

Solid Waste Environmental Disclosures of Public Companies in Brazil of Environmentally Sensitive Industries*

Barbara de Lima Voss

Ph.D. student in Graduate Program in Accountancy, University of São Paulo
E-mail: babivoss@usp.br

Elisete Dahmer Pfitscher

Ph.D., Department of Accounting Sciences, Federal University of Santa Catarina
E-mail: elisete.dahmer@ufsc.br

Fabricia Silva da Rosa

Post-Doctoral Scholar, Graduate Program in Accounting and Administration, Regional University of Blumenau
E-mail: fabriciasrosa@hotmail.com

Maisa de Souza Ribeiro

Ph.D., Department of Accounting, Ribeirão Preto School of Economics, Administration and Accounting, University of São Paulo
E-mail: maisorib@usp.br

Received 3.26.2012 - Accepted on 3.28.2012- 4th version accepted on 2.28.2013

ABSTRACT

This study is motivated by companies' obligations to submit environmental information on solid waste in 2010. The research question is as follows: how was environmental information related to the solid waste of public companies in Brazil of environmentally sensitive industries disclosed in 2010? The general method used to answer this question was an analysis of public companies in Brazil of environmentally sensitive industries about of solid waste environmental disclosures in 2010. The following specific objectives were set: (i) to propose a model to identify documents as solid waste environmental disclosures and (ii) to evaluate the level of environmental disclosure and correlate it with financial variables. An analytical model of the solid waste environmental disclosure (Waste-Ede) was constructed for data analysis, which combined the concepts contained in the Environmental Disclosure Evaluation model, national policies regarding solid waste (Federal Law. no. 12.305/2010) and the Global Reporting Initiative (GRI) (2006) guidelines. The results show that most companies did not publish a sustainability report. The non-probabilistic final sample included 86 companies. The results limited to this sample showed that companies are disclosing information on solid waste at the market level (according to the model), with a mean of 12.44 points, and that there was a significant correlation at the 95% level between the Waste-Ede index and the following financial variables: environmental investments, total assets, net equity and gross revenues. In conclusion, in 2010, public companies in Brazil of environmentally sensitive industries that were part of the study most likely complied with regulations because of pressure from investors, given that regulators had no power of enforcement.

Keywords: Environmental Disclosure. Solid Waste. Public Companies in Brazil of Environmentally Sensitive Industries.

*Paper presented at the XXXVI ANPAD Meeting, 2012, Rio de Janeiro.

1 INTRODUCTION

Rio+20 in 2012 gave rise to debates and discussions on climate change, environmental impact and world environmental education in Brazil. Issues such as how to reconcile consumption and development with sustainable environmental policies were widely debated. Among the subjects discussed was solid waste, an essential factor in a nation's economy. Questions on the topic include how to manage it, where to dispose of it, how to recycle it and which raw materials to use.

In 2010, the XII International Fair and Seminar for Industrial Environment and Sustainability (Feira e Seminário Internacional do Meio Ambiente Industrial e Sustentabilidade - FIMAI/SIMAI) offered courses dealing with the subject of solid waste. In 2011, the Brazilian Association of Solid Waste and Public Cleansing held the 3rd International Forum on Solid Waste. The increased public attention, availability of information and discussions on the topic from both a social and business perspective, especially following the adoption of Federal Law no. 12.305/2010, gave rise to this study of public Brazilian companies from an accounting perspective.

The influence of the abovementioned law, which addresses national policy on solid waste for both public and private entities, requires some reflection. Determining whether companies with a high degree of environmental impact reveal their environmental issues and how they do so is critical to determine whether this law has had an impact on company management. Based on the concept described by Rosa, Ferreira, Ensslin, and Ensslin (2010), environmental disclosure is a tool used to support management decisions regarding the environmental information disclosed.

In the context of previous studies, Cho and Patten (2007) discussed environmental disclosure as a tool used to legitimize organizational actions. Note that the focus there is on whether disclosure affects the social environment in which the company operates. Cho, Roberts, and Patten (2010) analyzed the language employed in environmental disclosures. Studies by Holder-Webb, Cohen, Nath and Wood (2009) and Reverte (2009) sought to relate environmental disclosure to corporate social responsibility. Jenkins and Yakovleva (2006) studied the communication of environmental impact. Neu, Warsame and Pedwell (1998) analyzed the role and functionality of environmental disclosures. Patten (2002) sought to relate environmental performance and environmental disclosure.

How much environmental information is disclosed has been discussed in an article by Zeng, Xu, Dong and Tam (2010), who argue that the relation of information is related to the type of business activity. In particular, disclosure is more likely in sectors where there is greater pressure from the government due to increased potential for environmental problems, such as the oil and gas industries. The conclu-

sion of these authors is similar to that of Cho and Patten (2007): they found that companies with a higher potential to pollute had a higher level of environmental disclosure.

The definition of a polluting activity was based on Brazilian legislation, specifically Federal Law. 10,165 (Política Nacional do Meio Ambiente [National Environment Policy], 2000) and the registration manual of the Brazilian Institute of the Environment and Renewable Natural Resources (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis - IBAMA) (2004). The list is neither exhaustive nor conclusive and requires constant analysis to be appropriate for the social state on which it is based.

Solid waste is most commonly garbage or dejects, i.e., material that is unwanted after consumption. Because this study deals with all public companies in Brazil, a definition that could encompass all types of waste was sought. Therefore, we used the following terminology from the Brazilian Technical Standards Association (Associação Brasileira de Normas Técnicas - ABNT) (2004): solid waste is waste in solid form that can result from industrial, domestic, commercial and other activities.

This study has limitations regarding the companies studied. Companies with shares traded on the BM&FBOVESPA (Bolsa de Valores, Mercadorias & Futuros de São Paulo - Securities, Commodities and Futures Exchange) were initially considered. However, due to the limited availability of information on solid waste, companies that manage and treat solid waste but do not disclose such information were not considered. The disclosure aspect is the point addressed in the study.

This article aims to fill the gap in research into environmental disclosure by focusing on solid waste from an accounting perspective. Studies of environmental disclosure in Brazilian accounting treat the subject as a whole; therefore, the gaps in Brazilian research can be filled by addressing the details of a particular area of environmental disclosure, such as solid waste. In this context, the question that guides this research is as follows: how was environmental information related to the solid waste of public companies in Brazil of environmentally sensitive industries disclosed in 2010? The general objective was to verify environmental disclosure regarding the solid waste of public companies in Brazil that may potentially be polluting in 2010. To achieve this goal, the following specific objectives were set: (i) to propose a model to identify documents as solid waste environmental disclosure and (ii) to evaluate levels of environmental disclosure and correlate them with financial variables. The methodology used was a systemic analysis based on content analysis to identify information on solid waste management in sustainability reports and on websites. The study was qualitative and quantitative, descriptive, practical, applied and deductive-inductive. Data were obtained from secondary sources.

2 LITERATURE REVIEW

The theoretical framework is based on Brazilian and international perspectives on environmental disclosure and solid waste.

2.1 Environmental Disclosure.

According to Voss (2012), environmental disclosure in Brazil between 2009 and 2010 can be divided into se-

ven aspects: (1) disclosure practices, (2) disclosure relationships, (3) adherence to disclosure rules, (4) explanatory factors for disclosure, (5) levels of disclosure, (6) scientific production and (7) management models. This study links the explanatory factors for environmental disclosure (group 4) and levels of environmental disclosure (group 5).

According to Voss (2012), in quantitative studies using variables to understand the levels of disclosure, the following nine variables were highlighted between 2009 and 2010 for Brazil and are summarized in Figure 1: size, control source, internationalization, profitability, indebtedness, industry, governance, audits and share issuance.

SOURCE	MAIN VARIABLES								
	Size	Control source or controlling interest	Internationalization (stock exchange)	Profitability (return on assets/equity - ROE or ROA)	Indebtedness	Industry or nature of the activity	Corporate Governance	Audit	Share issuance
Braga, Oliveira and Salotti (2009a)	√	√		√	√	√	√		
Ciofi (2010)									
Coelho, Ott, Pires and Alves (2010)	√	√	√	√	√		√		
Gondrige (2010)	√		√					√	
Murcia (2009)		√				√			
Murcia and Santos (2009a)	√	√	√	√	√	√	√	√	√
Murcia and Santos (2010)	√	√	√	√	√	√	√	√	√
Murcia and Souza (2009)	√	√	√			√	√	√	√
Murcia, Souza, Dill and Costa Junior (2010)	√			√	√				
Nossa (2002)	√								
Rover and Murcia (2010)	√		√	√	√				

Figure 1 Main significant variables studied

Source: Voss (2012).

The variable "size" is the most significant in studies of Brazilian companies, followed by internationalization, control source, profitability and indebtedness. Controlling interest is understood primarily as whether the controlling share is of national or foreign origin, whereas internationalization refers to the ownership of securities traded on stock exchanges in other countries.

Reverte's (2009) literature review shows that, at an international level, research into the corporate practices of social responsibility has produced different theoretical perspectives in support of social reporting, such as agency theory, legitimacy theory and stakeholder theory, among others. According to the same author, stakeholder theory deals explicitly with the impact of the expectations of different stakeholder

groups within society on corporate disclosure policies. The central thesis in that study is that corporate disclosure is a management tool used to manage the information requirements of various powerful stakeholder groups such as employees, shareholders, investors, consumers, governments and non-governmental organizations (NGOs).

Voluntary initiatives that lead companies to disclose environmental issues are described in the study by Jenkins and Yakovleva (2006) on mining companies. Among the reasons outlined as causing a sense of corporate social responsibility and voluntary initiatives are the following: industry opinion, pressure groups, the financial sector and difficulties in obtaining an operating license. Figure 2 presents a summary of these motivations.

SOURCE	MOTIVATION
Rae and Rouse (2001)	The opinions of natural resource extraction industries is influenced more by concern over environmental and social performance than products, prices, quality and safety.
Walker and Howard (2002)	Pressure groups challenge the legitimacy of the industry. For example, the opposition of communities and indigenous groups to the development of a uranium mine in Australia delegitimized it.
SRI (2002)	The financial sector is increasingly focused on risk management and social responsibility. Thus, mining companies are not typically seen as a socially responsible investment.
Walker and Howard (2002)	Obtaining a license to operate is a challenge, e.g., the expansion of gold mining in Peru suffered from charges of bribery, lack of community involvement, detrimental impact on agriculture, pollution, health impact and loss of work.

Figure 2 Sources of motivation for mining companies

Source: Adapted from Jenkins and Yakovleva (2006).

Patten (2002) states that causes of environmental or social disclosure are diverse and result in numerous theories of social disclosure. In discussing social disclosure, the author is also referring to environmental disclosure. Legitimacy and stakeholder theories, according to Gray, Kouhy and Lavers (1995a), are considered to be more overtly concerned with "mediation, modification and transformation". These authors assert that the stakeholder theory, from a bourgeois point of view, is strategically concerned with the continued success of the organization. With regard to legitimacy theory, Patten (2002) argued that a corporation's economic legitimacy is obtained by participating in public politics, of which a common method is the disclosure of financial reports. Other authors corroborate the previous idea, and Cho and Patten (2007) suggest that legitimacy theory predicts that companies with poor environmental performance would be expected to provide wider dissemination or positive environmental disclosure in their financial reports.

The study of Lindblom (1994 *apud* Gray, Kouhy, & Lavers, 1995a) identifies the following four strategies that organizations can adopt in terms of social and environmental disclosure to acquire legitimacy: (i) educating and informing the relevant public about changes in performance and activity, (ii) changing the perceptions of the relevant public about performance, (iii) diverting attention from important issues such as environmental pollution and (iv) changing external expectations about the organization's performance. Note that the goal of these strategies is to persuade users in favor of the organization's purposes.

According to Reverte (2009), social and environmental disclosure can be useful in determining the contractual bond, administrative compensation contracts or implicit political costs. However, as indicated by Cormier et al. (2005 *apud* Revert, 2009), agency theory, which focuses on monetary considerations or wealth, leads agents trading in efficient markets to intentionally limit the relevance of social and environmental disclosure because many potential users of such information (e.g., Greenpeace) cannot act in these markets.

The relationship between environmental disclosure and accounting information has been studied by several authors. The first example is the study of Francis, Nanda, and Olsson (2008), who investigated voluntary disclosure, earnings quality and cost of capital, while Francis, Khurana, and Pereira (2005) studied voluntary incentives and the effects of cost of capital in various business enterprises worldwide. The third example is that of Frederickson, Hodge, and Pratt (2006), who reported the results of experiments of enterprises related to voluntary disclosure. Continuing these studies, Holder-Webb et al. (2009) proposed the construction

of a model based on previous work on disclosure as a component of corporate social responsibility and explored communication practices adopted by many U.S. companies, except those related to financial services, investment funds and monopolies.

Cho et al.'s (2010) article examines whether the biased language and verbal tone present in corporate environmental disclosures varies according to an individual company's environmental performance, specifically for the sector of businesses that have the potential to pollute. In an earlier study, Cho and Patten (2007) examined whether environmental disclosure is used as a legitimization tool.

Another example of a study of the potentially polluting sector in the U.S. is Cho, Patten, and Roberts' (2006) study on corporate political activity, which tried to determine whether this activity is consistent with the results of environmental disclosure, that is, whether companies that are worse in terms of environmental performance spend more on political activity than those with better performance. They also attempted to identify whether electoral campaign expenditure is related to the concomitant use of environmental disclosure in financial reports.

Jenkins and Yakovleva (2006) explored trends in communication regarding the impact on and challenges of the global mining industry. They studied the development of environmental and social communication media in the mining industry and factors driving the development of this disclosure.

Environmental disclosure can be measured using many criteria. Rosa, Ensslin and Ensslin (2012) identified studies in the period 1991-2010 that used the following criteria: management approach; voluntary actions for sustainable development; water; degraded areas; auditing; biodiversity; communication channels; climate; fossil fuels (transportation); communication; community, employees and consumers; legal compliance; conservation and preservation of natural resources; environmental accounting; effluents; Environmental Impact Assessment (EIA) and Environmental Impact Report (EIR); atmospheric emissions; energy; future legal requirements; impact management and emergency situations; expenditure and investments; legitimacy; materials; monitoring, life cycle assessment (LCA) and supply chain; objectives and targets; research and development of products and services; pendencies and sanctions; planning; politics; pollution; waste; professional liability; economic results; insurance and concessions; environmental management system and certifications; transport; impact treatment; training/education. A summary of the most frequently referenced of these criteria is presented in Figure 3.

Classes are also defined by ABNT, with solid waste Class I (hazardous) encompassing waste that is hazardous due to its physical, chemical or infectious-contagious properties and that may present (1) a public health hazard, causing mortality, incidence of disease or increasing rates of such or (2) risk to the environment if the waste is managed improperly. Class II A waste (non-inert) may exhibit properties of biodegradability, flammability, and water solubility, and class II B waste (inert) is any waste that, when sampled in a representative manner and subjected to dynamic and static contact with distilled or deionized water at room temperature, has none of its constituents solubilized at concentrations above the standard for water potability, except for appearance, color, turbidity, hardness and taste.

The object and scope of Federal Law no. 12,305 (2010) are all physical or juridical persons directly or indirectly responsible for the generation of solid waste. These persons, according to this law, may be those who develop integrated management activities or management of solid waste, and both the consumption and the integrated management of waste are linked to municipal plans for the proper disposal of waste and the premise of sustainable development (economic, social and environmental).

The law holds that throughout a product's life cycle, responsibility is shared among manufacturers, importers,

distributors, traders, consumers and holders of public urban sanitation and solid waste management contracts. It further holds that packaging should be manufactured in such a way that it can be reused or recycled. It also states that, regardless of the system of urban sanitation and solid waste management, there is an obligation to perform reverse logistics; manufacturers, importers, distributors and dealers of pesticides, batteries, tires, lubricants, fluorescent lamps and electronic products and their components are required to participate. The definition of reverse logistics in the aforementioned law consists of a set of actions aimed at the collection and proper disposal of solid waste.

According to Federal Law no. 12,305 (2010), solid waste generators (public and industrial sanitation, healthcare services and construction) are required to prepare a plan for solid waste management and cannot treat it in the same manner as household waste due to the nature or volume of waste involved. Article 21 of the Act addresses management plans for solid waste, the minimum requirements of which are as follows: description of the activity; diagnosis of solid waste generated or managed containing the origin, volume and waste characterization, including related environmental liabilities; actions relating to shared responsibility for the product life cycle and other remedial measures for related environmental liabilities.

3 METHODOLOGY

The study is methodologically classified as descriptive, deductive-inductive, applied, qualitative and quantitative

and documentary. The data are secondary, and the systemic analysis is based on content analysis, as shown in Figure 5.

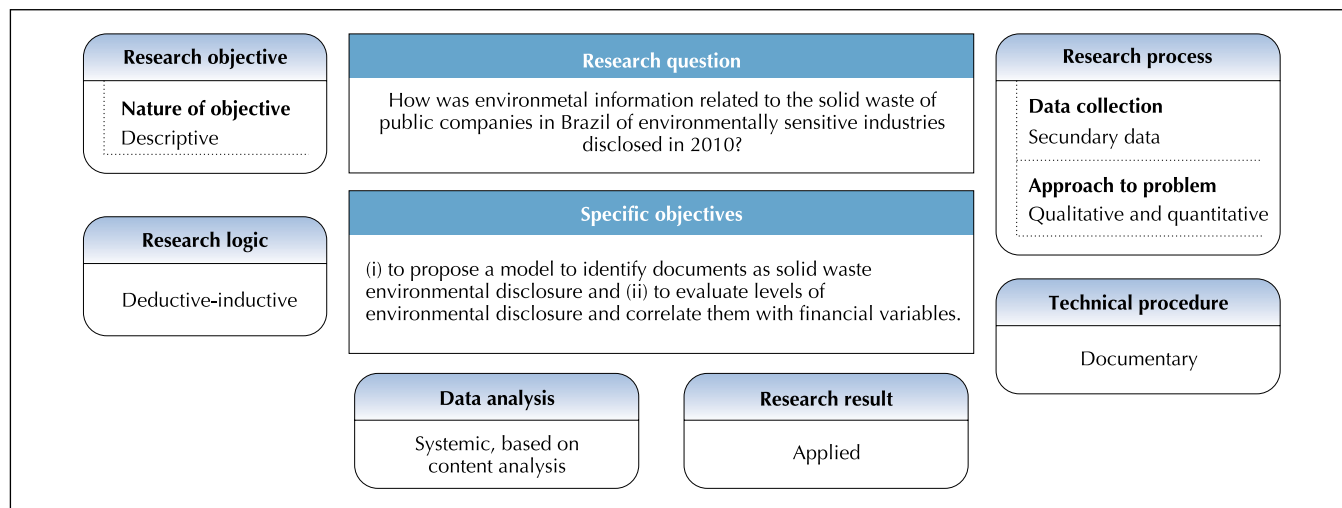


Figure 5 Research framework

Source: Research data.

Gil (2002) defines the descriptive nature of the objective as seeking to describe a phenomenon. In this study, the phenomenon to be described is how environmental information relating to solid waste is disclosed. The logic of the research is deductive-inductive,

as discussed by Richardson (1999), as it works both from the general to the specific and vice versa, i.e., both theory and practice are studied in both directions. The data used are secondary, as defined by Gil (2002). The approach to the problem is both qualitative and

quantitative, according to the definition of Raupp and Beuren (2006). Collis and Hussey (2005) state that applied research with grounded theory aims to generate knowledge through case studies. This research is documentary because it makes use of company reports. Data analysis is performed using a systemic logic based on the technique of content analysis, inspired by the principles of Bardin (2010).

3.1 Procedures for Data Collection.

The study population consisted of Brazilian public companies listed on the BM&FBOVESPA on March 24, 2011.

The sample was defined based on potentially polluting activities that utilize environmental resources covered by Federal Law No. 10,165 (2000) and those contained in the registration manual of potentially polluting activities included in the IBAMA table of activities. The final collection date was December 4, 2011.

The following are the requirements for a company to be included in the sample: (a) it must belong to the potentially polluting sector, (b) it must have shares traded on BM&FBOVESPA and (c) it must have information about solid waste. Table 1 lists the types of companies classified in this procedure.

Table 1 Potentially polluting companies - population and sample

SECTOR	POP.	SAMPLE	SECTOR	POP.	SAMPLE
Sugar and Alcohol	4	2	Dairy	2	-
Agriculture	3	2	Construction and Agricultural Machinery and Equip.	2	1
Various foods	6	1	Hospital Machinery and Equip.	1	-
Weapons and Munitions	1	1	Industrial Machinery and Equip.	5	1
Copper Artifacts	1	1	Machinery and Equipment	2	-
Iron and Steel Artifacts	7	-	Building Materials	6	3
Coffee	3	-	Aeronautical Materials	1	1
Footwear	4	-	Railway Materials	1	-
Meat and Derivatives	6	-	Road Materials	13	1
Cigarettes and Tobacco	1	1	Metal Minerals	5	1
Construction	23	8	Compressor Engines and Others	3	2
Heavy Construction	5	-	Pulp and Paper	7	5
Electrical Energy	66	29	Petrochemicals	6	2
Electrical Equipment	1	-	Various Chemicals	2	-
Road Operations	17	6	Steel	6	1
Exploration and/or Refining	7	3	Air Transport	2	-
Fertilizers and Pesticides	4	1	Railway Transport	6	4
Gas	2	1	Water Transport	2	1
Grains and Derivatives	1	-	Road Transport	2	1
TOTAL				235	86

Source: Research data.

At this point, it should be noted that the majority of potentially polluting public companies provided no information on solid waste, whether in report form or on their websites. The final sample included 86 companies, of which 39 published sustainability reports and disclosure on their electronic sites. The total number of companies that disclosed environmental information on their websites was 216, of which nearly 39% disclosed environmental information on solid waste. Data analysis based on Bardin's (2010) content analysis used the phrase as the unit of analysis and the theme as the semantic unit. The next section shows how the Waste-Ede model was built to evaluate solid waste environmental disclosure.

3.2 Waste-Ede Model Construction.

The Waste-Ede model construction is based on a previous study by Crespo Soler, Ripoll Feliu, Rosa and

Lunkes (2011), which presented the *Environmental Disclosure Evaluation (EDE)* model for the evaluation of environmental disclosure based on the model of the *Global Reporting Initiative (GRI)* sustainability report. The content of this model was based on the perceptions of internal managers. The proposed model is based on an external view, i.e., using a non-management perspective.

The sources of the Waste-Ede model subareas are fundamentally the GRI and Law no. 12,305 (2010). The model can be viewed as consisting of both voluntary information, such as that provided by the GRI in its environmental performance indicators EN2, EN14, EN22, EN26, EN28 and EN30, and mandatory information provided by companies that generate non-household waste, as required by the aforementioned law. Figure 6 illustrates the documentary sources of the model.

Waste-Ede - Environmental Solid Waste Disclosure Assessment	SOURCES	
Solid waste environmental disclosure assessment model	GRI	Solid Waste Act
1. Diagnosis of solid waste		
1.1 Characterization of solid waste	EN22	Art. 21, section II
1.2 Method of disposal (separated by type of waste)	EN22	
2. Legal Compliance		
2.1 Regulatory concerns with respect to solid waste		
2.2 Fines and sanctions	EN28	
3. Environmental policies		
3.1 Environmental education	EN14	
3.2 Solid waste recycling	EN2	Art. 21, section VI
3.3 Reverse logistics		Art. 21, section VII
3.4 Reduction of solid waste (current and previous years)	EN26	Art. 21, section VI
4. Economic aspects		
4.1 Concern for environmental liabilities		Art. 21, section VIII
4.2 Investment in environmental protection	EN30	

Figure 6 Documentary sources for the Waste-Ede model

Source: Research data.

The Waste-Ede model unites the EDE, GRI guidelines (2006) and Federal Law no. 12,305/2010. Information was obtained from the websites and sustainability

reports of these sources to meet the objectives for each area. Figure 7 presents the specific objectives of each subarea.

Waste-Ede – Solid Waste Environmental Disclosure Assessment	
Solid waste environmental disclosure assessment model	
	OBJECTIVE
1. Diagnosis of solid waste	
1.1 Characterization of Solid Waste	Is the volume (tons) (V), the characterization of waste (hazardous or non-hazardous) (C) and the origin (O) declared?
1.2 Method of disposal (separated by type of waste)	Is the waste treatment method reported?
2 Legal Compliance	
2.1 Regulatory concerns with respect to solid waste	Was there awareness of national policy on solid waste? (Vision of improvement of waste management?)
2.2 Fines and sanctions	Are there penalties or fines resulting from legal noncompliance?
3 Environmental Policies	
3.1 Environmental education	Is environmental education promoted internally (I) and/or externally (E)?
3.2 Solid waste recycling	Is there solid waste recycling?
3.3 Reverse Logistics	Is there some indication of concern for the product's life cycle? I.e., Using collection posts, partnerships with cooperatives, association with transporters and distributors, identifying consortium solutions or those shared with other generators.
3.4 Reduction of solid waste (current and previous year)	Percent reduction in the previous year's waste that was accomplished in the last year.
4 Economic Aspects	
4.1 Concern for environmental liabilities	Is there concern for environmental liabilities?
4.2 Investment in environmental protection	Are there environmental protection investments related to solid waste?
OVERALL SCORE	

Figure 7 Objectives of each subarea of the Waste-Ede model

Source: Voss (2012, pp. 43-44).

The model therefore consists of four areas (diagnosis, legal compliance, environmental and economic aspects) and 10 subareas (characterization, disposal method, regulatory concerns, fines and sanctions, environmental education, recycling, reverse logistics, reduction, concern for environmental liabilities and investment in environmental protection). Each subarea has a specific scale. Some include the following impact levels: (D) declarative, (M) monetary,

(Q) quantitative, or the combinations (D/M), (D/Q), (Q/M) and (D/Q/M) in accordance with Gray, Kouhy and Lavers' (1995b) research; others are dichotomous. The details of the scales are explained in the description of Figure 9.

The green, yellow and red colors represent how a company is classified based on the score obtained by the model, as shown in Figure 8.

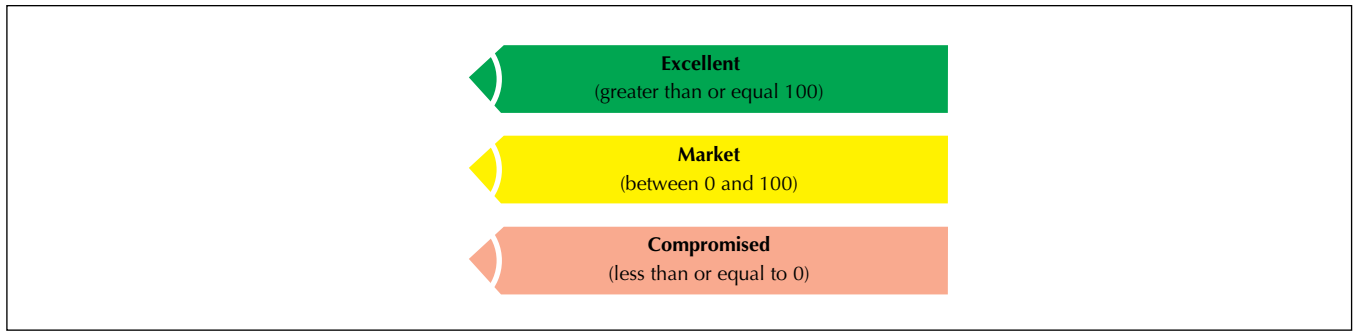


Figure 8 Ordinal scale colors and cardinal scale score

Source: Adapted from Crespo Soler et al. (2011).

The Waste-Ede model containing the four areas, 10 subareas and scales for each of these is shown in Figure 9.

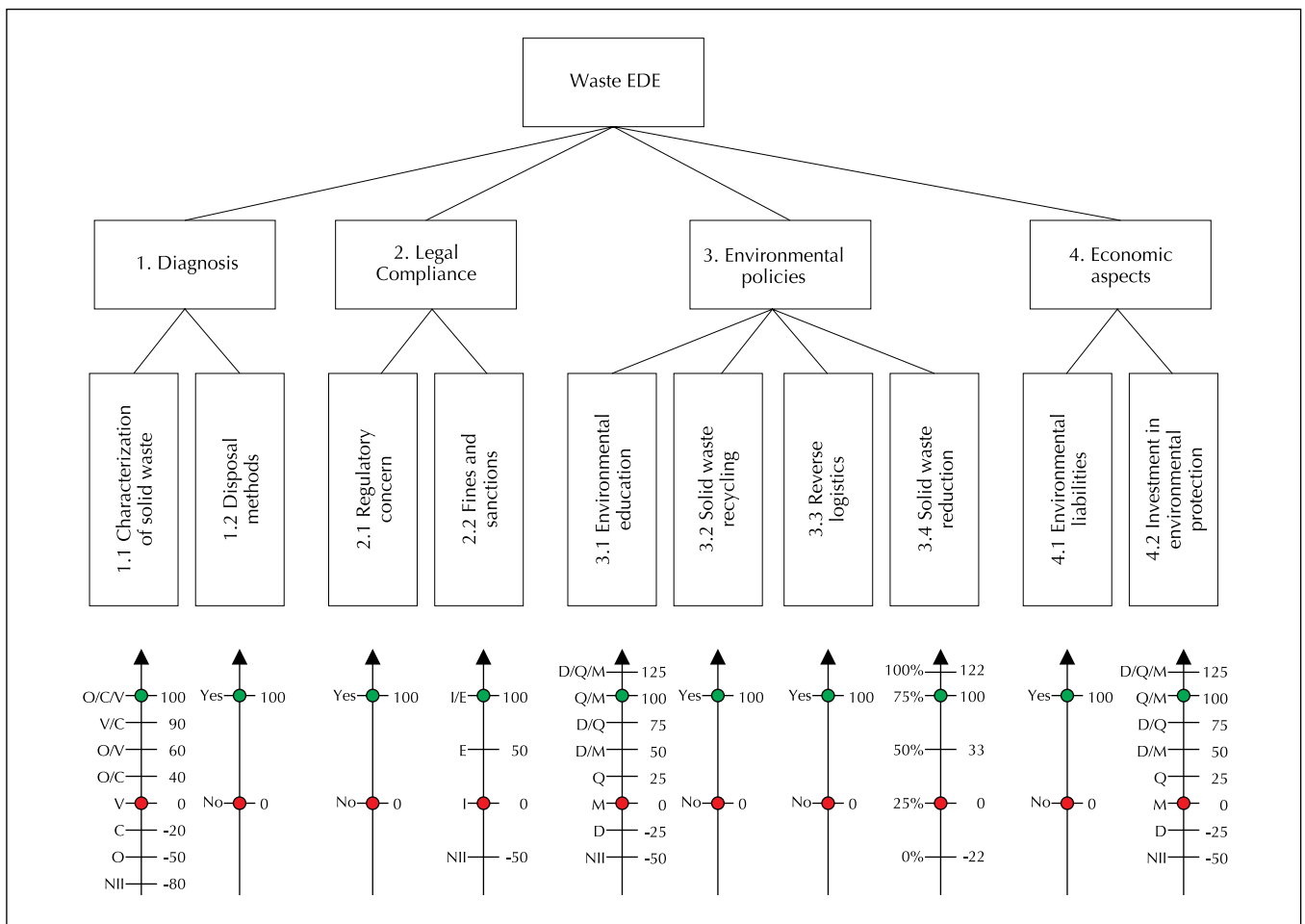


Figure 9 Waste-Ede Model structure

Source: Voss (2012).

The order and color of the scales depends on whether the level is excellent (green), market (yellow) or compromised (red). Semantic judgment was used to transform each of the ordinal scales into cardinal scales with the aid of *M-Macbeth software* version 2.3.0, which represents the difference in attractiveness between the levels. Judgment was performed internally between the scales, then between the subareas, and finally between the model areas.

3.3 Data Analysis Procedures.

Eighty-six companies were included in the final sam-

ple (Table 1). The analysis period was the year 2010, when the national solid waste policy law was passed. The financial data of these companies were examined to determine whether there was any relationship between the Waste-Ede index and appropriate listed financial data, and the annual financial statements ending 12/31/2010 were collected from the Brazilian Securities Commission (Comissão de Valores Mobiliários - CVM) database available on the BM&FBOVESPA website. Total investments and investment in solid waste were obtained from sustainability reports, as shown in Figure 10.

VARIABLE	DESCRIPTION	AREA
Shares	Number of shares (paid-in capital)	Standardized financial statements/company data
Assets	Total assets (1 total assets)	Consolidated financial statements/balance sheet assets
EI	Total environmental investments	Sustainability report
EI-Waste	Total investments in solid waste	Sustainability report
NE	Net equity (2.03 Consolidated Net Equity)	Consolidated financial statements/balance sheet liabilities
Revenue	Gross revenue (7.01 Revenue)	Consolidated financial statements/value-added statement

Figure 10 Financial variables

Source: Research data.

The determination of a possible association of the Waste-Ede index with financial variables was performed with the aid of the *Statistica* software v. 6.0.

4 ANALYSIS OF RESULTS

The answer to the research question was obtained through achieving the two specific objectives that were previously described. Consequently, the results are divided into (i) the Waste-Ede model for identification of environmental disclosure items and (ii) the assessment of the level of environmental disclosure and correlation with financial variables.

4.1 Waste-Ede Model for Identification of Environmental Disclosure Items.

The ten Waste-Ede model subareas applied to the

sampled companies provide quantification of qualitative information because the semantic judgment allowed the ordering and numerical representation of this classification. The model has a voluntary and compulsory nature. Five subareas of the model are supported in the legislation and four in GRI guidelines. One of the subareas, regulatory concern regarding solid waste, was interpreted based on industry standards. The application of the model to the study sample is presented in Table 2.

Table 2 Final result of disclosure items and their scores per subarea

Sector/Company	Score	1.1	1.2	2.1	2.2	3.1	3.2	3.3	3.4	4.1	4.2
Sugar and Alcohol	29.08	28.21	-	3.58	-4.37	-6.32	10.42	1.26	-1.6	-	-2.11
Sugar and Alcohol	-35.27	-22.57	-	-	-13.1	-6.32	10.42	-	-1.6	-	-2.11
Agriculture	-28.95	-22.57	-	-	-13.1	-	10.42	-	-1.6	-	-2.11
Agriculture	-28.95	-22.57	-	-	-13.1	-	10.42	-	-1.6	-	-2.11
Various Foods	-35.27	-22.57	-	-	-13.1	-6.32	10.42	-	-1.6	-	-2.11
Weapons & Munitions	-45.69	-22.57	-	-	-13.1	-6.32	-	-	-1.6	-	-2.11
Copper artifacts	31.75	25.39	13.89	3.58	-13.1	-6.32	10.42	-	-	-	-2.11
Cigarettes and Tobacco	65.10	25.39	13.89	3.58	21.84	-6.32	10.42	-	-1.6	-	-2.11
Construction	51.71	28.21	-	-	21.84	-6.32	10.42	1.26	-1.6	-	-2.11
Construction	37.53	25.39	13.89	3.58	-13.1	-6.32	10.42	-	-1.6	-	5.27
Construction	33.19	-	-	3.58	21.84	-	10.42	-	-1.6	1.05	-2.11
Construction	-27.90	-22.57	-	-	-13.1	-	10.42	-	-1.6	-	-1.05
Construction	-35.27	-22.57	-	-	-13.1	-6.32	10.42	-	-1.6	-	-2.11
Construction	-13.71	-5.64	-	3.58	-13.1	-6.32	10.42	-	-1.6	-	-1.05
Construction	-28.95	-22.57	-	-	-13.1	-	10.42	-	-1.6	-	-2.11
Construction	-44.64	-22.57	-	-	-13.1	-6.32	-	-	-1.6	1.05	-2.11
Electrical Energy	91.42	25.39	13.89	3.58	21.84	12.63	10.42	-	-1.6	-	5.27
Electrical Energy	87.84	25.39	13.89	-	21.84	12.63	10.42	-	-1.6	-	5.27
Electrical Energy	86.37	25.39	13.89	3.58	21.84	6.32	10.42	1.26	-1.6	-	5.27
Electrical Energy	83.29	28.21	13.89	-	21.84	12.63	10.42	-	-1.6	-	-2.11
Electrical Energy	6.03	-14.10	13.89	-	-13.1	12.63	10.42	-	-1.6	-	-2.11
Electrical Energy	22.24	-	-	-	21.84	-6.32	10.42	-	-1.6	-	-2.11
Electrical Energy	22.24	-	-	-	21.84	-6.32	10.42	-	-1.6	-	-2.11
Electrical Energy	95.84	28.21	13.89	3.58	21.84	12.63	10.42	-	-	-	5.27
Electrical Energy	67.63	-	13.89	3.58	21.84	12.63	10.42	-	-	-	5.27
Electrical Energy	95.51	28.21	13.89	3.58	21.84	12.63	10.42	1.26	-1.6	-	5.27

continuous

continued

Sector/Company	Score	1.1	1.2	2.1	2.2	3.1	3.2	3.3	3.4	4.1	4.2
Electrical Energy	50.88	-	13.89	-	21.84	-	10.42	-	-1.6	1.05	5.27
Electrical Energy	92.48	25.39	13.89	3.58	21.84	12.63	10.42	-	-1.6	1.05	5.27
Electrical Energy	63.51	-	13.89	-	21.84	12.63	10.42	-	-1.6	1.05	5.27
Electrical Energy	54.08	-5.64	13.89	3.58	21.84	6.32	10.42	-	-1.6	-	5.27
Electrical Energy	59.72	-	13.89	3.58	21.84	6.32	10.42	-	-1.6	-	5.27
Electrical Energy	79.38	16.92	13.89	-	21.84	12.63	10.42	-	-1.6	-	5.27
Electrical Energy	76.97	28.21	13.89	-	21.84	6.32	10.42	-	-1.6	-	-2.11
Electrical Energy	-12.74	-22.57	-	3.58	-13.1	12.63	10.42	-	-1.6	-	-2.11
Electrical Energy	53.19	28.21	13.89	3.58	-13.1	12.63	10.42	1.26	-1.6	-	-2.11
Electrical Energy	53.19	28.21	13.89	3.58	-13.1	12.63	10.42	1.26	-1.6	-	-2.11
Electrical Energy	5.08	28.21	-	-	-13.1	-6.32	-	-	-1.6	-	-2.11
Electrical Energy	-9.27	-22.57	-	-	4.37	12.63	-	-	-1.6	-	-2.11
Electrical Energy	-35.80	-22.57	-	3.58	-13.1	-	-	-	-1.6	-	-2.11
Electrical Energy	-28.95	-22.57	-	-	-13.1	-	10.42	-	-1.6	-	-2.11
Electrical Energy	-28.95	-22.57	-	-	-13.1	-	10.42	-	-1.6	-	-2.11
Electrical Energy	5.08	28.21	-	-	-13.1	-6.32	-	-	-1.6	-	-2.11
Electrical Energy	-28.95	-22.57	-	-	-13.1	-	10.42	-	-1.6	-	-2.11
Electrical Energy	-35.27	-22.57	-	-	-13.1	-6.32	10.42	-	-1.6	-	-2.11
Electrical Energy	-39.38	-22.57	-	-	-13.1	-	-	-	-1.6	-	-2.11
Road ops.	95.30	28.21	13.89	3.58	21.84	12.63	10.42	-	-1.6	1.05	5.27
Road ops.	-16.32	-22.57	-	-	-13.1	12.63	10.42	-	-1.6	-	-2.11
Road ops.	-35.27	-22.57	-	-	-13.1	-6.32	10.42	-	-1.6	-	-2.11
Road ops.	-35.27	-22.57	-	-	-13.1	-6.32	10.42	-	-1.6	-	-2.11
Road ops.	-45.69	-22.57	-	-	-13.1	-6.32	-	-	-1.6	-	-2.11
Road ops.	-33.67	-22.57	-	-	-13.1	-6.32	10.42	-	-	-	-2.11
Refinery	87.84	25.39	13.89	-	21.84	12.63	10.42	-	-1.6	-	5.27
Refinery	-42.11	-22.57	-	3.58	-13.1	-6.32	-	-	-1.6	-	-2.11
Refinery	-36.96	-22.57	-	-	-4.37	-6.32	-	-	-1.6	-	-2.11
Fertilizers	-35.27	-22.57	-	-	-13.1	-6.32	10.42	-	-1.6	-	-2.11
Fertilizers	-35.27	-22.57	-	-	-13.1	-6.32	10.42	-	-1.6	-	-2.11
Gas	60.98	-	13.89	3.58	21.84	6.32	10.42	1.26	-1.6	-	5.27
Constr.Mach.Equip.	-35.27	-22.57	-	-	-13.1	-6.32	10.42	-	-1.6	-	-2.11
Indust.Mach.Equip.	32.97	28.21	13.89	3.58	-13.1	-6.32	10.42	-	-1.6	-	-2.11
Construction Mats	24.32	-22.57	-	3.58	21.84	6.32	10.42	-	-1.6	1.05	5.27
Construction Mats	-35.27	-22.57	-	-	-13.1	-6.32	10.42	-	-1.6	-	-2.11
Construction Mats	-35.27	-22.57	-	-	-13.1	-6.32	10.42	-	-1.6	-	-2.11
Aeronautical Mats	44.89	28.21	13.89	-	-13.1	6.32	10.42	1.26	-	-	-2.11
Road Mats	51.38	16.92	-	3.58	21.84	-6.32	10.42	1.26	-1.6	-	5.27
Road Mats	-45.69	-22.57	-	-	-13.1	-6.32	-	-	-1.6	-	-2.11
Road Mats	6.50	-5.64	13.89	3.58	-13.1	-	10.42	-	-1.6	-	-1.05
Road Mats	-9.37	-22.57	13.89	3.58	-13.1	-	10.42	-	-1.6	1.05	-1.05
Road Mats	-39.38	-22.57	-	-	-13.1	-	-	-	-1.6	-	-2.11
Road Mats	18.16	11.28	13.89	3.58	-13.1	-6.32	10.42	-	-1.6	1.05	-1.05
Metal Minerals	60.15	25.39	13.89	3.58	-4.37	12.63	10.42	1.26	-1.6	1.05	-2.11
Compress. Motors	-31.69	-22.57	-	3.58	-13.1	-6.32	10.42	-	-1.6	-	-2.11
Compress. Motors	-17.80	-22.57	13.89	3.58	-13.1	-6.32	10.42	-	-1.6	-	-2.11
Paper & Pulp	81.00	25.39	13.89	3.58	21.84	12.63	-	-	-1.6	-	5.27
Paper & Pulp	61.64	25.39	13.89	-	-4.37	12.63	10.42	-	-1.6	-	5.27
Paper & Pulp	31.63	25.39	-	-	-13.1	12.63	10.42	-	-1.6	-	-2.11
Paper & Pulp	72.47	25.39	13.89	3.58	21.84	-6.32	10.42	-	-1.6	-	5.27
Paper & Pulp	-35.27	-22.57	-	-	-13.1	-6.32	10.42	-	-1.6	-	-2.11
Petrochemicals	-35.27	-22.57	-	-	-13.1	-6.32	10.42	-	-1.6	-	-2.11
Petrochemicals	-35.27	-22.57	-	-	-13.1	-6.32	10.42	-	-1.6	-	-2.11

continuous

continued

Sector/Company	Score	1.1	1.2	2.1	2.2	3.1	3.2	3.3	3.4	4.1	4.2
Steel	85.11	25.39	13.89	3.58	21.84	6.32	10.42	-	-1.6	-	5.27
Rail Transport	11.94	11.28	13.89	3.58	-13.1	-	-	-	-1.6	-	-2.11
Rail Transport	11.94	11.28	13.89	3.58	-13.1	-	-	-	-1.6	-	-2.11
Rail Transport	11.94	11.28	13.89	3.58	-13.1	-	-	-	-1.6	-	-2.11
Rail Transport	21.10	11.28	13.89	-	-13.1	-	10.42	1.26	-1.6	-	-1.05
Water Transport	-44.43	-22.57	-	-	-13.1	-6.32	-	1.26	-1.6	-	-2.11
Road Transport	-42.11	-22.57	-	3.58	-13.1	-6.32	-	-	-1.6	-	-2.11

Source: Research data.

Table 2 is the result of applying the Waste-Ede model to the companies. The "score" column shows the company level (excellent, market or compromised). The third through twelfth columns symbolize the weighted measurement of the specific scale of each model subarea, which were defined in Figure 7. For example, one company reported its fines and sanctions on solid waste declaratively, quantitatively and in monetary terms (subarea 2.2). The total potential of the level of impact (D/Q/M) is 125 points, and there was 17.47% participation; the result is therefore 21.84 points. Positive values correspond to "market" or "excellent" impact levels, and negative relate to the "compromised" level.

The application of the model revealed that two exclusively regulatory subareas (reverse logistics and concern for environmental liabilities) did not have values below zero, and another area of both regulatory and voluntary nature (reducing solid waste) had the largest mean of the rest of the subareas. The disposal methods subarea was the next largest with 6.14 mean points. Subarea 2.2, which addresses fines and penalties, pulled the index below the mean. The mode of this subarea was -13.10 points. Waste characterization (subarea 1.1) showed the lowest value of -22.57. The mixed subareas, i.e., those of voluntary and mandatory sources, comprised 1.1, 3.2 and 3.4 and had a shared mean of 5.32 points. Exclusively voluntary subareas (1.1, 2.1, 2.2, 3.1 and 4.2) had a mean score of 6.82, while legislation subareas 3.3 and 4.1 had a mean share of 0.30. On average, one can see that company disclosure was 5.62% (mandatory) versus 6.82% (voluntary).

The result is low but positive.

At this stage, the final sample was characterized to interpret the results. This procedure included 86 companies, with some sectors having no representation, such as iron and steel artifacts, footwear and meat and derivatives. Others had a low level of representation, particularly road materials (8%), various foods (17%), steel (17%) and petrochemicals (33%). Another aspect to be discussed is the number of companies in each sector; for example, the gas sector has two companies, one of which was included in the sample. The presence of few companies in the mining and iron industry and only two of the six petrochemical companies in the sample is worrying.

The companies in this sample have a mean performance regarding the appropriate publication of waste information of approximately 12%. This figure is lowered by companies that do not provide a sustainability report, as the information provided on the websites is insufficient in relation to solid waste. If we consider only companies that submitted a sustainability report according to the GRI model and in Portuguese, the mean performance rises to 60%.

A total of 47 companies from the agricultural, various food, weapons and munitions, fertilizers and pesticides, construction and agricultural machinery and equipment, petrochemical, water transport and road transport sectors are below the Waste-Ede index mean. Figure 11 shows the overall performance of listed companies by sector, and the orange band represents the mean.

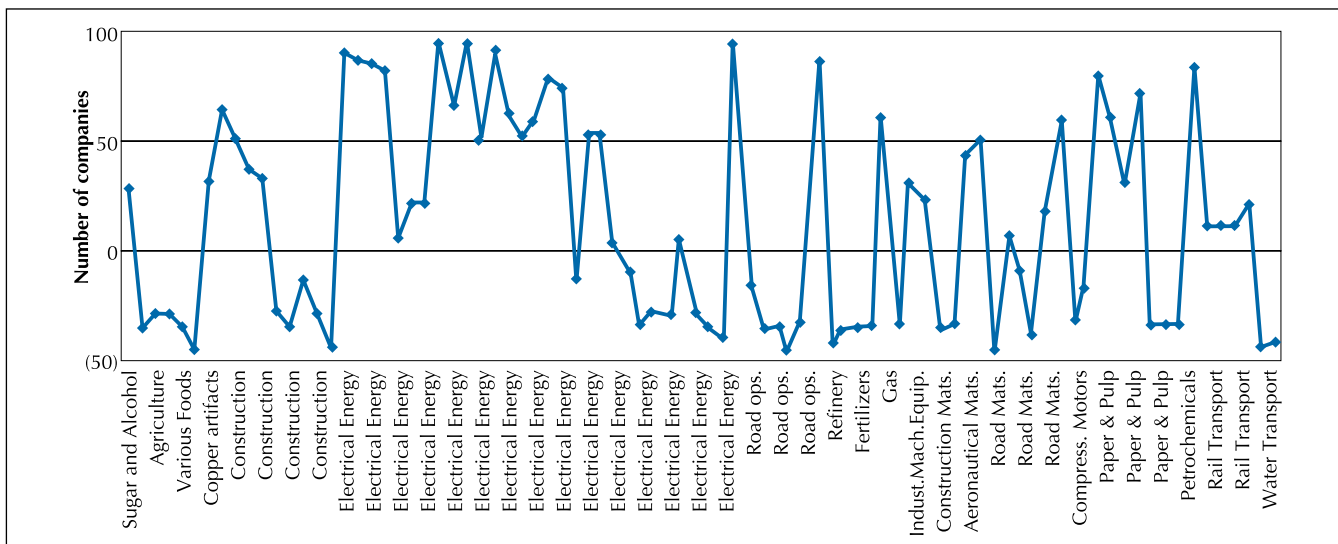


Figure 11 Overall performance of solid waste disclosure

Source: Research data.

Figure 11 shows that one of the two sugar and alcohol companies is at the market level (29%) and that the other is at the compromised level (-35%). The agriculture, weapons and munitions and various foods sectors are at the compromised level. Copper artifacts (32%) and cigarettes and tobacco companies (65%) are also at the market level. Performance is poor in construction. Only two of the seven companies in this sector are at the market level, and one is at the excellent level. Eight of the 29 electrical energy companies are at the compromised level. Basically, these are companies that only disclosed on their websites, while the other 16 companies are at the excellent level, one of which provided the best disclosure on solid waste in the study. The road operations sector exhibits a great contrast; one company is at the excellent level, and the remaining five are at the compromised level of disclosure. One exploration and/or refining company is at the excellent level, while the other is at the compromised level. The only gas company in the sample is at the excellent level. One road material company is at the beginning of the excellent range, close to 50%. One of the pulp and paper companies is at the compromised level (-35%), another is at the market level, and the remaining three are at the excellent level. The petrochemical companies exhibit poor disclosure and therefore are at the compromised level. The only steel company in the sample has excellent disclosure (85%).

The characterization of solid waste, also present in the GRI (EN22 indicator), is responsible for up to 28.21 points or 28.21% ($42.10\% \times 67\% \times 100$), and the minimum score possible is -22.57 ($42.10\% \times 67\% \times -80$). Note that companies are in compliance with the requirements of the GRI indicator and the Waste-Ede evaluation model. Most companies

were rated as excellent, i.e., above 100%. Subarea 1.2 (disposal method) generally showed a positive result, although 48 companies in this subarea did not provide disclosure.

Declarative, quantitative and monetary analysis was conducted in subarea 2.2, and the result obtained was negative because 27 companies achieved the highest score but 54 did not provide disclosure. With regard to environmental education, 57 companies reported none or that they only invested in or supported the environmental education of their employees and did not extend this benefit to other stakeholders, such as suppliers, local communities, or investors, among others. Eighteen companies did not provide information about recycling. The result was negative with respect to reverse logistics; 74 companies did not provide any information. Those that did (12) belonged to the sugar and alcohol, construction, electrical energy, gas, aeronautical equipment, road materials, metal minerals and rail and water transportation sectors.

The maximum waste reduction compared with the previous year was 25%, and this situation occurred in five companies. The maximum score for environmental liabilities was exhibited by 10 companies, which belong to the following sectors: construction (2), electrical energy (3), road operations (1), building materials (1), road materials (2) and metal minerals (1). Investment in environmental protection with scales equal to those used by Gray et al. (1995b) was presented with complete information by 22 companies. Full disclosure was considered to be that which presents declarative, monetary and quantitative information. Conversely, 58 companies did not present any information. Another way to view the subareas disclosed and measured by the Waste-Ede model is presented in Table 3.

Table 3 Environmental disclosure items per sector and level

SUBAREAS	Level	1.1	1.2	2.1	2.2	3.1	3.2	3.3	3.4	4.1	4.2
Construction	E	1	1	3	2		7	1		2	1
	M	1									
	C	6	7	5	6	8	1	7	8	6	7
Electrical Energy	E	8	17	12	16	14	24	4		3	12
	M	5			1	4					
	C	16	12	17	12	11	5	25	29	26	17
Road Operations	E	1	1	1	1	2	5			1	1
	M										
	C	5	5	5	5	4	1	6	6	5	5
Road Materials	E		3	4	1		4	1		2	1
	M	2									
	C	4	3	2	5	6	2	5	6	4	5
Paper and Pulp	E		3	2	2	3	4				3
	M	4									
	C	1	2	3	3	2	1	5	5	5	2
Others	E	3	13	15	5	2	24	6		2	4
	M	9				3					
	C	20	19	17	27	27	8	26	32	30	28
TOTAL	E	13	38	37	27	21	68	12		10	22
	M	21			1	7					
	C	52	48	49	58	58	18	74	86	76	64

Legend: (E) Excellent; (M) Market and (C) Compromised.

Source: Research data.

It should be noted that the sectors with greater representation in the sample were electrical energy, construction, road operations, road materials and paper and pulp. Few companies were at the market level because some scales, such as 1.2, 2.1, 3.2, 3.3 and 4.1, are of a dichotomous type, i.e., either at the excellent or compromised level. The mean Waste-Ede index was at the market level, although some information is at the compromised level. Of the 10 subareas, most companies (9) were at the compromised level. Only recycling was above a 50% disclosure level. The worst performances were found in the following subareas: (1) solid waste reduction (100% of companies), (2) concern for environmental liabilities (88%) and (3) reverse logistics (86%). The evaluation of a product's life cycle, according to Ekvall et al. (2007 apud Cleary, 2010), has as parameters solid waste reduction through prevention and reuse of products. Most companies seem to continue production without concern for reducing waste and, consequently, the product's life cycle.

There are problems associated with the environmental disclosure of reverse logistics because the subject is controversial (see coverage of this issue in the Fecomércio event in 2010) and complex, such as in regard to the determination of shared responsibility as described in Federal Law 12,305/2010. The holistic approach in considering the product's life cycle, such as that proposed by Thorneloe, Weitz, and Jambeck (2007), was ignored because there was no information regarding related environmental liabilities. It is hoped that with greater technological advancement and regulations, waste can be reduced to a minimum and be consistent with sustainable development.

4.2 Assessment of the Level of Environmental Disclosure and Correlation with Financial Variables.

This section presents an assessment of the level of solid waste environmental disclosure of Brazilian public companies that may potentially pollute in the sample and the correlation of the Waste-Ede index with financial variables and also seeks explanations for the results. The Waste-Ede model was applied to the 86 companies in the sample, and a mean solid waste disclosure value of 12.44% was found. Most of the companies (59) were at the low level, i.e., less than 50%, as illustrated by Figure 12.

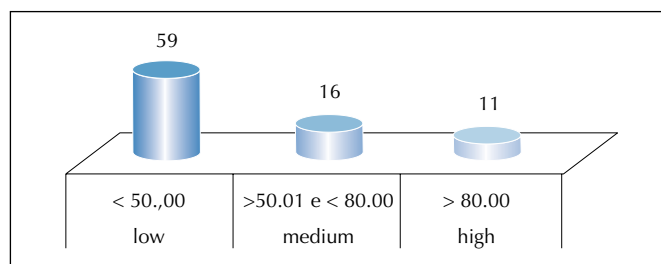


Figure 12 Waste-Ede index by level

Source: Research data.

There are 16 companies at the medium level and 11 at the high level. Extremely negative results were obtained by weapons and munitions and road materials and operations

companies with minimum scores of -45.69 points or -45.69%. The most extreme positive scores were obtained by electrical energy and road operations companies. The electric energy sector has greater representation in the sample. Eight companies are at the compromised level, i.e., below 0%; five are at the market level, i.e., up to 50%; and the remaining 16 are at the excellent level. This result demonstrates that even companies in the same sector, such as the electrical energy and road operations sectors, have large disparities regarding the disclosure of solid waste environmental information.

One of the reasons why the electrical energy sector provides the most comprehensive environmental information is the pressure exerted on it by its regulator, the National Energy Agency (Agência Nacional de Energia Elétrica - ANEEL). Road operations companies work in partnership with public authorities that impose certain contractual obligations. Reverte (2009) states that enterprises need to manage the information requirements of power groups associated with the organization. This may explain the high representation of the electrical energy sector in the sample.

The Waste-Ede index histogram is able to show the position of companies in the sample in relation to solid waste disclosure. Rosa et al. (2010) found that environmental disclosure involves a complex operation and that there may be conflicting pressures between the various entities involved. The frequency distribution of the Waste-Ede scores is shown in Figure 13.

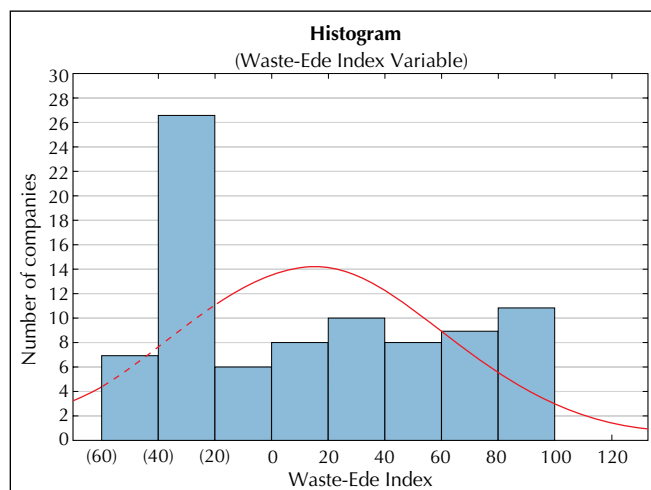


Figure 13 Waste-Ede Index Histogram

Source: Research data.

Normal distribution of the data is indicated by a red line on the graph. It is clear from this figure that the Waste-Ede distribution is not normal. Due to this lack of normality, correlation of financial variables was performed using Spearman's nonparametric test. The objective of seeking a relationship with financial variables is similar to the objectives of previous Brazilian studies that primarily used regression analysis and found a relation between variable size and environmental disclosure. The histogram indicates that most companies' scores are between 40 and -20. Using *Statistica* software

re, a mode of -35.27 was obtained. The descriptive statistics of the variables analyzed complement this graph and are shown in Table 4.

Table 4 Descriptive statistics of the study variables

	N	MEAN	MEDIAN	MINIMUM	MAXIMUM	STANDARD DEVIATION
Waste-Ede	86	12.44	6.26	-45.69	95.84	47.71
EI*	26	53,533,378	14,230,159	4,135	523,186,800	108,389,444
EI-Waste*	15	3,682,432	962,542	44,000	41,301,789	10,442,116
Shares	86	7,540,281,399	192,742,133	17,000	398,381,000,000	47,964,761,592
Assets*	86	16,607,969	3,356,629	135,498	519,970,003	61,724,238
NE*	86	7,052,251	1,382,319	-107,878,525	310,223,300	38,159,873
Revenues*	86	9,875,210	2,568,653	0	340,198,426	38,313,656

* Values in R\$ thousand.

Source: Research data.

The mean and median of each variable in this case are very far apart, and the standard deviations are high, which indicates the wide dispersion of the data. This finding confirms the non-normality of the variables, including the Waste-Ede index, as illustrated by Figure 13. The variables of environmental investment (EI) and environmental in-

vestment in solid waste (EI-Waste) were not available for all companies in the sample. The sample sizes for these variables were 26 and 15, respectively.

Spearman's nonparametric test aims to detect any non-parametric and non-linear relationship between variables. The results of this test are shown in Table 5.

Table 5 Spearman's nonparametric correlation

	WASTE-EDE	EI	EI-WASTE	SHARES	ASSETS	NE	REVENUE
Waste-Ede	1						
EI	0.418*	1					
EI-WASTE	0.046	0.211	1				
SHARES	-0.061	0.039	0.511	1			
ASSETS	0.482*	0.521*	0.300	0.242*	1		
NE	0.503*	0.506*	0.307	0.314*	0.860*	1	
REVENUES	0.491*	0.589*	0.071	0.215*	0.888*	0.739*	1

* Significant correlation ($p < 5\%$)

Source: Research data.

The result of the Waste-Ede index correlation with all variables indicated that there was significant correlation at a confidence level of 95% for the variables environmental investments, total assets, net equity and gross revenues. Values ranged from 0.41 to 0.50, which is explained by the fact that a variation in the Waste-Ede index can be affected by up to 50% by these variables. This result is consistent with Brazilian studies that consider the variable "size" (a transformation of total assets) to be significant in explaining environmental disclosure in Brazilian public companies (Figure 1).

There is evidence that companies belonging to the potentially polluting sector in the study are pressured by their users, such as the government, through legislation and re-

gulatory agencies, to disclose information regarding solid waste, as is the case for the electrical energy companies. The justification for this pressure is described in the literature, such as by Gray et al. (1995a), for companies displaying concern about continuous success. Cho et al. (2006) studied the relationship between environmental disclosure, political strategy and the potentially polluting sector in the U.S.A. Their study is similar to the present one in that it also sought theories to explain levels of disclosure in the same sectors. The stakeholder and legitimacy theories were among those considered to explain the relationship. Legitimacy theory is discussed by Gray et al. (1995a), Cho and Patten (2007), Reverte (2009) and Eugénio (2010).

5 CONCLUSION

In this study, a Waste-Ede model was constructed to evaluate solid waste environmental disclosure by public companies in Brazil of environmentally sensitive industries in 2010. The approach to the issue contained predominantly qualitative aspects but was also quantitative. After constructing the model, the level of environmental disclosure was evaluated and correlated with financial variables.

The non-probabilistic final sample included 86 public companies. The evaluation of environmental disclosure revealed that there was little participation according to the companies' mean values, and companies that provided a sustainability report according to GRI guidelines were the most participatory. The evaluation of company websites revealed that few companies use

this medium to communicate solid waste disclosures. Voluntary participation exceeded, on average, mandatory participation. This is not surprising given that until 2009 there was no specific law for all solid waste in Brazil but only specific legislation for hazardous waste, for example, waste resulting from the use of batteries and fertilizers.

The power of Brazilian regulators to enforce the issue of solid waste in 2010 was low or almost null because this legislation was enacted without any punishment for non-compliance with the law. Furthermore, companies in general were not prepared to adhere to the standard. A possible explanation for the predominantly voluntary disclosure is therefore the role of other agents that exert pressure on companies to provide disclosures and perform other activities beyond those required by the regulators.

Legitimacy and stakeholder theories were considered to be consistent with the findings and explain the medium level and voluntary nature of participation in disclosure. Entities with greater environmental impact need to legitimize their actions by means of disclosure (legitimacy theory) and respect their powerful users (stakeholder theory). Regulatory pressures, such as the enactment of Federal Law no. 12.305/2010, shareholders and investors, among others, are responsible for most corporate transparency. In the hierarchy of stakeholders responsible for disclosure, regulators were not the main drivers of such disclosure. The most substantial influence may have been exerted by investors and creditors. All public companies seek investor resources, so this level of disclosure is therefore most likely caused by pressure from investors.

According to Eugénio (2010), there is a social contract between companies and society that requires certain behavior in order for the company to be accepted. Patten (2002) found that legitimacy theory strengthens the explanation of what environmental information is disclosed, which is consistent with this study.

The Waste-Ede model construction helped to transform attributes into numerical values through semantic judgment. Therefore, this study may aid further research about solid waste environmental disclosure.

Some issues were lacking or even absent from the solid waste environmental disclosure of various organizations, such as reduction of solid waste compared to the previous period, concern for environmental liabilities and reverse logistics. The low disclosure of reverse logistics is understandable due to the definition of shared responsibility. The reduction of solid waste is a global concern, which reflects an ignorance of (or disregard for) a product's life cycle. The lack of information on environmental liabilities may be seen as lack of understanding of or indifference to the fact that their activities may affect the environment on the part of these organizations. This is problematic because lack

of interest in environmental issues can lead to unsustainable development.

The environmental impact associated with business activities can increase the risk of discontinuation of certain activities or even part of the environment. The lack of concordance of business activity with the environment can be dangerous and cause structural breaks. The social impact of a company being unable to operate or creating a contaminated environment can have a wide range of effects, including some on mankind.

This work provides an understanding of how environmental information can influence accounting information and alter the management of companies, investors' choices, public policies and societal attitudes. Qualitative information was therefore measured during construction of the Waste-Ede model. A significant correlation at the 95% level was found in the following variables: environmental investments, total assets, net equity and gross revenues. The conclusion drawn from this finding is that companies have a financial motivation for disclosing environmental information. Concern with solid waste is influenced by the size of the company. Investment in appropriate information systems, solid waste management plans and qualification of professionals may be influenced by economics. The finding of this research is that the solid waste environmental disclosure of the sampled companies is related to financial variables.

The electrical energy sector was the most representative, and an electrical energy company and a road operations company showed the largest Waste-Ede model index. The reasons why these sectors disclose the most information on solid waste can be attributed to the agents who exercise power in these companies, such as ANEEL and the government, in the form of contracts for road construction.

In terms of future research, there are several studies that have been performed elsewhere that would provide useful information if performed in Brazil. The first is the study of Cho et al. (2010), which sought to identify the tone of the language used in environmental disclosure. The second study is that of Hasseldine, Salama, and Toms (2005), which consists of studying whether organizational reputation has an effect on the quality of environmental information disclosure. The third study is by Francis, Nanda, and Olsson (2008), who investigated environmental disclosure and the implications on profit and cost of capital. Finally, based on the work of Jenkins and Yakovleva (2006), the association between environmental disclosure and environmental impact communication should be explored.

This study cannot be generalized. It is specific and applies only to the companies in the study and the year studied. It is important to take into account the maximum possible number of companies that have a high environmental impact and that are listed on the stock exchange.

References

- Associação Brasileira de Normas Técnicas. ABNT. (2004). *NBR 10004: resíduos sólidos: classificação*. Rio de Janeiro: ABNT.
- Bardin, L. (2010). *Análise de conteúdo*. (5 ed.). (L. A. Pinheiro, Trad.). Lisboa: Edições 70.
- Cho, C. H., & Patten, D. M. (2007). The role of environmental disclosures as tools of legitimacy: a research note. *Accounting Organizations and Society*, 32 (7-8), 639-647.
- Cho, C. H., Patten, D. M., & Roberts, R. W. (2006). Corporate political strategy: an examination of the relation between political expenditures, environmental performance, and environmental disclosure. *Journal of Business Ethics*, 67 (2), 139-154.
- Cho, C. H., Roberts, R. W., & Patten, D. M. (2010). The language of US corporate environmental disclosure. *Accounting, Organizations and Society*, 35 (4), 431-443.
- Cleary, J. (2010). The incorporation of waste prevention activities into life cycle assessments of municipal solid waste management systems: methodological issues. *International Journal of Life Cycle Assessment*, 15 (6), 579-589.
- Collis, J., & Hussey, R. (2005). *Pesquisa em Administração: um guia prático para alunos de graduação e pós-graduação* (2 ed.). (L. Simonini, Trad.). Porto Alegre: Bookman.
- Crespo Soler, C., Ripoll Feliu, V., Rosa, F. S., & Lunkes, R. J. (2011). Modelo EDE - environmental disclosure evaluation. *Quadern de treball*, 169, 1-28.
- Eugênio, T. (2010). Avanços na divulgação de informação social e ambiental pelas empresas e a teoria da legitimidade. *Revista Universo Contábil*, 6 (1), 102-118.
- Francis, J. R., Khurana, I. K., & Pereira, R. (2005). Disclosure incentives and effects on cost of capital around the world. *Accounting Review*, 80 (4), 1125-1162.
- Francis, J., Nanda, D., & Olsson, P. (2008). Voluntary disclosure, earnings quality, and cost of capital. *Journal of Accounting Research*, 46 (1), 53-99.
- Frederickson, J. R., Hodge, F. D., & Pratt, J. H. (2006). The evolution of stock option accounting: Disclosure, voluntary recognition, mandated recognition, and management disavowals. *Accounting Review*, 81 (5), 1073-1093.
- Gil, A. C. (2002). *Como elaborar projetos de pesquisa* (4 ed.). São Paulo: Atlas.
- Global Reporting Initiative. GRI. (2006). *Diretrizes para relatório de sustentabilidade: versão 3.0*. Recuperado em 26 maio, 2011, de <http://www.globalreporting.org>.
- Gomes, L. P., Coelho, O. W., Erba, D. A., & Veronez, M. (2001). Critérios de seleção de áreas para disposição final de resíduos sólidos. In Andreoli, C. V. *Resíduos sólidos do saneamento: processamento, reciclagem e disposição final* (pp. 145-163). Curitiba: ABES.
- Gray, R., Kouhy, R., & Lavers, S. (1995a). Corporate social and environmental reporting: a review of the literature and a longitudinal study of UK disclosure. *Accounting, Auditing & Accountability Journal*, 8 (2), 47-77.
- Gray, R., Kouhy, R., & Lavers, S. (1995b). Constructing a research database of social and environmental reporting by UK companies. *Accounting, Auditing & Accountability Journal*, 8 (2), 78-101.
- Hasseldine, J., Salama, A. I., & Toms, J. S. (2005). Quantity versus quality: the impact of environmental disclosures on the reputations of UK Plcs. *The British Accounting Review*, 38 (2), 231-248.
- Holder-Webb, L., Cohen, J. R., Nath, L., & Wood, D. (2009). The supply of corporate social responsibility disclosures among US firms. *Journal of Business Ethics*, 84 (4), 497-527.
- Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis. IBAMA. (2004, agosto 24). *Manual do cadastro de atividade potencialmente poluidora*. Brasília, Distrito Federal, Brasil. Recuperado em 24 março, 2011, de <http://servicos.ibama.gov.br/ctf/manual/html/010401.htm>.
- Jenkins, H., & Yakovleva, N. (2006). Corporate social responsibility in the mining industry: Exploring trends in social and environmental disclosure. *Journal of Cleaner Production*, 14 (3-4), 271-284.
- Neu, D., Warsame, H., & Pedwell, K. (1998). Managing public impressions: environmental disclosures in annual reports. *Accounting, Organizations and Society*, 23 (3), 265-282.
- Patten, D. M. (2002). The relation between environmental performance and environmental disclosure: a research note. *Accounting, Organizations and Society*, 27 (8), 763-773.
- Política Nacional do Meio Ambiente*. (1981, agosto de 31). Brasília, Distrito Federal, Brasil. Recuperado em 24 março, 2011, de <http://www.planalto.gov.br/ccivil/leis/L10165.htm>
- Política Nacional de Resíduos Sólidos*. (2010, agosto 2). Brasília, Distrito Federal, Brasil. Recuperado em 7 novembro, 2010, de http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2010/lei/112305.htm.
- Raupp, F. M. (2006). In Bueren, I. M. *Como elaborar trabalhos monográficos em contabilidade: teoria e prática* (3 ed., pp. 76-97). São Paulo: Atlas.
- Reverte, C. (2009). Determinants of corporate social responsibility disclosure ratings by Spanish listed firms. *Journal of Business Ethics*, 88 (2), 351-366.
- Richardson, R. J. (1999). *Pesquisa social: métodos e práticas* (3 ed.). São Paulo: Atlas.
- Rosa, F. S., Ensslin, S. R., & Ensslin, L. L. (2011). Gestão da evidência ambiental: um estudo sobre a potencialidade e oportunidade do tema. *Revista de Engenharia Sanitária e Ambiental*, 16 (2), 157-166.
- Rosa, F. S., Ensslin, S. R., & Ensslin, L. L. (2012). Management environmental disclosure: a constructivist case. *Management Decision*, 50 (6), 1117-1136.
- Rosa, F. S., Ferreira, A. C., Ensslin, S. R., & Ensslin, L. (2010). Evidência ambiental (EA): contribuição da metodologia multicritério para identificação dos aspectos financeiros para a gestão ambiental. *Revista Contabilidade Vista e Revista*, 21(4), 27-61.
- Tchobanoglous, G., Theisen, H. E., & Eliassen, R. (1977). *Solid wastes: engineering principles and management issues*. Tokyo: McGraw-Hill Kogakusha.
- Thornloe, S. A., Weitz, K., & Jambeck, J. (2007). Application of the US decision support tool for materials and waste management. *Waste Management*, 27 (8), 1006-1020.
- Voss, B. L. (2012). *Environmental disclosure: estudo sobre a evidência ambiental dos resíduos sólidos presentes nos relatórios de sustentabilidade de empresas brasileiras potencialmente poluidoras para o ano de 2010*. Dissertação de mestrado, Programa de Pós-Graduação em Contabilidade, Universidade Federal de Santa Catarina. Florianópolis, SC, Brasil.
- Zeng, S. X., Xu, X. D., Dong, Z. Y., & Tam, V. W. (2010). Towards corporate environmental information disclosure: an empirical study in China. *Journal of Cleaner Production*, 18 (12), 1142-1148.