



## MARIANA (MG) DAM RUPTURE: CHANGES IN ENVIRONMENTAL DISCLOSURE FOR MINING SECTOR

Franciele Machado de Souza<sup>1</sup>  
Marcelo Resquetti Tarifa<sup>2</sup>  
Luiz Panhoca<sup>3</sup>

### ABSTRACT

**Purpose of the study:** This study analyzes the changes in environmental disclosures in publicly traded mining companies listed on “BMF & BOVESPA” stock market after the breakdown of the Mariana dam in 2015.

**Methodology / approach:** A content analysis was carried out in the financial statements and sustainability reports of mining companies with shares listed on BMF & BOVESPA between 2014 and 2016. The variable environmental disclosure was divided into seven categories, as proposed by Heflin & Wallace (2011).

**Originality / Relevance:** This study is relevant in bringing the discussion on whether environmental disasters, such as the rupture of the Fundão Dam, may increase the information to the investor regarding the potential for another accident within the Brazilian mining sector. He innovates by adapting the model proposed by Heflin & Wallace (2011) to the Brazilian context.

**Main results:** The empirical results show that the mining companies surveyed, with environmental liabilities, use Impression Management strategies to divulge their environmental impacts. The strategies used by the companies are the concealment and attribution to external factors, presenting in this way a skewed and selective discourse about their environmental impacts.

**Theoretical / methodological contributions:** This study contributes to the literature on environmental disclosure and provides insight into the discussion about environmental management from the perspective of the environmental disclosure of Brazilian mining companies.

**Conclusion:** It is concluded that the mining companies surveyed did not increase their environmental disclosure after the dam rupture of the mining company Samarco in 2015.

**Keywords:** Environmental Disasters. Mariana dam. Samarco. Environmental Disclosures.

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<sup>1</sup> Mestre em Contabilidade – Universidade Federal do Paraná – UFPR. Curitiba, Paraná – Brasil. ORCID: <https://orcid.org/0000-0002-5681-8704> E-mail: [m.franciele@gmail.com](mailto:m.franciele@gmail.com) .

<sup>2</sup> Pós-Doutor em Contabilidade – Universidade Federal do Paraná – UFPR. Curitiba, Paraná – Brasil. ORCID: <https://orcid.org/0000-0003-1300-7319> E-mail: [marcelotarifa@hotmail.com](mailto:marcelotarifa@hotmail.com) .

<sup>3</sup> Pós-Doutor em Geografia – Universidade Federal do Paraná – UFPR. Curitiba, Paraná – Brasil. ORCID: <https://orcid.org/0000-0002-0839-1611> E-mail: [panhoca.luiz@gmail.com](mailto:panhoca.luiz@gmail.com).



## O ROMPIMENTO DA BARRAGEM DE MARIANA (MG): MUDANÇAS NO *DISCLOSURE* AMBIENTAL DO SETOR DE MINERAÇÃO

### RESUMO

**Objetivo do estudo:** Este estudo analisa as mudanças de *disclosures* ambientais em empresas mineradoras de capital aberto, listadas na BMF&BOVESPA após o rompimento da barragem de Mariana, em 2015.

**Metodologia/abordagem:** Foi realizada uma análise de conteúdo nas demonstrações financeiras e relatórios de sustentabilidade de empresas mineradoras com ações listadas na BMF&BOVESPA, entre 2014 a 2016. A variável *disclosure* ambiental foi dividida em sete categorias, conforme propõem Heflin & Wallace (2011).

**Originalidade/Relevância:** Este estudo é relevante ao trazer a discussão sobre se desastres ambientais, tais como o rompimento da Barragem de Fundão, podem aumentar a informação ao investidor a respeito do potencial para outro acidente dentro do setor da mineração brasileira. Inova ao adaptar o modelo proposto por Heflin & Wallace (2011) ao contexto brasileiro.

**Principais resultados:** Os resultados empíricos revelam que as empresas mineradoras pesquisadas, com passivos ambientais, utilizam-se de estratégias de Gerenciamento de Impressões para divulgações de seus impactos ambientais. As estratégias utilizadas pelas empresas são a ocultação e atribuição a fatores externos, apresentando desta forma um discurso enviesado e seletivo sobre seus impactos ambientais.

**Contribuições teóricas/metodológicas:** Este estudo contribui para a literatura de divulgação ambiental e fornece *insights* sobre a discussão a respeito da gestão ambiental sob a perspectiva do *disclosure* ambiental de empresas de mineração brasileiras.

**Conclusão:** Conclui-se que as empresas mineradoras pesquisadas não aumentaram a sua divulgação ambiental após o rompimento da barragem da companhia mineradora Samarco, em 2015.

**Palavras-chave:** Desastres ambientais. Barragem de Mariana. Samarco. *Disclosures* Ambientais.

## EL ROMPIMIENTO DEL BARRAGEM DE MARIANA (MG): CAMBIOS EN EL *DISCLOSURE* AMBIENTAL DEL SECTOR DE MINERA

### RESUMEN

**Objetivo del estudio:** Este estudio analiza los cambios de las revelaciones ambientales en las empresas mineras de capital abierto, listadas en la BMF y BOVESPA tras la ruptura de la represa de Mariana en 2015.

**Metodología / enfoque:** Se realizó un análisis de contenido en los estados financieros e informes de sostenibilidad de empresas mineras con acciones listadas en la BMF & BOVESPA, entre 2014 a 2016. La variable de divulgación ambiental se dividió en siete categorías, según propone Heflin & Wallace (2011).

**La originalidad / Relevancia:** Este estudio es relevante al traer la discusión sobre si los desastres ambientales, tales como la ruptura de la represa de Fundão, pueden aumentar la información al inversor acerca del potencial para otro accidente dentro del sector de la minería



brasileña. Inova al adaptar el modelo propuesto por Heflin & Wallace (2011) al contexto brasileño.

**Principales resultados:** Los resultados empíricos revelan que las empresas mineras investigadas, con pasivos ambientales, se utilizan de estrategias de Gestión de Impresiones para divulgar sus impactos ambientales. Las estrategias utilizadas por las empresas son la ocultación y atribución a factores externos, presentando de esta forma un discurso sesgado y selectivo sobre sus impactos ambientales.

**Contribuciones teóricas / metodológicas:** Este estudio contribuye a la literatura de divulgación ambiental y proporciona información sobre la discusión sobre la gestión ambiental desde la perspectiva del reportamiento ambiental de las empresas mineras brasileñas.

**Conclusión:** Se concluye que las empresas mineras investigadas no aumentaron su divulgación ambiental tras el rompimiento de la represa de la compañía minera Samarco en 2015.

**Palabras-clave:** Desastres ambientales. Presa de Mariana. Samarco. Disclosures Ambientales.

## 1 INTRODUCTION

On November 5, 2015, the breakdown of the Samarco mining dam in Mariana, Minas Gerais state, dumped sixty billion liters of iron ore tailings along more than 500 km in the Rio Doce basin. The environmental damage of irreparable size has as one of the most serious effects of the waste discharge in the waters the silting up of the mud of rivers and streams of the river Doce basin. The avalanche of tailings generated in the state of Minas Gerais due to the rupture caused immeasurable and irreversible environmental and social damages. It caused a devastating scenario in the district of Bento Rodrigues, about 2 km from where the breakup occurred, with 85 families losing their homes, 17 people were found dead under the mud and 3 remain missing (Jacobi & Cibim, 2015).

Environmental disasters can raise investor awareness about the potential for another accident within the industry of the same industry. Such expectations depend on investors believing that disruption is a unique, highly unlikely event or whether it is indicative of widespread safety lapses in the industry. Thus, the impact of the disruption of the Mariana dam on the environmental disclosure policy of mining companies is an empirical question (Heflin & Wallace, 2011).

There are two broad perspectives on voluntary environmental disclosure strategies in corporate narratives - incremental information and impression management (Merkl-Davies & Brennan 2007; Clarkson, Li, Richardson & Vasvari 2008). The mode of presentation of incremental information assumes that voluntary disclosures provide relevant information intended to improve the investor's decision-making. In environmental disclosure, this means that the best environmental managers make extensive environmental disclosures, which is distinguished from managers who make lower disclosures. Thus, the perspective of incremental information suggests that companies with better environmental disclosures will suffer smaller declines in shareholder value in response to the environmental disaster. Investors expect smaller incremental costs for these companies by adopting and adapting to the new rules or a lower chance of a future environmental disaster (Heflin & Wallace, 2011).

Research on management impression (Ginzel et al., 1993; Bergman & Roychowdhury, 2008; Heflin & Wallace, 2011) assume that voluntary environmental disclosures represent an attempt to manipulate and manage impressions transmitted to users of accounting information.



In the context of environmental research, this implies that bad environmental managers provide more environmental disclosures than the best environmental managers to create impressions and denote environmental concern. This perspective suggests that companies with more environmental disclosures are no better or even less willing to accept new regulations, prevent future disasters, and thus cause negative reactions to share value (Heflin & Wallace, 2011).

Previous research following major environmental accidents, such as the Exxon Valdez oil spill in Alaska and British Petroleum (BP) in the Gulf of Mexico, suggests that companies increase their environmental disclosures in response to negative changes in investors' perceptions (Patten, Bergman & Roychowdhury, 2008; Heflin & Wallace, 2011).

From the foregoing, it is assumed that the disruption of the Mariana dam negatively affected investors' perceptions of environmental issues and the mining companies reacted by increasing their environmental disclosures. In this context, the following question was raised: What are the changes in environmental disclosures in mining companies after the breakdown of the Mariana dam in 2015? Therefore, this study aims to analyze the changes to environmental disclosures in publicly traded mining companies listed on the BMF & BOVESPA after the breakdown of the Mariana dam in 2015. The research hypothesis is similar to the study by Heflin and Wallace (2011), suggests that the mere threat of increased regulatory costs, or the potential for future disaster costs, calls for a voluntary disclosure shift, an empirical issue that is generally not investigated in Brazilian accounting literature.

Ferreira Neto, Gomes, Bruni, and Dias Filho (2015) investigated the impact of environmental accidents on the volume of disclosure and social-environmental investments of Brazilian companies in the period from 1997 to 2012, and found that companies reported a higher socio- two years after the occurrence of the accident compared to two years before the accident with a significance of 5%.

In addition to contextualization, theories of impression management and incremental information will be discussed in the second section. Next, insights on the motivation for the change of environmental disclosure are presented. The third section describes the methodological procedures performed. In the fourth section, the results are presented and discussed. The article concludes with the final considerations, limitations, and suggestions for future research.

## 2 THEORETICAL REFERENCE

Environmental disasters can increase investor awareness of the potential for another accident in the same industry (Heflin & Wallace, 2011). In this sense, it is argued that the disruption of the Mariana dam negatively affected investors' perception of environmental issues. Considering the objective proposed by this research and in line with the study by Heflin and Wallace (2011), this paper explores whether companies increase their voluntary environmental disclosures in response to negative changes in investors' perceptions and motivations.

In the accounting research, Merkl-Davies and Brennan (2013) highlight four perspectives of impression management: (1) economic, (2) psychological, (3) sociological and (4) criticism. The psychological and economic perspectives focus primarily on the image of investment and focus on managers' attempts to manage shareholder perceptions of their financial performance. If successful, it results in short-term capital allocations (Merkl-Davies & Brennan, 2007).

In contrast, the sociological perspective is concerned with the image and legitimacy of corporate social and environmental responsibility. This perspective focuses on the management of impressions that influence the perceptions of the organizational public about the social and environmental performance and the organizational compliance of the norms and social rules. If



shareholders are convinced through print management, it will result in unjustified stakeholder support (Merkl-Davies & Brennan, 2013).

Finally, the critical perspective is concerned with power and focuses on managerial attempts to influence the perceptions of the organizational public about corporate influence and control. If impression management succeeds, the result is hegemony. In this context, hegemony refers to the process of influencing stakeholder perceptions, so that they are persuaded to support organizations of their own volition (Merkl-Davies & Brennan, 2013).

There are two wide perspectives on voluntary environmental disclosure strategies in corporate narratives - incremental information and management impression (Merkl-Davies & Brennan 2007; Clarkson et al., 2008). For Merkl-Davies and Brennan (2007), voluntary disclosures can be seen in two ways: (a) they contribute to the decision making process by overcoming information asymmetries between managers and stakeholders; or (b) constitute an opportunistic behavior by which managers exploit the asymmetries of information between them and the stakeholders through partial reports, that is, managing impressions.

In a context of corporate communication, impression management is considered as an attempt to control and manipulate impressions transmitted to users of accounting information (Clatworthy & Jones, 2001). As a result, managers are assumed to use corporate reporting as impression management vehicles in order to strategically manipulate stakeholder perceptions and decisions (Yuthas, Rogers & Dillard, 2002).

According to Merkl-Davies and Brennan (2007), the opportunity for managing impressions in corporate reports is increasing. The growing importance of descriptive parts in corporate reporting offers companies the opportunity to overcome information asymmetries by presenting more detailed information and explanations, thus increasing their usefulness for decision making (Merkl-Davies & Brennan, 2007).

However, they also offer an opportunity to present financial performance and prospects as best as possible, thus having the opposite effect. In addition to increasing opportunism by agents, voluntary disclosure facilitates Impression Management, where corporate narratives are largely unregulated (Merkl-Davies & Brennan, 2007).

The interpretation of voluntary disclosure strategies and the management of impressions are based on the hypothesis of weak market efficiency. This assumes that investors are unable to assess managerial bias in the short term. Based on this assumption, managers engage in impression management to influence the stock price of the company, through stock options for managers (Adelberg, 1979, Rutherford, 2003 and Courtis, 2004).

In contrast, incremental information is based on a strong / semi-strong market efficiency hypothesis, in which investors are able to assess information bias. The efficient market hypothesis asserts that all market participants have rational expectations about future returns, which implies that, on average, the market is able to assess reporting bias (Hand, 1990).

This assumes that partial reports (including impression management) would lead to a higher cost of capital and a reduction in stock price performance. Since managers' remuneration is linked to stock price performance, managers do not have economic incentives to impression management practice. Thus, proponents of incremental information deny the existence of impression management (Baginski, Hassell & Kimbrough, 2000). On the contrary, the manager has economic incentives to get involved in the content of the report because it increases its reputation and compensation (Baginski et al., 2000).

For Merkl-Davies and Brennan (2007), managers are convinced to engage in one of two types of behavior: (1) concealment or (2) assignment. Concealment can be achieved in two ways: by (1a) obfuscation of negative results (bad news) or (1b) emphasizing positive organizational results ("good news"). Attribution is a print management strategy, borrowed from social psychology (Heider, 1958, Jones & Davis, 1965, Kelley, 1967), which consists of an autonomous bias that manifests itself in the tendency to claim more responsibility for



successes than for failures. In a context of sustainability reports, managers attribute positive organizational results to internal factors and negative organizational results to external factors (Merkl-Davies & Brennan, 2007).

Merkl-Davies and Brennan (2007) present seven Impression Management strategies. These strategies support choices in terms of: a) dissemination of information; b) or type of information presentation, through bias or selectivity. While bias involves the provision of information in a highly favored way, selectivity comprises the omission or inclusion of certain information items.

Six strategies are used to conceal information. Two of them refer to the obfuscation of bad news, by manipulating verbal information, by (1) Manipulating readability (ie making text harder to read) or (2) rhetorical manipulation (ie using language persuasive). The remaining four are associated with the emphasis on good news. By manipulating verbal or numerical information: (3) thematic manipulation emphasizes positive words and themes or emphasizes positive financial performance; (4) visual and structural manipulation involves the way information is presented (ie, visual and structural emphasis); (5) performance comparisons involve choosing benchmarks that depict current financial performance in the best possible light; (6) choosing performance indicators involves selecting indicators to portray current financial performance. The seventh strategy of impression management (attribution of organizational performances) is a defensive tactic that shifts managers from blame for poor organizational performance, attributing them to factors external to the organization or management.

Clatworthy and Jones (2006, p.506) note that it is unclear "whether impression management is conscious or unconscious." According to Merkl-Davies & Brennan (2007), this confusion can be partially attributed to previous studies related to agency theory and social psychology. Unlike obfuscation, autonomous bias (in the form of performance assignments) constitutes a distortion, which is at least partially, unconscious of the way humans perceive reality.

## **2.1 Environmental disclosure of companies after an environmental disaster**

The literature suggests a variety of configurations of companies that chose to change their environmental disclosure policy for strategic reasons in response to regulatory changes, demand or investor opinion (Patten, 1992, Bergman & Roychowdhury, 2008, Heflin & Wallace, 2011). Eljayash, Kavanagh and Kong (2013) investigated that international gas and oil corporations tend to have better environmental disclosures compared to national organizations.

There is evidence from companies that use voluntary disclosure strategically. Frankel, McNichols and Wilson (1995), for example, found that firms increase the amount of good news released before offering equity to generate larger revenues. Moreover, Aboody and Kasznik (2000) found that companies rush the bad news and reduce the good news before the grant option dates, in order to reduce the exercise price of the option.

These studies suggest that firms change their disclosure to their own advantage, based on knowledge of certain upcoming events (Heflin & Wallace, 2011). Likewise, it is plausible that mining companies change their disclosure based on the expectation of future regulation, driven by the breakdown of the Mariana dam.

In addition, surveys suggest that companies adjust their disclosure policy based on investor sentiment. Patten (1992) investigated whether oil and gas companies increased environmental disclosure following the Exxon Valdez oil spill. The author found an increase in disclosure made up of seven categories: 1) past environmental spending, 2) disaster recovery plan; 3) sustainability reports; 4) social responsibility; 5) current or future environmental



regulation; 6) future estimates of environmental expenditures; and 7) environmental litigation. In addition, the author reports that the change in environmental disclosure is related to the size of the company and the right of ownership (ownership of the company's capital).

Bergman and Roychowdhury (2008) investigated the strategy of companies to react to investors' perceptions of disclosure policies. The authors found that during periods of negative opinion, firms increase both the frequency of profit forecasts and the number of management forecasts that "improve" the current forecasts of long-term gains.

Heflin and Wallace (2011) found that oil and gas companies increased their environmental disclosure following the BP accident. For the authors, this increase in disclosure, however, is largely limited to a shift in disclosure regarding disaster recovery plans, consistent with the assumption that managers were more concerned with investors '(and regulators') perceptions of their ability to prevent and mitigate future environmental incidents.

By this bias, the disruption of the Mariana dam probably directed the view of investors more to the downside for mining companies. This negative feeling is specific to environmental issues. That is, the disruption of the most negative investor's Mariana dam with respect to the potential environmental consequences (and the potential costs associated with these consequences). In this way, it can be said that managers will react in order to improve the negative opinion about the potential environmental impact, with the increase of their environmental disclosures. The H1 of the survey is then established.

**H1: Mining companies listed on the “BMF & BOVESPA” stock market increased environmental disclosures in the post-breakup period.**

### 3. METHODOLOGY

#### 3.1. The Sample selection

The study sample consists of publicly traded companies listed on the BMF & BOVESPA stock market between 2014 and 2016, belonging to the mining sector. The choice of sample is due to the fact that the company **Samarco SA** operates in the mining sector, the period is justified because it is a year before and one year after the disruption of the Fundão dam, in 2015. Thus, 5 companies were selected, using the Bovespa sector classification of August 2016, according to Table 1:

**Table 1 - Composition of the sample**

<i>SECTOR</i>
1. FREEPORT - MCMORAN COPPER GOLD INC
2. LITEL - LITEL PARTICIPACOES S.A.
3. MMX MINER
4. VALE
5. CCX CARVAO

Source: prepared by the authors.

#### 3.2 Determination of variables

The research utilized secondary sources, comprised of financial statements (DFPs) and corporate sustainability reports (CSR). The analyzed reports were obtained on the websites of the companies and Bovespa.

As the environmental disclosure variable is not directly observable, it was necessary to choose metrics to interpret the evidence. In this way, the environmental disclosure will be divided into seven categories: 1) past environmental expenses, 2) disaster recovery plan; 3)



sustainability reports; 4) social responsibility; 5) current or future environmental regulation; 6) future estimates of environmental expenditures; and 7) environmental litigation; as proposed by Heflin and Wallace (2011). The environmental rating score ranges from 0-7, depending on how many of the following seven items the company posts, as Figure 1 shows.

N.	Categories	Description
1	CAPEX	1(one) if a capital expenditure amount for environmental protection is included, and 0(zero) otherwise
2	PLAN_DUM	1 (one) if the company's custom disaster recovery plan is mentioned, or if a detailed description of a disaster recovery plan is provided, and 0 (zero) the otherwise
3	SR	1(one) if a sustainability report is mentioned, or if the company has an independent sustainability report on its website, and 0(zero) otherwise
4	ENVLIAB	1 (one) if environmental liability is included, and 0(zero) otherwise
5	REGUL	1(one) if current or future environmental regulations are mentioned, and 0 ( zero) otherwise
6	CAPEXFUT	1(one) if an amount for future environmental capital expenditures is included, and 0 (zero) otherwise
7	LIT	1(one) if environmental litigation is mentioned, and 0(zero) otherwise;

**Figure 1: Categories of environmental disclosure.**

Source: Heflin and Wallace (2011).

The categorical variable PLAN\_CAT represents the extent to which companies provide details about their disaster recovery plan. If PLAN\_CAT = 0, no disaster recovery plan has been mentioned, PLAN\_CAT = 1 if environmental laws and regulations requiring a disaster recovery plan are mentioned, PLAN\_CAT = 2 if the company's custom disaster recovery plan is mentioned and PLAN\_CAT = 3 if a detailed description of the disaster recovery plan is provided.

In order to measure the environmental disclosure of the companies, we opted for the technique of content analysis, which allows the coding of information in categories, assisting in the process of inference of the conditions of production / reception of messages (Bardin, 2004).

From the conceptual framework, an environmental disclosure index was computed for each company in each of the 3 years investigated. This index is composed of the number of categories evidenced by the companies, divided by the total number of existing categories, and later transformed into percentage points.

Not all environmental disclosures that have been examined convey good news about a company's environmental position for shareholders, for example, the filing of a lawsuit on environmental grounds. Previous research on disclosure and stock price responses to negative environmental news generally shows a predisposition to the event to reveal negative items as indicative of greater desire and / or ability to deal with future environmental issues (Blacconiere & Patten, 1994, Heflin & Wallace, 2011). Therefore, in the environmental disclosure rating used in the research, the presence of each component increases the total score.

Rating values can range from zero to seven for each company, depending on how much of each of the seven categories of disclosures the company makes. The evaluation does not capture the quality of the disclosures. Thus, the rating probably measures the disclosure of each company with a measurement error. Reducing the number of categories can help minimize measurement error; the consequence is a loss of scope. The effectiveness given to the reduction



of the categories depends on whether the reduction of the measurement error compensates for the loss of information. Therefore, the research was conducted using a binary variable (PLAN\_DUM) and a categorical variable (PLAN\_DUM) in a combined and individual way.

### 3.3 Data processing

In order to test the hypothesis, the same information was collected from each company before and after disruption of the Fundão dam in 2015. The non-parametric Pearson Chi-Square test (Chi-Square) was used to establish the differences in disclosure before and after disruption, for each category of environmental disclosure.

## 4 RESULTS

The companies that have Sustainability Reports released are Freeport and Vale. Litel and MMX Miner do not have a Sustainability Report published on their corporate website, nor do they have a specific topic on the corporate website, clarifying environmental issues. The company CCX Carvão does not present a Sustainability Report on the corporate website, but it publishes a specific topic on sustainability on the site. Regarding the environmental disaster in Mariana, the only companies to comment on this were Freeport and Vale SA MMX Miner and CCX Carvão belong to the EBX Group in which Eike Batista is a controlling shareholder and MMX Miner is in the process of judicial recovery. MMX Miner does not have a Sustainability Report published on its corporate website.

Freeport spoke on the rupture of the Samarco dam in its 2015 Sustainability Report:

The failure of the tailings storage tank (TSF), at the Mount Polley mine owned by Imperial Metals located in British Columbia, on August 4, 2004, and the failure of the tailings deposit owned by Samarco Mineração S.A. in Minas Gerais, Brazil, on November 5, 2015. They were among the largest unplanned releases of spills in history, with significant loss of life, environmental impacts and impacts on social license. The failures led to multiple research reports, updates to the regulations and updates to the guides of professional organizations. Our internal tailings experts reviewed available documents, confirming that our processes and systems are in line with the relevant recommendations at public disposal. The independent investigation report for the Samarco fault, the ICMM Tailings Storage Facility Review Report (which considers the ICMM Health and Safety Critical Control Management Guide) and other documents are pending. The goal of Freeport-McMoRan is to have zero industrial failures of tailings deposits. We have an active tailings management program designed to advance in continuous improvement and evaluation, currently operating in 19 tailings deposits and managing 52 tailings that are not active or that have been fully recovered. At our Cerro Verde operation in Peru, we completed the construction and commissioning of the Linga tailings dam dike, with a net capacity of approximately 2,000 million metric tons of material. We also commissioned the Morenci dam in Arizona, increasing tailings storage capacity by approximately 568 million metric tons.

[Freeport-McMoran, Sustainability Report, 2015, p.31]

Merkel-Davies and Brennan (2007) report that impression Management strategies support choices related to how information is presented through bias or selectivity. While bias involves the provision of information in a highly favored way, selectivity comprises the omission or inclusion of certain information items. Freeport reports in its speech that, according to its experts, its processes are in accordance with the recommended. However, in the following paragraph the company claims to have outstanding reports and does not provide further details of this information. Then simply states that your goal is to have zero industrial flaws. The



Freeport company's disruption of the Samarco dam is presented in a selective and biased manner, using the concealment strategy, as Merkl-Davies and Brennan (2007), as it omits information from the pending reports and emphasizes positive information, such as: operations in Cerro Verde, Peru, and the Morenci Dam in Arizona.

In Vale's 2015 sustainability report, she clarifies that she is committed to supporting Samarco in serving the people affected and in all efforts necessary to minimize the impacts on the environment. The company's CEO, Murilo Ferreira, spoke in the 2015 Sustainability Report on the environmental disaster in Mariana:

Those who know the Health and Safety policy established at Vale can have the dimension of how devastating our company was to the loss of 19 lives as a result of the accident with the Fundão dam at Samarco in November last year. Those who follow my trajectory know how much I have made of Respect to Life my main flag since I took over the company's presidency in 2011; they also realize how much the accident has mobilized me personally. If I can guarantee anything, Vale will continue to support Samarco in all that is necessary to minimize the victims' pain and environmental damage, and we will do whatever it takes to establish the highest safety standards in the mining industry.

**[Vale, Sustainability Report, 2015, p. 11]**

According to Merkl-Davies and Brennan (2007), the attribution of organizational performance is a defensive tactic that shifts managers from blame for poor organizational performance, attributing them to factors external to the organization. This strategy of Impression Management is used in the speech of the CEO of Vale, as it reports what happened in Mariana as if Vale was not at fault in the accident with the dam of Fundão, which "belongs" to the company Samarco, emphasizing its good reputation and their Life-related values. Thus, in his speech, it does not make clear that it owns 50% of Samarco and also responsible for the disaster.

Freeport and Vale made a statement in their 2015 Sustainability Report regarding the increase in the number of chemical spills:

When operations have received a notice of environmental violation from a regulatory agency as shown in the table below, notifications typically have involved minor excesses with respect to permit conditions or other record-keeping violations that have no impact environmental or are minimal. Notifications have also been received after spills or leaks related to tailings dust or water impacts. Where our operations have been evaluated for the purpose of applying sanctions, these are usually individually less than \$ 100,000.

**[Freeport-McMoran, Sustainability Report, 2015, p. 28]**

In 2015, four spills considered critical were recorded, only one of them involving dangerous products. These events can have relevant environmental consequences, which led the company to implement emergency response plans to minimize the effects. The units involved acted in the appropriate mitigation of impacts, in the analysis of the incidents and in the adoption of preventive actions to avoid recurrence. All reported spills were reported to the relevant environmental agencies, which took appropriate action.

**[Vale, Sustainability Report, 2015, p.79]**

According to Merkl-Davies and Brennan (2007), managers are convinced to engage in one of two types of behavior: (1) concealment or (2) attribution. The speeches of Vale and Freeport, regarding the increase in the number of chemical spills, confirm the strategy of obfuscation of negative information, minimizing the damages caused to the environment. In particular, Freeport reports that environmental damage is minimal. However, it presents the values of environmental sanctions individually, to avoid showing higher values (total



sanctions). The company Vale reports that only one of the spills is considered critical, but it does not report more details, nor the values of the penalties received in its speech. The results show that the strategies used by mining companies researched about their environmental impacts are concealment and attribution to external factors, according to the theory of Impression Management.

Additionally, it should be noted that Vale, in its Sustainability Report 2014, classified the waste as non-material. However, after reviewing the process and deepening the materiality, the theme had its outstanding relevance; therefore, compose the 2015 Sustainability Report. It should be remembered that, on November 5, 2015, the disruption of the Fundão dam dumped sixty billion liters of iron ore tailings over more than 500 km in the Sweet River. The Vale Company uses the strategy of obfuscation of information, avoiding giving greater emphasis to omission and subsequent reinclusion of the waste theme:

For the 2014 Sustainability Report, the preparation of the materiality matrix included the G4 guidelines of the GRI and, at the end of the process, the theme Waste was classified as non-material. In the correlation between the stakeholder view (influence axis) and the Environmental, Social and Governance (ESG) management (impact axis) related to Vale, mineral and industrial waste types were excluded from the report. However, although the theme was not considered in the report released in 2014, the respective indicators remained on the internal agenda of sustainability performance management. In 2015, after revision of the process and deepening of materiality, the theme had its outstanding relevance; therefore, composes the 2015 Sustainability Report.

[Vale, Sustainability Report, 2015, p.77]

As established in the methodology, the environmental disclosure of the surveyed mining companies divided into seven categories and Table 2 shows the Spearman correlations among the variables that make up the disclosure index for the company sample.

**Table 2 - Spearman correlation and descriptive statistics for variables that include environmental disclosure (RATING)**

	CAPEX	PLAN_DUM	SR	ENVLIAB	REGUL	CAPEXFUT	LIT
CAPEX	1						
PLAN_DUM	1.000**	1					
SR	.667*	.667*	1				
ENVLIAB	1.000**	1.000**	.667*	1			
REGUL	.667*	.667*	1.000**	.667*	1		
CAPEXFUT	.408	.408	.272	.408	.272	1	
LIT	1.000**	1.000**	.667*	1.000**	.667*	.408	1
Média	.400	.400	.600	.4000	.6000	.100	.400
STD	.516	.516	.516	.516	.516	.316	.516
N	10	10	10	10	10	10	10

\*\* . The correlation is significant at the 0.01. \* Level. The correlation is significant at the 0.05 level.

Source: prepared by the authors.

There are several significant positive correlations among the environmental disclosure variables of the mining companies surveyed. It should be noted that the dissemination of the disaster recovery plan (PLAN\_DUM) is positively associated with the variables: environmental liabilities (ENVLIAB) and environmental litigation (LIT). This suggests that the companies that made the disclosure of disaster recovery plans have involvements with environmental liabilities and environmental litigation. The disclosure of the Sustainability Report (SR) by the mining companies surveyed is positively related to companies that have environmental liabilities (ENVLIAB), environmental disputes (LIT) and disclose in their sustainability reports



information on current environmental regulations. These results are similar to those obtained by Heflin and Wallace (2011) who claim that bad environmental managers provide more environmental disclosures than do better environmental managers to create impressions and denote environmental concern.

The companies surveyed with the highest environmental disclosure rating and disclosing their environmental disaster recovery plan (PLAN\_CAT) are the Freeport and Vale, according to Table 3. However, these companies have a greater involvement in environmental litigation compared to the other companies surveyed. These results are similar to those obtained by Heflin and Wallace (2011) who claim that bad environmental managers provide more environmental disclosures than do better environmental managers to create impressions and denote environmental concern.

**Table 3 - Rating by company of environmental disclosure**

	RATING Before	RATING After	PLAN_CAT Before	PLAN_CAT After
1.FREEPORT	6	7	3	3
2. LITEL	0	0	0	0
3. MMX MINER	0	0	0	0
4. VALE	6	6	3	3
5. CCX CARVAO	2	2	0	0

Source: prepared by the authors.

The hypothesis of the research to be tested to analyze changes in environmental disclosures in publicly traded mining companies listed on the BMF & BOVESPA after the breakdown of the Mariana dam in 2015 is as follows:

**H1: Mining companies listed on “BMF & BOVESPA” have increased environmental disclosures in the post-breakup period.**

To test this hypothesis, the non-parametric Pearson Chi-Square test was performed for each category of environmental disclosure before and after the breakup. The results are set forth in Table 4.

**Table 4 - Non-parametric test results of Pearson Chi-Square**

	Mean Before	Mean After	Chi-square	p-value
PLAN_DUM	2	2	.000	1.000
PLAN_CAT	6	6	.000	1.000
CAPEX	2	2	.000	1.000
SR	3	3	.000	1.000
ENVLIAB	2	2	.000	1.000
REGUL	3	3	.000	1.000
CAPEXFUT	0	1	1.111	.292
LIT	2	2	.000	1.000
RATING	14	15	1.333	.721

Source: prepared by the authors.

Table 4 provides the results of the surveyed mining companies. It indicates that changes in the variables PLAN\_DUM (a binary variable representing whether the company's custom disaster recovery plan is mentioned), PLAN\_CAT (a categorical variable representing the extent to which companies provide details that pertain to your disaster recovery plan) and RATING (variable representing the company's environmental disclosure score) were not significant. Based on these results, H1 was rejected and it is concluded that the mining companies surveyed did not increase their environmental disclosure after the mining breakdown



of the Samarco mining company in 2015. The results found differ considerably from that of Heflin and Wallace (2011), which found that the oil and gas companies increased their environmental disclosure after the BP spill. However, for Heflin and Wallace (2011), this increase in disclosure is largely limited to a change in disclosure that relates to disaster recovery plans.

## 5 FINAL CONSIDERATIONS

The objective of this study was to analyze the changes in environmental disclosures in publicly traded mining companies listed on “BMF & BOVESPA” stock market after the breakdown of the Mariana dam in 2015. The empirical findings suggest that companies that disclose disaster recovery plans involving environmental liabilities and environmental litigation. The disclosure of the Sustainability Report (SR) by the mining companies surveyed is also positively related to companies that have environmental liabilities and environmental litigation. It can be seen that the companies surveyed with the highest index of environmental disclosure and divulging their disaster recovery plan are the Freeport and Vale Companies, which have a greater involvement in environmental litigation compared to the other companies surveyed.

Mining companies surveyed with environmental liabilities use Impression Management strategies to disseminate their environmental impacts. The strategies used by mining companies researched about their environmental impacts are the concealment and attribution to external factors, presenting in this way a skewed and selective discourse about their environmental impacts. Based on these results, H1 is rejected and it is concluded that the mining companies surveyed did not increase their environmental disclosure after the dam rupture of the mining company Samarco in 2015.

However, it is necessary to be careful with the results found, due to the sample size and the inferences not very sensitive to the choice of the specification. However, the results achieved are potentially of interest to society as a whole in assessing the consequences of decisions and responses to corporate environmental disasters. This study contributes to the literature on environmental disclosure and provides insight into the discussion regarding management from the perspective of environmental disclosure. Given the limitations of the study, the possible continuity of this research is suggested, based on a greater information base capable of contributing to increase the visibility of the changes in the environmental disclosures of the Brazilian mining sector. In other words, the prominent role that these companies have in the economic context cannot be overlooked.

## REFERENCES

- Aboody, D. & Kasznik, R. (2000). CEO stock option awards and the timing of corporate voluntary disclosures. *Journal of Accounting and Economics*, 29, p.73–100.
- Adelberg, A. H. (1979). Narrative disclosures contained in financial reports: Means of communication or manipulation. *Accounting and Business Research*, 10(Summer), p.179-189.
- Ajinkya, B., Bhojraj, S., & Sengupta, P. (2005). The association between outside directors, institutional investors, and the properties of management earnings forecasts. *Journal of Accounting Research*, 43(3), p.343-376.



- Baginski, S., Hassell, J. & Kimbrough, M. (2002). The effect of legal environmental on voluntary disclosure: Evidence from management earnings forecasts issued in U.S. and Canadian markets. *The Accounting Review*, 77(1), p.26-50.
- Bardin, L. (2004). *Análise de conteúdo*. (3ed.). Lisboa: Edições 70.
- Bergman, N. & Roychowdhury, S. (2008). Investor sentiment and corporate disclosure. *Journal of Accounting Research*, 46(5), p.1057-1083.
- Botosan, C. & Harris, M. (2000). Motivations for a change in disclosure frequency and its consequences: An examination of voluntary quarterly segment disclosures. *Journal of Accounting Research*, 38(2), p.329-353.
- Brown, S., Hillegeist, S. & Lo, K. (2004). Conference calls and information asymmetry. *Journal of Accounting and Economics*, 37(3), p.343-366.
- Bushee, B. & Noe, C. (2000). Corporate disclosure practices, institutional investors, and stock return volatility. *Journal of Accounting Research*, 38, p.171-202.
- Chen, S., Chen, X. & Cheng, Q. (2008). Do family firms provide more or less voluntary disclosure? *Journal of Accounting Research*, 46(3), p.499-536.
- Clarkson, P., Li, Y., Richardson, G. & Vasvari, F. (2008). Revisiting the relation between environmental performance and environmental disclosures: An empirical analysis. *Accounting, Organizations, and Society*, 33, p.303-327.
- Clatworthy, M. & Jones, M. J. (2001). The effect of thematic structure on the variability of annual report readability. *Accounting, Auditing and Accountability Journal*, 14(3), p.311-326.
- Courtis, J. K. (2004). Corporate report obfuscation: Artefact or phenomenon? *British Accounting Review*, 36(3), p.291-312.
- Diamond, D. & Verrecchia, R. (1991). Disclosure, liquidity, and the cost of equity capital. *Journal of Finance*, 46, p.1325-1360.
- Eljayash, K. M., Kavanagh, M. & Kong, E. (2013). Environmental disclosure practices in national oil and gas corporations and international oil and gas corporations operating in organization of Arab petroleum exporting countries. *International Journal of Business, Economics and Law*, 2 (1), p.35-52.
- FIELD, A. (2009). *Descobrimos a estatística usando SPSS*. Porto Alegre: Artmed.
- Field, L., Lowry, M. & Shu, S. (2005). Does disclosure deter or trigger litigation? *Journal of Accounting and Economics*, 39, p.487-507.
- Ferreira Neto, J. V.; Gomes, S. M. S.; Bruni, A. L.; & Dias Filho, J. M. (2015). Desastres ambientais impactam o volume de investimento e de disclosure socioambientais de empresas brasileiras? Centre for Social and Environmental Accounting Research, Universidade Federal da Bahia, Salvador.
- Francis, J., Philbrick, D. & Schipper, K. (1994). Shareholder litigation and corporate disclosures. *Journal of Accounting Research*, 32(2), p.137-164.



Frankel, R., McNichols, M. & Wilson, G. (1995). Discretionary disclosure and external financing. *The Accounting Review*, 70, p.135–50.

Ginzel, L. E., Roderick M. K. & Robert, I. S. (1993). Organizational impression management as a reciprocal influence process: The neglected role of the organizational audience. *Research in organizational behavior*, 15, p. 227-227.

Guedhami, O. & Pittman, J. (2006). Ownership concentration in privatized firms: The role of disclosure standards, auditor choice, and auditing infrastructure. *Journal of Accounting Research*, 44(5), p.889-929.

Hand, J. (1990). A test of the extended functional fixation hypothesis. *The Accounting Review*, 65(4), p.764-780.

Healy, P., Hutton, A. & Palepu, K. (1999). Stock performance and intermediation changes surrounding sustained increases in disclosure. *Contemporary Accounting Research*, 16, p.485-520.

Heider, F. (1958). *The psychology of interpersonal relations*. Wiley, New York.

Heflin, F. & Wallace, D. (2011). The BP oil spill: shareholder wealth effects and environmental disclosures. Working Paper. Available at SSRN: <http://ssrn.com/abstract=1933531>.

Hooghiemstra, R. 2000. Corporate communication and impression management – New perspectives why companies engage in social reporting. *Journal of Business Ethics* 27: 55-68.

Jacobi, P. R. & Cibim, J. (2015). A necessária compreensão das consequências ampliadas de um desastre. *Ambiente e sociedade*, 18(4).

Jones, E. E. & Davis, K. E. (1965). From acts to dispositions: The attribution process in person perception. In *Advances in experimental social psychology*, Vol. 2. Berkowitz, L. (ed.). 219-226. Academic Press, Orlando, FL.

Kelley, H. H. (1967). Attribution in social psychology. *Nebraska Symposium on Motivation*, 15, p. 192-238.

Merkel-Davies, D. & Brennan, N. (2007). Discretionary disclosure strategies in corporate narratives: Incremental information or impression management? *Journal of Accounting Literature*, 26, p. 116-194.

Merkel-Davies, D. & Brennan, N. (2013). *Accounting Narratives and Impression Management*. Routledge, p. 1-49.

Patten, D. (1992). Intra-industry environmental disclosure in response to the Alaskan oil spill: A note on legitimacy theory. *Accounting, Organizations, and Society*, 17(5), p.471-475.

Rogers, J. & Van Buskirk, A. (2009). Shareholder litigation and changes in disclosure behavior. *Journal of Accounting and Economics*, 47, p.136-156.

Rutherford, B. A. (2003). Obfuscation, textual complexity and the role of regulated narrative accounting disclosure in corporate governance. *Journal of Management and Governance*, 7, p.187-210.



Skinner, D. (1994). Why firms voluntarily disclose bad news. *Journal of Accounting Research*, 32, p.38–60.

Yuthas, K., Rogers, R. & Dillard, J. F. (2002). Communicative action and corporate annual reports. *Journal of Business Ethics*, 41(1-2), p.141-157.