria was dismembered into sub criteria, enabling to understand aspects of disclosure performance, according to Table 5.

Table 5: Triennial average about disclosure performance in the annual reports of companies listed in the IBRX-50

Criteria and sub-criteria analysis on emissions	**Média trienal**
1. Emissions	**13,69**
1.1. Direct emissions	7,17
1.1.1. Information Type	14,13
1.1.2. Performance Management	3,43
1.1.2.1. Metric	-15,74
1.1.2.2. Use of protocols	72,22
1.1.2.3. tendencies	-62,22
1.2. Indirect Emissions	4,72
1.2.1. Information Type	10,57
1.2.2. Performance Management	1,57
1.2.2.1.Mmetric	-12,04
1.2.2.2. Use of protocols	72,22
1.2.2.3. Tendencies	-75,56
1.3. Emissions of substances that destroy the ozone layer	-75,56
1.4. Emissions of NOx, SOx, and other significant substances	53,7
1.5. Reduction of emissions	59,26
1.5.1. Information Type	-56,06
1.5.2. Occurrence	-37,04
1.5.3 Trends	-80
2. Wastewater	**-7,14**
2.1. Information Type	-10,61
2.2. Treatment	8,64
2.2.1. % Treaty	5,06
2.2.2 Treatment Method	25,09
2.3. Annual goals	-28,7

3. Waste	**33,69**
3.1. Solid waste	-32,16
3.1.1. Information Type	1,82
3.1.2. Method of provision	29,13
3.2. Transported hazardous waste	-10,24
3.2.1. Information Type	-41,96
3.2.2 Treatment	51,85
3.3. Reduction Targets	-69,44
4. Products and services	**-16,79**
4.1. Impacts	-18,29
4.1.1. Initiatives	-42,18
4.1.2. Reducing Impacts	-38,17
4.2. Recovery descartes	-14,81
4.2.1. Amount	-45,93
4.2.2. Category	-8,15
5.Transporte	**-18,55**
5.1. Impacts of transport	-7,57
5.1.1. Transport used by the company	-39,44
5.1.1.1 Type information	-0,19
5.1.1.2. Scope	-25,93
5.1.2. Transportation used for logistical purposes	9,46
5.1.3. Transport used for internal public transport	21,68
5.2. Criteria for evaluating impacts	4,46
5.3 Reducing Impact	14,81
5.3.1. Type	1,11
5.3.2. Goal	-25,93

Source: Own souce

First, it is verified that information on **emissions (13.69) and waste (33.69)** are on average in the **market level**. For information improving about **emissions,** one realizes the need to improve the following evidenced data by these companies: (1) data showing the evolution of impacts. (2) Detailed information about substances that harm the ozone layer, and (3) type of information provided (descriptive, quantitative and monetary).

With regard to **waste**, there are opportunities to improve the information on (1) transportation of hazardous waste, and (2) annual targets of reduction. With the analysis, it was also possible to recognize that the disclosure level of information about **liquid effluents (-7.14), products/services (-16.79)** and **transportation (-18.55)** possesses a performance considered as **compromising.**

The result also shows the absence of monetary and quantitative information about the generation of liquid effluents and goals to reduce them. Lack of information on impacts generated by products and services, and consequently, lack of information on targets to reduce these impacts. Finally, the companies need to give information on impacts of the transportation used by them.

It is appealing to note the vital role of society in the process of information improvement. Thus, in the last decade there was an increase of pressures on the companies for some issues, such as emissions and waste.

Therefore, it appears that subjects with greater emphasis in the media, the meetings in Stockholm (2011), Rio+20 (2012) and national regulations (Federal Law number 12.305/2010 - solid waste), also prodece better performances in the companies´ information level. This might represent that firms increase their disclosure levels to meet social and normative demands.

The analysis shows that, in general, the companies lack comparison protocols use, information about distributing substances of the ozone layer, presentation of comparative charts about the development of impacts reduction and generation.

They also need more information details on effluents treatment methods and solid waste disposal, transportation used for logistical purposes and staff, and information related to impacts that need to be extended (as the vast majority is merely descriptive).

4.3 Determinant Factors

The determining factors are observed in order to understand the relationship between the five criteria of impacts management disclosure (EF - effluents, EM - emissions, PS - products/services, RE - waste, TR - transportation).

With economic performance indicators (ROA - return on assets, and ROE - return on average equity) and environmental performance (POTEN - potentially polluters, ISE – index of business sustainability, DRS - disclosure of sustainability report and SITE - disclosure on site). The results can be seen in Table 6.

Table 6 - Results of regressions and canonical correlations

1ª Equação		2ª Equação		Correlação P-valor
EFRA	-0,2175	EFRS	0,0293	77,47% 0,0000*
EMRA	0,3481	EMRS	0,3288	
PSRA	-0,3652	PSRS	0,2084	
RERA	0,5211	RERS	-0,0098	
TRRA	0,8249	TRRS	0,6128	
DRS	0,6785	RAG	0,0522	49,98% 0,0461*
ISE	-0,2106	RSG	0,9633	
POTEN	0,3635			
ROA	1,0838			
ROE	-0,5513			
SITE	0,2143			
DRS	0,6836	RAG	-0,1109	49,42% 0,0359*
ISE	-0,1674	RSG	1,0731	
POTEN	0,5093			
ROA	0,9881			
ROE	-0,4862			
DRS	0,6603	RSG	1,1659	41,08% 0,0439*
POTEN	0,8708	RAG	-0,2687	
ISE	-0,2973			
RAG	1,7334	RAG	0,2132	34,47% 0,1431
ROE	0,8411	RSG	0,8411	

Source: Own souce

The first analysis is performed with the aim of assessing the relationship between the communication channels used by the company for impacts management disclosure (RSG and RAG). Here, one observed a strong correlation between the annual report and sustainability one. For this analysis, it was possible to consider only companies that disclose their sustainability reports.

This proves that when the companies have sustainability report, the information provided is consistent with the specified in the annual report. One also observed that the differences between one report and another are in the information coverage on the criteria. This leads to believe that the annual report is used to display general information and the sustainability report shows detailed information.

This result may be due to greater coverage of criteria to be presented in the sustainability report that lead companies to promote better internal levels of control and knowledge about their environmental performance. In addition, through the internal policy that offers greater levels of disclosure on impacts management.

The second, third and fourth analyzes reveal the correlation between environmental and economic performances (together) with the levels of disclosure in the annual reports on sustainability. The best index of canonical correlation found was 49.98%, demonstrating better correlation of the disclosure level reports with environmental and economic data. This proves that potentially polluting companies, with information of disclosure on the website that reveal the sustainability report, and have better economic performance (ROA and ROE), are those with better disclosure levels.

This shows that the disclosure is complex. It can be determined by a number of internal and external factors and not just by the internal policy of disclosure. Thus, it depends on factors related to economic activity and results.

Finally, when analyzing the correlation between disclosure levels of the reports and economic performance (only ROA and ROE), it was not possible to find significance in the result. Then, for this sample of companies, there is no correlation between these factors.

5 CONCLUSION

This paper aims to identify the determinant factors of environmental disclosure level of Brazilian companies listed on the stock exchange, in different sectors of the economy. There was a sample of 50 companies that make up the IBRX-50 index. Their sustainability and annual reports were analyzed between 2009 and 2011.

The literature review, presented in Table 1, reveals evolution in the information type since, in the 1990s, the analysis on issues related to management, commitment and legal aspects used to hold greater emphasis. From the year 2000, the aspects related to environmental performance, such as data on impacts and natural resources consumption, have become frequent in the researches.

The empirical study in these 50 companies reveals gradual increase in the information level about managing impacts. Because of this, one realizes that the issues related to environmental performance are gaining ground, showing aspects of management, commitment, and also those related to performance.

In order to accomplish this research, the theoretical framework used for analyzing the disclosure level of impacts management was guided by the disclosure theory. It was possible to build the information assessment model provided by the companies from the literature review and experts knowledge. The results were analyzed to determine the disclosure level on emissions, liquid effluents, waste, products/services and transportation through annual and sustainability reports of 50 companies listed in the IBRX-50 of BM & FBOVESPA. From this analysis, it was performed canonical correlation analysis of disclosure level with indicators of economic and environmental performances.

Data reveal that only 22% of the surveyed companies disclose their sustainability reports, and the highest level of disclosure can be related to atmospheric emissions. All companies have annual reports because they are compulsory, and the best information levels are those related to atmospheric emissions and waste. This correlation between reports is possible to confirm in the statistical analysis, where one can observe a level of 77.47% correlation. This demonstrates that companies having both reports are consistent in their disclosures, only differentiating the level of information detail, where the sustainability report allows greater detail and depth.

Finally, it is also possible to observe the relation of disclosure level in both reports with the economic and environmental performances. However, the disclosure level cannot be correlated with economic performance only. Then, it makes to believe that, for surveyed companies, the disclosure level influences or might be influenced by other factors besides the economic result.

On future researches, it is essential to: (1) expand the sample for other national and

international companies. (2) To analyze the information disclosure on natural resource depletion, management aspects (policy, goals, certifications, management systems, professional liability) and financial aspects and (3) incorporate other elements for correlation analysis, such as issues related to profitability and country (with larger sample).

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