Environmental disaster in Brumadinho: Assessment of the impact on the reputation of Vale S.A.

Desastre ambiental em Brumadinho: Avaliação do impacto sobre a reputação da Vale S.A.

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Abstract: The company Vale do Rio Doce was created in 1942 as a mixed capital corporation, being privatized in 1997. The company operates in 30 countries producing nickel, coal, copper, manganese, ferroalloys, iron ore and pellets. In 2019, a dam owned by the mining company, in the municipality of Brumadinho, failed and caused one of the biggest environmental disasters in Brazil, with the potential to affect the company's reputation and its legitimacy before society to continue to exist. The general objective of this work is to analyze the impact of the dam failure on the company's reputation. The study is deductive, descriptive, comparative, quantitative, case study and documental, analyzing the company's reputation in five dimensions (media, academy, company, society and by the border of the last two). The findings showed a synergy between the dimensions, and in all of them there was a behavior that in the years before the disaster, the company had a reputation that guaranteed its legitimacy and, in 2019, this reputation was affected, but communication The mining company's organizational structure managed to recover its reputation and maintain the legitimacy to continue operating.

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Keywords – Business reputation; Brumadinho dam; Vale S.A.

Resumo: A empresa Vale do Rio Doce foi criada em 1942 como sociedade anônima de economia mista, sendo privatizada no ano de 1997. A companhia opera em 30 países produzindo níquel, carvão, cobre, manganês, ferroligas, minério de ferro e pelotas. Em 2019, uma barragem da mineradora, no município de Brumadinho, rompeu e causou um dos maiores desastres ambientais do Brasil, com potencial de afetar a reputação da empresa e sua legitimação perante a sociedade para continuar existindo. O objetivo geral deste trabalho é analisar o reflexo do rompimento da barragem sobre a reputação da empresa. O estudo é dedutivo, descritivo, comparativo, quantitativo, estudo de caso e documental, analisando a reputação da empresa cinco dimensões (mídia, academia, empresa, sociedade e pela fronteira das duas últimas). Os achados mostraram uma sinergia entre as dimensões, sendo que em todas elas se observou um comportamento de que nos anos anteriores ao desastre, a companhia possuía uma reputação que garantia sua legitimidade e, no ano de 2019, essa reputação foi afetada, mas a comunicação organizacional da mineradora conseguiu recuperar sua reputação e manter a legitimidade para continuar operando.

Palavras-chave – Reputação empresarial; Barragem de Brumadinho; Vale do Rio Doce.

Introduction

The company Vale do Rio Doce was created in 1942, through Decree-Law No. 4352, by President Getúlio Vargas. On May 6, 1997, the mining company was privatized and managed by the Brazil Consortium, formed by a group of administrators who acquired 41.37% of the shares. Later, said consortium became the company 'Valepar'. In the second stage of privatization, part of the company's capital was sold to employees, while the controlling interest was sold to the private sector. The third and final stage of the sale of shares held by the Union took place in the 2000s, when thousands of people were able to use part of the Service Time Guarantee Fund (FGTS[1]) resources to buy shares in the company (Vale, 2012).

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[1] The FGTS is a fund that is supported by a monthly contribution of 8% of the employee's salary, paid by the employer. The resource may be made available to the employee in some cases provided for by

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Vale is a company that operates in 30 countries, and produces iron ore, pellets, nickel, coal, copper, manganese, and ferroalloys. That said, the miner is the largest exporter of iron ore and pellets in the world. From the point of view of corporate governance, Vale is part of the new market level and has an executive board, a board of directors and a fiscal council.

On January 25, 2019, a dam owned by the mining company, located in the municipality of Brumadinho (MG), broke and caused one of the biggest environmental disasters in Brazil. The tragedy was responsible for the death of 272 people, in addition to contaminating the Paraopeba River with 12 million cubic meters of tailings. This disruption also caused the loss of more than 70 hectares of permanent preservation areas and affected 26 municipalities in urban areas, reaching a total of 200,000 people (Brasil de fato, 2022).

One year after the dam collapse, law nº 14066/2020 was approved in Brazil, which prohibits the use of upstream dams, that are used by Vale. To remedy this issue, the mining company has a plan to decharacterize all of its thirty upstream dams by 2025 in Brazil, twelve of which have already been decharacterized (Vale,2022).

In this context, Ferreira and Luiz (2016) states that corporate reputation is characterized as the perception of all stakeholders of a company regarding the expectations created in relation to it. Furthermore, previous studies such as Alves, Carneiro and Paiva (2020) investigated corporate reputation and society's trust in corporations. Still in this line, the present research is relevant for analyzing the reputation and legitimacy, in society, of the company Vale, which in 2021 was the 3rd with the highest net revenue in Brazil and was the organization with the highest profit among those registered in Brazilian stock exchange (B3), being the most valuable organization on the exchange. In addition, the historical review of what happened in Brumadinho is capable of helping policymakers to improve the government's performance on the subject. In view of the above, the research question of this study is: What were the

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Brazilian legislation, for example: in the case of dismissal of the employee involuntarily and without 'just cause' (Brasil, 1990).

effects of the Vale disaster on the corporate reputation of the company Vale do Rio Doce S.A, in the period from 2017 to 2021?

Therefore, the general objective is: to analyze the reflection on the reputation of Vale S.A. before and after the Brumadinho dam collapse, in light of the dimensions: company, media, academia, society and the boundary between business and society. The theories that supported this work were the theory of social action, which states that social actors play different roles according to everyday situations, and the theory of legitimacy, which has society as the legitimate holder of the means of production, thus, the companies need to have the tacit authorization of society to be able to explore these productive means and continue operating.

About the method, in the 'company' dimension, a content analysis on Vale's financial, sustainability and integrated reporting for the period from 2016 to 2020 and obtained on the B3 (Brasil, Bolsa & Balcão) website. In the 'academy' dimension, bibliometric research was applied with papers collected on the CAPES (Fundação Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) journal portal that dealt with and the Brumadinho dam collapse and were published between 1970 and 2022. About the 'society' dimension, search interest in Vale and the breaking of its dam was observed on the Google trends platform from 2017 to 2021. Finally, to analyze the boundary between the 'company' and 'society', the behavior of the Vale company's share price on the New York exchange from 2017 to 2021 was collected on the Yahoo Finance *website*.

The research is organized into five sessions. The first is the introduction that presents the research objectives and research question. The second is the bibliographic review that deals with the theory of social action, theory of legitimacy, corporate reputation, corporate image, panorama of public policies in Brazil and the history of dam disasters in the country. In the third, the main methodological aspects of the research are considered. The fourth presents the main results of the study, and the fifth details the main conclusions of this investigation.

Bibliographic Review

Social action theory, corporate image/reputation and legitimacy theory

Social action theory explains why companies seek a positive image. This theory was formulated by Goffman (1985) and states that individuals, in a situation of social interaction, play roles similarly to the performance of actors, so that the subject is not the same in all everyday situations. According to this theory, the façade region is the space where this representation takes place, that is, the 'stage' where the 'scene' takes place. In this way, when the individual is in the presence of a group of people who exert some influence over him, he will present a façade of behavior, that is, some gestural and body aspects are accentuated, while others, which may discredit the transmitted impression, are suppressed; thus, this manipulated representation seeks to make the 'spectators' believe that it has certain attributes or meets stereotypes.

Maciel and Berbel (2015) highlight that in addition to the façade region, the individual has a 'personal façade' that has two characteristics, one of which is the 'appearance', which is responsible for revealing the social status and activity that he engages in dedicates at a given time, the other characteristic is the 'manner', this is defined with stimuli and behaviors, such as humility, aggressiveness or arrogance, which inform about the 'roles fulfilled in each situation'. Thus, for the person to be able to convey, consciously or not, the desired impression and, therefore, to have good communication, it is necessary that there is a coherence between the two characteristics of the personal façade.

However, the backstage region is the space/moment in which a reduction or absence of representation occurs. The back region is the 'dressing room' where the actors can relax, not act out the façade behavior and not play the 'character'. Therefore, it is in the backstage area where the individual can feel free to abandon his virtual identity, his façade, and start exercising his real identity. (Salvini; Souza & Marchi Júnior, 2015).

It is worth emphasizing that the expressiveness of the individual, which serves to convey an image to others, presents two kinds of resources. The former are those that the subject 'transmits' and are represented by verbal symbols such as vocabulary, while the latter are those 'emitted' by the actors and are symbolized by bodily, non-verbal, and contextual aspects. Having said that, people, in addition to paying attention to what they say in social situations, should also be concerned with attending to a body attitude

and presentation that is in accordance with that situation. Not meeting these 'labels' through representations, previously elaborated behind the scenes, and performed by manipulating expressions, the individual will generate constraints, misunderstandings, and asymmetries. (Maciel & Barbel, 2015).

In turn, corporate identity comprises the characteristics that make the organizational personality tangible. These characteristics can be exemplified by the name, location, field of activity in the economy, number of employees, mission, values, organizational culture, and visual identity. Furthermore, the corporate identity is the essence of the entity and can be considered as the first element of the chain that will result in the legitimacy of the company (Najadzion; Santos & Souza, 2021).

Corporate communication is the process in which the corporate identity is transmitted to stakeholders. Maino (2004) highlights that this communication is a management tool, as it must be focused and well-directed, while all levels of the organization must be harmonized to effectively effect the image desired by the company. Consequently, it is possible to conclude that the corporate image is an abstract concept that everyone apprehends during the communication and actions practiced by the company, causing him to formulate a set of impressions, opinions, and perceptions about the economic-financial aspects, social, environmental, ethical and legal (Alves; Carneiro & Paiva, 2020).

Therefore, from the perspective of the theory of social action, it is clear that the corporate identity is part of that assumed by the entity in the backstage region, because in it, many of the organization's characteristics translate into its essence and the real identity of the company, being that its projection does not occur before external agents. Corporate communication, on the other hand, corresponds to the façade behavior of companies, where in this process the company finds itself in front of people who influence it, such as its stakeholders. In this way, seeking to obtain a positive image, companies can, for example, adopt good corporate governance practices and carry out actions related to corporate social responsibility, such as minimizing impacts on the environment, developing the local economy and defining a policy of positions and salaries (Alves; Carneiro & Paiva, 2020).

In this context, corporate reputation is the collective representation resulting from many images of the entity and can be characterized as the perception of all stakeholders about the company's compliance with the expectations created in relation to it (Ferreira & Luiz, 2016; Ali *et al.,* 2021). Transparency plays

a fundamental role in the formation of a favorable reputation, as the disclosure of all relevant information, even those not determined by law or regulations, is the only way that stakeholders must assess the attractiveness of the entity and compare it there with your competitors.

In turn, Góis *et al*. (2017) investigated the relationship between corporate reputation and value creation in companies listed on the Brazilian stock exchange, the authors carried out a descriptive and quantitative research, using data from 230 companies, referring to 2013, collected in the reference form, in the balance sheet, in the bylaws, in the ranking of owners in Brazil and in the Economática database. The data were treated through multiple linear regression and the results showed that corporate reputation is a strategic resource that positively influences value creation.

França and Monte (2019) measured the reputation of 225 publicly traded Brazilian companies, this measurement was based on: presence of the firm in the ranking of the largest and best companies in Brazil by Exame magazine, Standard & Poor's ratings, market analyst coverage and Corporate Reputation Index. With the use of linear regression, the authors showed a propensity of companies with a strong reputation to obtain a reduction in taxes levied on net income through more aggressive tax planning practices, the authors explained this result through the moral licensing theory, which states that an actor is licensed to act immorally because of past good deeds. Thus, entities with a strong reputation practice more aggressive tax planning because they believe they will be 'forgiven' by society.

In turn, Góis and Soares (2019) aimed to investigate the relationship between corporate reputation, through transparency, and earnings management in publicly traded companies listed on the B3. The study presented a sample of 231 companies where multiple linear regression analysis was applied. The researchers concluded in their study that corporate reputation provides greater competitiveness for entities, by signaling to shareholders that it has good quality accounting information.

Kim (2019) applied a survey with 930 consumers in the USA to demonstrate the positive effects of Corporate Social Responsibility (CSR) communication factors on knowledge, perception and trust in reputation. The findings suggest that the positive effects of CSR informativeness are long-lasting and independent of consumers' levels of identification with a company, such that CSR communication improves consumers' knowledge about it, which has a positive effect on corporate reputation.

Pinto and Freire (2020) investigated the main reputation proxies used in finance and accounting research. The authors used the literature review method and found that there is a framework of proxies, such as: being listed in the yearbook of the 1000 largest companies published by Exame magazine, companies mentioned in Revista Capital, companies participating in the ISE and the rankings of the Institute Reputation and the Merco Institute.

Pletsch et al. (2020) developed a study to investigate the relationship between corporate reputation and the economic-financial performance of the 100 largest companies in B3. The researchers used the Corporate Sustainability Index and the ranking of the largest and best companies in Brazil, prepared by Exame magazine, to verify the company's reputation, while economic and financial data were collected through Economática. Applying descriptive statistics and the DP2 method identified that it is not possible to say that there is a relationship between reputation and economic-financial performance.

In the meantime, there is a relationship between the elements mentioned so far. If communication manages to convey an impression that aligns with stakeholders' expectations, then through their identification with the company, it translates into a positive corporate image; so that the set of images, from all the parties involved, over time, constitute the corporate reputation. But there is still a lack of support for this rationality: why would companies have to meet the expectations of the largest possible group of stakeholders? And yet, why does it need to act to meet these expectations and not society, which should adjust to the dictates of firms?

Shedding light on these issues, the theory of legitimacy presupposes that companies are not the owners of the resources available in society, in fact, firms would not even have the right to exist if the community did not allow it. If the company does not comply with these satisfactions, it will be considered illegitimate, so it will not have society's consent to continue extracting and exploiting productive resources, which will result in the entity's discontinuity. Thus, this theory assumes the premise that companies act through a tacit social contract with society/community (Alves; Carneiro & Paiva, 2020).

The theory of legitimacy is also used to explain the voluntary disclosures and disclosures of the company's actions, because based on it, companies disclose information seeking to justify their existence and growth to society. This applies mainly to companies with a high environmental impact such as Vale,

whose mining activity causes habitat imbalance, silting of water bodies, atmospheric pollution and reduced air quality. (Silva & Silva, 2021).

Overview of environmental public policies in Brazil

Pereira and Figueiredo Neto (2018) present the concept of environmental public policy as the set of objectives, guidelines and actions by the government that seek to eliminate or minimize existing environmental problems, as well as to avoid the emergence of new problems. Thus, it is possible to perceive that environmental public policies are implemented through legislation, state investments, budget allocations and government programs related to the preservation of natural resources and state intervention in the face of issues related to these resources.

As far as environmental policy is concerned, in the period from the 1930s to the 1960s, the first rules were created to deal with the management of natural resources. According to Moura (2016), the laws of these periods demonstrated a policy aimed at the 'rational control' of natural resources, given their relevance to economic activity. Thus, in 1934, Decree No. 24,643, of July 10, 1934 (Water Code) and Decree No. 23,793, of January 23, 1934 (Forest Code) emerged, whose agricultural activities. In 1937, the Itatiaia National Park was created, the first environmentally protected area, and finally, in 1967, Law No. that wild animals are in the possession of the State, and their use, pursuit, hunting or collection is prohibited.

The 1970s are marked by the creation of the I National Development Plan (PND) whose execution would take place between 1972 and 1974. Antunes (2019) states that the PND manifested itself by outlining a development plan characterized by the expansion of activities that had the ability to generate strong negative environmental impacts, such as mining. However, in the second year of implementation of the plan, the United Nations conference on the environment took place in Stockholm, in which the treaty had Brazil as a signatory. This fact changed the environmental policy of the period, to the point of creating the Special Secretariat for the Environment (SEMA) in 1973, through Decree No. Interior and was the first to address environmental issues at the federal level. Also, during this period, the II National Development Plan (II PND) was prepared, which differed from the I PND for incorporating some

environmental guidelines and for having a more detailed analysis of the relationship between accelerated growth and the consumption of natural resources, according to with Antunes (2019), this greater government concern demonstrated the worsening of the environmental problem resulting from the accelerated development plan of the I PND.

The 1980s were marked by the National Environmental Policy (PNMA) that created the National Environment System (Sisnama). Moura (2016) highlights that these facts had decentralization as an innovative character, given that this policy determined principles, guidelines, instruments, and attributions for various entities of the Federation that work in the national environmental policy. Still in that decade, the Ministry of Urban Development and Environment was created and the inclusion of article 255 to the Federal Constitution of Brazil of 1988 (CF/88), this legal provision states that a balanced environment is everyone's right. Finally, there was the creation of the Nossa Natureza program, which restructured the federal agencies responsible for the environment, and the National Environment Fund (FNMA), which became responsible for financing the PNMA through social participation.

In the 1990s, Brazil hosted RIO-92 and signed the following agreements: Climate and Biodiversity Conventions; Schedule 21; Rio Declaration for Environment and Development and Declaration of Principles for Forests. It was also in this decade that, through credits from the World Bank, the first stage of the National Environment Program was implemented, which focused on: structuring the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA) and the Ministry of Environment (MMA); Furthermore, the program also sought to manage Conservation Units (UC), protect ecosystems, and carry out projects with decentralized execution. Another fundamental fact for the environmental policy of the period was the creation of Law nº 9,605, of February 12, 1998 (Environmental Crimes Law), which made Brazil have an environmental criminal law.

In the year 2000, the National System for the Conservation of Nature (SNUC) was created, which had the importance of standardizing the protection instruments and the categories of conservation units, in the same year, the federal agency called the National Agency for Waters (ANA) whose attributions include the management of hydrographic basins, and the second stage of the National Environment

Program also began. The following year, the Cities Statute was sanctioned, and the color code was established.

Garvão and Baia (2018) highlight that the Cities Statute was important to provide municipalities with development mechanisms in accordance with environmental interests, while the color code is adopted in the recognition of waste by collectors and transporters. Also, in 2007, the creation of the Autarchy called Instituto Chico Mendes para Conservação da Biodiversidade (ICMBio) was created, which is responsible for promoting programs for research, protection, preservation, and conservation of biodiversity (Moura, 2016). Finally, in 2009, the third stage of the National Environment Program was initiated, operating in three lines: environmental management, environmental monitoring, and environmental licensing.

Law nº 12,305, of August 2, 2010 and CONAMA Resolution nº 442/2010 were legislation responsible, respectively, for the creation of the National Waste Policy and for the detailing of Environmental Education. Another important law for the decade was nº 12,512, of October 14, 2011, which among its regulations, instituted the green grant program, which aimed to contribute financially to economically vulnerable families who lived in conservation areas and that, therefore, they had a fundamental role in the protection of natural resources.

Also noteworthy are Law nº 12,651, of May 25, 2012, which revoked the old forestry code, and Law nº 13,153, of July 30, 2015, which institutes the National Program to Combat Desertification and Mitigation of Drought effects. Finally, in the Pluriannual Plan planned by the Union to be carried out in the period from 2016 to 2019, more than R$ 20 billion were foreseen to be allocated to thematic programs aimed at: climate change, conservation and sustainable use of biodiversity, environmental quality, and water resources.

However, Fearnside (2019) shows government actions that set back the Brazilian environmental issue, among them the fact that, in 2019, the functions of control and inspection of deforestation, as well as the Brazilian forest service, were transferred from the Ministry of the Environment to the Ministry of Agriculture. Another measure was the change in the norms of the Ministry of the Environment that make individual inspectors financially responsible if an infraction recorded by them is later overturned. In the

same year, projects that the MMA had contracted through non-governmental organizations (NGOs) were also suspended for ninety days. Finally, it is exposed the fact that the responsibility for the demarcation of indigenous lands was transferred from Funai to the Ministry of Agriculture.

As for the mining activity, Araujo, Yoshida and Lima (2020) argue that society is heavily dependent on the mining sector, given that it is important for the production of various items, such as those related to civil construction, batteries, animal feed and steel, in addition, the sector is strategic for Brazil's trade balance as it represents around 11% of the country's exports. Despite this, it was only in 2010 that a specific law for dams was enacted, known as the National Policy for Dam Safety (PNSB).

Silva et al. (2021) points out that countries such as England already had consolidated legislation on dam safety since 1930. Feliciano and Pasquelato (2019) point out that in the Brumadinho disaster there were irregularities regarding the observation of legislation, with inconsistencies being identified in the licensing process to from administrative decisions of the Government of Minas that simplified this process for large enterprises, the absence of the correct delimitation of the Area of Direct Influence (AID) was also presented. Another irregularity is the presence of administrative and support structures close to the dam's risk areas, such as the administrative center, the cafeteria, maintenance workshops, a loading terminal, and a rail network. Finally, there were also irregularities related to the failure of the safety sirens and the inadequacy of the construction method by raising and upstream of the dam.

Studies on dam environmental disasters

Soares (2020) explains that environmental disasters can be defined as incidents that result in damage that is often incalculable and difficult to repair or repay. According to Alves, Carneiro and Paiva (2020), Brazil has an extensive history of socio-environmental disasters, which involves several tragedies and environmental crimes, and this history includes incidents involving the rupture of dams.

About disasters involving Brazilian dams, Coelho et al (2017) highlights the events that date back to the 1980s. aluminum. In addition, in 1986, the dam belonging to the Itaminas Group in Itabirito (MG) collapsed, causing the death of seven people. After these events, in 2006 and 2007, two disasters occurred due to the rupture of dams in Cataguases (MG), leaving 4,000 people homeless and contaminating the

basins of the Pomba River and the Paraíba do Sul River. In 2009, the leakage of industrial tailings from the Alunorte company in the metropolitan region of Belém (PA) stands out. Furthermore, in 2014, the city of Itabirito (MG) suffered from the collapse of the mining dam owned by the Herculano company, which injured one person and killed three others.

In 2015, in the district of Bento Rodrigues, located in Mariana (MG), a dam belonging to the company Samarco collapsed. Launching about 35 million m³ of iron mining tailings into the environment, so that 16 million m³ were carried by the Rio Doce towards the sea. Other negative impacts were the death of 19 people, 14 of whom were company workers. There was also the destruction of 80% of the 257 buildings in the district, which displaced 329 families. In addition, the mud destroyed permanent preservation areas, buried smaller trees, affected the pH of the soil, destroyed habitats, buried lakes and springs, killed 11 endangered species in the Rio Doce river basin, affected the turbidity of the water in the region and increased the concentration of metals in it (Dias et al, 2018).

Four years after the Samarco disaster, the company Vale, which holds 50% of Samarco's capital, also had its dam ruptured in the municipality of Brumadinho (MG). The tragedy killed 259 people and was responsible for the disappearance of 11 more. Furthermore, the dam had approximately 11.7 million m³ of tailings deposited. Among the irresponsibility present in the event, there is the fact that the cafeteria and the mining company's office are located below the dam, so that 300 people were working around it at the time of the disaster, and no sound signal was given for these workers increased their chances of survival. In addition, the tailings from the dam also reached an inn where about 35 people were staying (Soares, 2020).

Methodology

The research seeks to analyze the impact of the Vale disaster on the reputation of the company Vale. Therefore, this work is based on an investigation of this reputation was carried out on the dimensions: company, academy, media, and society; in line with a previous study by Alves, Carneiro and Paiva (2020). In addition to the description of the behavior of the actions, which cannot be considered a

new dimension as it involves the company and society. Two of the authors were responsible for classifying the materials, while the third (of a more senior academic level) acted as an arbiter when the first had disagreements in their investigations.

In the first 'company' dimension, the sustainability, financial and integrated reporting were verified on the B3 *website*. The documents collected refer to the period from 2016 to 2020, which allowed a comparative analysis of the years that are: before (2016 and 2017), during (2018) and after the disaster (2019 and 2020). Although the disaster occurred in 2019, the 2018 reports were the reference for the event, as they are the first to address the tragedy, since they are published in the following year - 2019 -, when the disaster had already happened. In this dimension, a content analysis of the reports was carried out, so that in the financial documents, economic and financial information was sought, such as: profits, losses, investment plan. In the sustainability reports and integrated reporting, information on corporate social responsibility programs, share performance percentage and aspects of the company's conduct were examined.

Content analysis was applied in three stages (Cardoso; Oliveira; Ghelli, 2021; Bardin, 1977). In the first, pre-analysis was carried out, so that documents of interest were selected (financial and sustainability reports) and the use of adjectives and adverbs that indicate a positive meaning (growth, recovery, investments, recognition) was observed. , more, greater, etc.) or negative (losses, losses, less, smaller, unfortunately, etc.). During the analysis of the material, each document is read in full to identify the words used (record unit) and their relationships with the rest of the text (context unit), with as enumeration rule the direction of the meaning (positive, negative or neutral) and semantics for categorization. The treatment of what was obtained occurs by describing the main information in the reports and giving meaning to their set of words, in order to indicate the image that the company tries to disseminate to the stakeholders who will access the materials.

In the second dimension 'academy', the journals Portal of the Coordination for the Improvement of Higher Education Personnel (CAPES) was accessed, in the search bar 'search for subjects', the terms 'Brumadinho' and 'Vale S.A.' were entered, filtered the results for 'articles', 'peer-reviewed journals' and a period from 1970 to 2022 were delimited. In addition, bibliometric research was applied (Quevedo-Silva

et al., 2016), where the collected works were organized in an Excel spreadsheet, so that each work was arranged in a row, whose columns presented the information: name, number for identification purposes, authors, journals with their respective Qualis in the last official edition (2013-2016) and impact on reputation (negative, positive and neutral). It is worth mentioning that the analysis of the impact on reputation is subject to the researchers' interpretation bias, however, articles that deal with technical and procedural aspects of the company were considered, for example, as neutral; as positive, articles that address profitability, economic relevance and social investments; as negative, the works that highlight the Vale disaster with information about malpractices, as well as those that deal with environmental damage related to the sector.

In the third dimension 'media', the Google search website was used, and in the 'news' tab, the terms "Brumadinho" and "Vale s.a." were searched separately. The results were filtered to include the news published in the period from '01/01/2017 to 12/31/2021', after that, the publications related to the disaster or the company were classified as positive, negative, and neutral.

In the 'society' dimension, the Google trends tool was used, which observed the correlation of internet users' words in relation to the term 'Vale s.a.' and 'Bumadinho disaster', in the period from 2017 to 2021. represents the 'company' and 'society' dimensions, the behavior of the company's stock price on the New York Stock Exchange was observed, so that the data were collected on the Yahoo finance website, where it was possible to determine the prices of the stocks, in the opening and closing of the markets, in the period from 2017 to 2021. Having obtained the data, a line chart was made in Excel, which made it possible to compare the opening and closing prices.

Results Description and Discussion

Reputation analysis in the company dimension

During It was observed that the 2016 financial report showed a net income of R$13.3 billion - 'R$' is the currency of Brazil, the real, in which one unit of US dollars is quoted at 4.62 real, on 04/21/2022 -. In that year, the company had a net revenue of R$94.6 billion, which represented an increase in relation

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to the previous year of R$16.5 billion. According to Vale, the increase in revenue is attributed to: the increase in iron ore prices, higher sales volume and the devaluation of the Brazilian real. Also in that year, the company set production records for: iron ore, carajás, nickel, copper, cobalt and gold.

In 2017, net income increased by R$4.3 billion and totaled R$17.6 billion, while net revenue was R$108.5 billion and increased by R$13.9 billion. The increase in these results in the year is linked to the increase in the prices of the entity's products. Finally, the organization continued to show record levels of production in iron ore, copper, cobalt and gold.

In the 2018 financial report, the entity showed a lesser presentation of its economic-financial performance to the detriment of matters related to the Vale disaster such as victim reparation and socio-environmental actions, however, the net profit for the period was R$25.7 billion, that is, R$8 billion above the 2017 result, so that this performance was due to the cash generation measured by earnings before interest, taxes, depreciation and amortization (EBITDA) at R$12.1 billion. In that year, the dam failure had a negative impact on iron ore production by 92.8 million tons per year (Mtpy).

Although Góis and Soares (2019) state that transparency and quality information contribute to reputation, It is clear that Vale did little to address, before the disasters, the risks that the city of Brumadinho faced due to its dam, However, after the incident, It changes the approach to its reports.

In the 2019 financial report, a loss of R$6.7 billion was presented, the second for the company in 20 years, which is related to: provision and expenses due to the Vale disaster, provisions for Fundação Renova and recognition of impairments. In the following year, in the financial report, the analyzed company again recorded a profit of R$26.7 billion, which was influenced by the good results in EBITDA. In terms of net revenue, the company presented a result of R$208.5 billion and was motivated by the devaluation of the real and the appreciation of iron ore prices.

The 2016 sustainability report was divided into five blocks: business vision, health and safety, local development, social strengthening and environmental responsibility. In terms of business vision, actions focused on ethics, integrity, transparency, legal management, regulatory management, risk management and operational business were presented. When it comes to health and safety, Vale sought to demonstrate a concern for the health and safety of workers and the surrounding community. Regarding

local development, the management of environmental, social and economic impacts on the territories in which it operates was highlighted. In social strengthening, the mining company emphasizes respect for human rights, development, retention of professionals, dialogue and engagement. Finally, environmental responsibility involved the management of waste, water and energy resources, in addition to biodiversity, and the mitigation of climate change.

Regarding the 2017 sustainability report, it was divided into 6 themes. One of them was purpose, which referred to transparency. The partnership theme, on the other hand, addressed the engagement of stakeholders with the company and the risk management of operational businesses. On the topic of peace, the report dealt with regulatory management, health and safety of workers and communities. On prosperity, management of environmental, social and economic impacts was reiterated, as well as issues related to incentives for scientific research and qualification of the population. When dealing with the planet theme, there were actions aimed at mitigating climate change, biodiversity, management of water and mineral resources. In addition, about people, issues were raised aimed at attracting, developing and retaining professionals.

In the first sustainability report dealing with the disaster, it was divided into two parts. The first focused on dealing with actions related to the tragedy, mainly with regard to: dams, dam control, accident prevention and emergency response. In the last part, the document highlighted the company's organizational profile, sustainability, external verification and the Global Reporting Initiative (GRI) content index. The 2019 report was divided into five chapters: the first showed the history of the dam failure, the second dealt with Vale's organizational profile, the third addressed actions and programs focused on human rights, the penultimate one sought to show the mining company's commitment to the planet and the fifth chapter highlighted economic performance. In 2020, the mining company began to publish the integrated report to replace the sustainability report, which highlighted issues related to: disaster repair, plan to face the COVID-19 pandemic, organizational profile of Vale, Environmental, Social strategy and Governance (ESG), corporate governance, environmental and social actions.

It was observed that in the financial and sustainability reports prior to the disaster, Vale presented an optimistic view, so that in 2016, the good results that were caused by the increase in demand for

minerals in China and the devaluation of the real against the Brazilian real were highlighted. dollar, which increased the profit of exporting companies. In 2017, the organization presented the year as a turning point, as it was undergoing a change in its management and organizational structure. Furthermore, during this period, the company sought to reinforce its legitimacy, presenting the objective of becoming the reference company in sustainability in the mining sector, highlighting the introduction of the organization in the new market level of corporate governance, highlighting the return to the International Council Mining and Metals and detailing an Integrated Management System (SGI), which involves environment, health and safety.

However, in 2018, due to the Vale disaster, the company's reports demonstrated the objective of recovering the company's reputation, in such a way that it reduced the information regarding its economic-financial performance, even though no impacts of the disaster were observed. in the 2018 profit and sought to increase accountability in the face of what happened, so that it even presented the objective of not using the heightening and upstream dams. Therefore, the organization projected impacts on operations, such that it suspended the payment of dividends.

In the 2019 reports, Vale sought to show itself as a resilient company that was re-establishing a new social pact to make its legitimacy effective, in such a way that the de-characterization of the height and upstream dams was highlighted, in addition to wanting to show itself as a leading mining company. in the transition from low carbon operation. Furthermore, the company continued to show less emphasis on its economic and financial performance, and this was the year in which it presented losses.

Regarding the 2020 reports, the company resumed its optimism from the periods preceding the incident, firstly, the global agreement signed between the mining company, the Public Defender's Office of Minas Gerais, and the Federal Public Ministry and the State of Minas Gerais was highlighted, in which it was established that the company should spend around R$ 37.7 billion in repairing the disaster, that said, the documents showed that the disaster would be fully repaired, which reduced the risks regarding the value of the resources that the company would suffer. Although Pletsch *et al.* (2020) did not observe a reletionship between corporate reputation and economic financial performance, the company was in a favorable economic scenario, as despite being the period of the COVID-19 pandemic, it benefited from

the appreciation of the price of iron ores, base metals and their respective by-products, in addition to the devaluation of the Brazilian currency, which generated a strong positive impact on this exporting company, causing it to present a net profit higher than its target in 2018.

Reputation analysis in the media dimension

In the 'media' dimension, the news referring to the keywords 'Vale S.A.' and 'Brumadinho' were selected in the period from January 1, 2017 to December 31, 2021. Having collected the news, the impact of reputation was classified of them about the company in: negative, positive and neutral. The research obtained 340 news items, 261 of which were classified as negative, 36 neutrais and 43 positive.
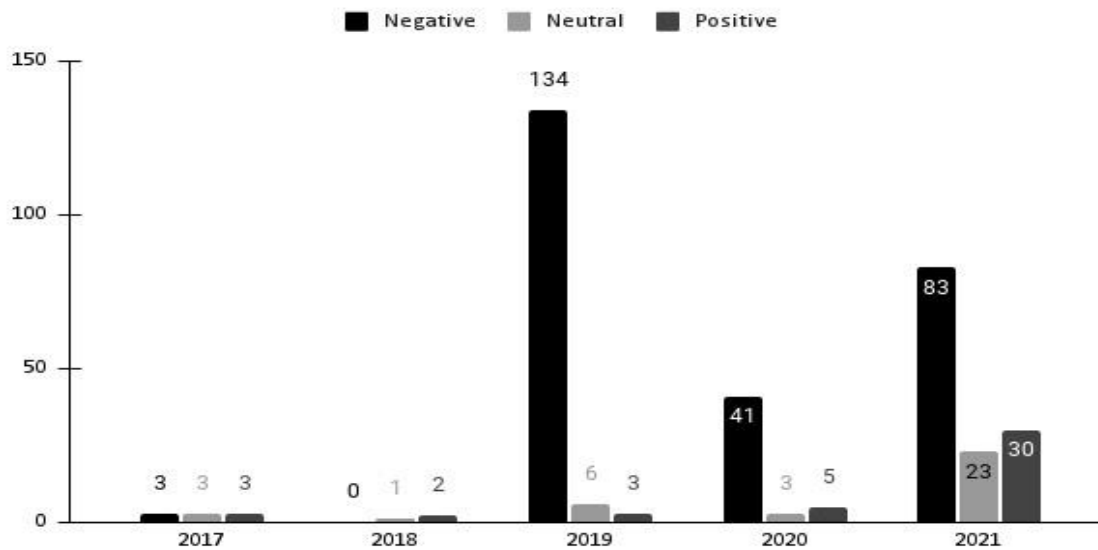
Graph 1.
Number of news about Vale from 2017 to 2021
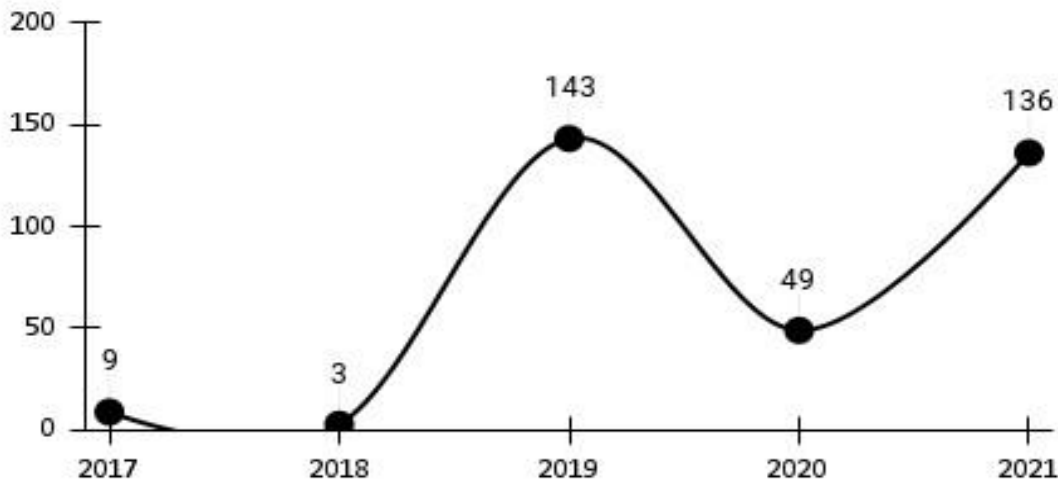
Graph 1 shows that in the period before the disaster, there was less media interest in the mining company, however, this interest showed its highest level in 2019, the year of the disaster, with a total of 143 articles. In 2020, it can be seen that the number of headlines has reduced to 49 but remained above the level presented in the years before the disaster, in 2021, the volume of news about the company resumed growth and made the graph indicates a growing trend in media interest in the Vale. Graph 2 shows the segregation of this volume of materials by type of impact.

Graph 2.
Negative, neutral and positive news from 2017 to 2021

Observing Graph 2, it can be seen that in 2017 the company presented three negative news, in 2018 this number was reduced to zero, however, in the year of the disaster, the company's negative news increased sharply, reaching its highest value in the analyzed period. In the year following the disaster, the mining company managed to reduce its negative publications to 41, highlighting a news item that dealt

with an alleged collusion between Vale and the auditing firm tuv sud, but in 2021, these publications rose again to 83.

In turn, 3 neutrals news were obtained in 2017, in 2018 this number became just one story and in 2019 this type of news increased to 6. In the first year after the Vale tragedy, the company again presented only 3 neutrals news, but in 2021 this classification presented its highest result in the period, which was represented by a total of 23 news.

Regarding the positive media articles for Vale, it was noted that in 2017 and 2018, respectively, 3 and 2 news were collected, in addition, even in the year of the disaster, the mining company still obtained a total of 3 positive news. In 2020, Vale managed to obtain 5 positive publications about it and in 2021, it was the year in which the mining company had the most news with positive impacts on its reputation. From Graph 2, it is possible to conclude that the mining company had a considerable negative impact on its media image in 2019 due to the dam failure, but that in the following years, the company managed to act to mitigate this impact, so that the proportional growth of negative news that occurred between 2020 and 2021, is lower than the observed growth of neutral and positive news in the same period.

Reputation analysis in the academic dimension

The evaluation of the academic dimension analyzes the image of Vale in academic production, in the Portal of Periodicals of Capes, which generated a sample of 128 articles, as shown in Table 1.

Table 1.
Scientific production on Vale from 2002 to 2022

Year	A1	A2	B1	B2	B3	B4	B5	C	NE	Total per year
2002			1							1
2010		1								1
2012						1				1
2013		2								2
2014			1	1						2

2015		1		1						2
2016				2		2				4
2017				1		1			1	3
2018		3			1					4
2019	2	4	5	5	3	4	3		1	27
2020	7	6	1	4	3	11	5	1	2	40
2021	4	4	5	11	3	4			3	34
2022	1	2	2	1		1				7
Total by Qualis	14	23	15	26	10	24	8	1	7	128

Note. Journals that did not have a Qualis rating.

From the analysis of Table 1, it can be seen that before the 2019 disaster, Vale was the subject of a small academic production, the years of greatest production in this period were 2016 and 2018, with 4 articles each. In 2019, the mining company was the subject of 27 publications, while the first year after the disaster was the one with the most papers dealing with the company. It is worth mentioning that the year 2020 was the year that presented the most articles due to the time required for the production of articles and their approval in peer-reviewed journals, but It could also signal that Vale's reputation has been damaged in the short term. In 2021, there was a reduction in academic interest in the company, as the number of articles reduced to 34. Table 1 also indicates that articles with themes about Vale are being well accepted by journals, since journals with Qualis/Capes of levels A1, A2, B1 and B2 concentrate 60.94% of articles about the mining company. So that the journals that concentrate the production were: Territorium (with 7 articles), Science of the Total Environment (6), Caderno de Geografia (6), Ciência e Cultura (5) and Saúde em Debate (4).

The content of the sample articles was also classified as negative, neutral and positive. In all, 113 articles were found to have a negative impact on reputation, while 11 articles were classified as neutrais and 4 were considered positive. The articles with a positive impact, presented the mining company as a leading company in socio-environmental action, dealt with the company's positive impact on the central

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north economy of Brazil, in addition to the entity's inclusion and educational programs, while the negative ones dealt with the Vale disaster and other actions by Vale against the environment and human rights, in Brazil and in other countries where the multinational operates.

Reputation analysis in the society dimension

In order to carry out an analysis of the 'society' of Vale, the terms "Brumadinho disaster" and "Vale S.A." were searched on Google trends. Graph 3 shows the research interest of internet users in Brazil about the disaster in the period from January 1, 2017 to December 31, 2021.
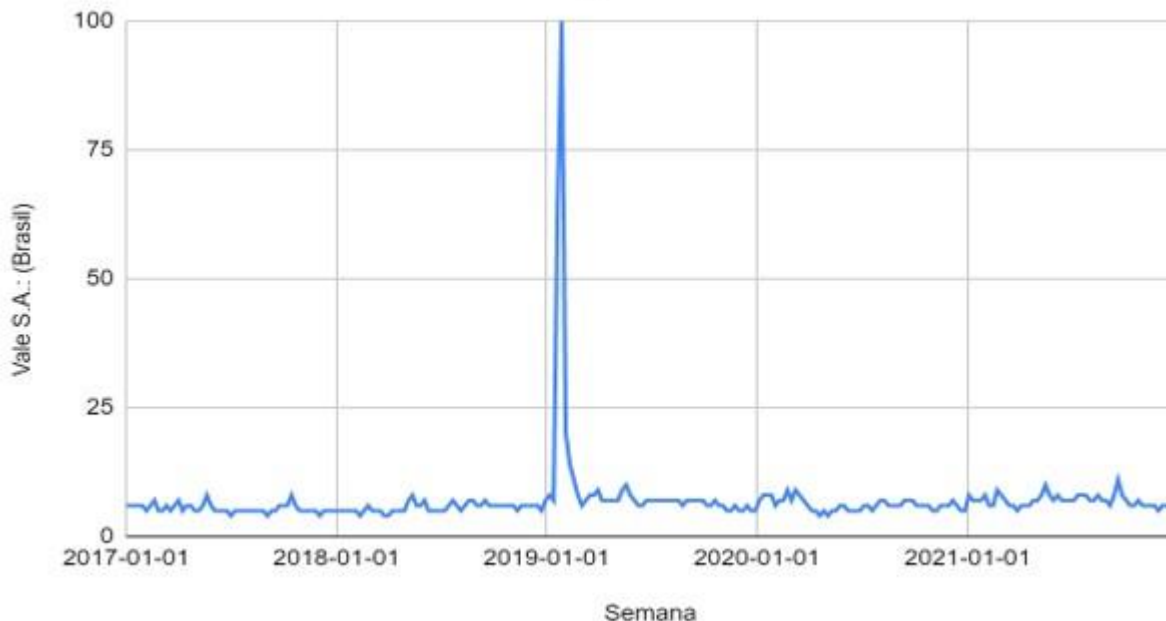
Graph 3.
Interest of searches on the Vale disaster in Brazil
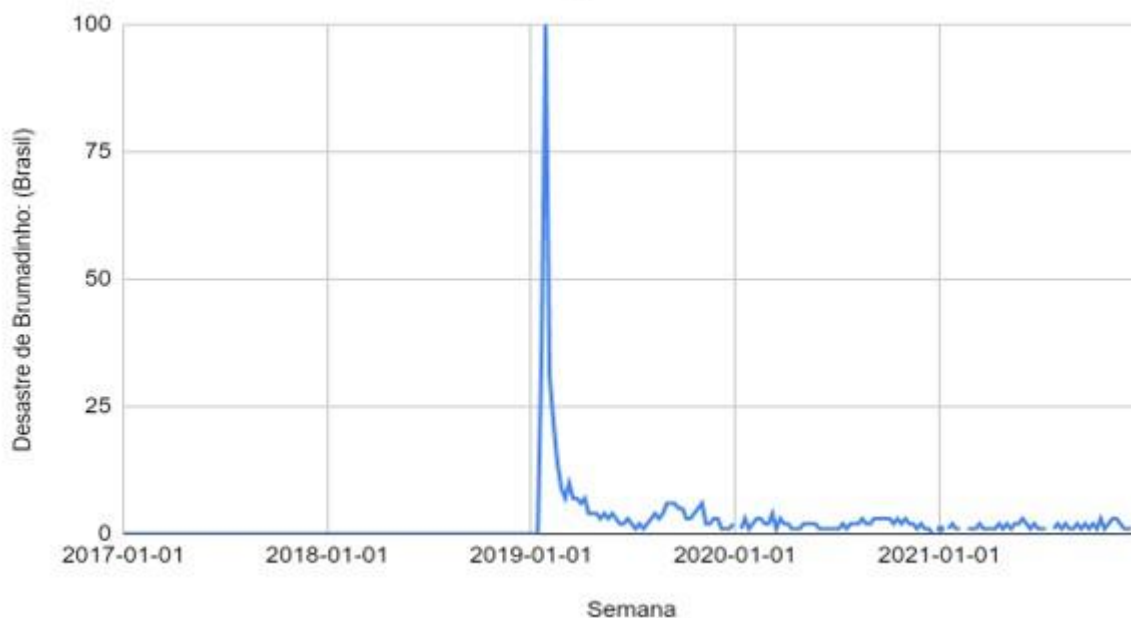
In Graph 3, it is observed that before 2019 there were no searches for the tragedy, as it had not yet occurred in that period. However, the year in which the dam failed was the one that concentrated the highest level of interest on the subject, with a certain number of searches persisting in the years 2020 and 2021. When investigating the geographical distribution, it was found that the Brazilian states that most researched about what happened were: Minas Gerais, Espírito Santo, Paraíba, São Paulo and Amazonas.

A possible explanation for why Minas Gerais appears as the most interested in what happened is due to the fact that this is the place where the tragedy happened, while Espírito Santo also has Vale operations. The large volume of research in São Paulo may be related to the large number of media vehicles based there; in turn, Paraíba and Amazonas have no possible explanations for their appearance in the ranking. Graph 4 shows Vale's search interest on Google by its users in Brazil.

Graph 4.
Search interests about Vale in Brazil

Graph 4 shows the search interest on the company Vale in the same period in which the Vale disaster was analyzed. In this way, it was observed that in the years before the disaster, the mining company had a certain level of interest among internet users, while these research reached their highest volume also in the year of the tragedy and resumed, in the years 2020 and 2021, for the level of research

that he had before the tragedy, which indicates that the dam collapse may not affect the Vale's legitimacy on the long term. The main states to be researched by the company were: Espírito Santo, Maranhão, Pará, Minas Gerais and Rio de Janeiro. It is noteworthy that the states of Espírito Santo, Maranhão, Pará and Rio de Janeiro may have a higher level of search for the company, perhaps because they have operations in their territory, and in Pará the company was the target of a Parliamentary Commission. of Inquiry (CPI) that investigated its performance in the State. Finally, Minas Gerais was also highlighted for being the place where the tragedy of Brumadinho occurred.

Reputation analysis at the boundary between society and company

To verify Vale's reputation on the border between the 'media' and 'society' dimensions, the company's share price was collected from January 3, 2017 to December 31, 2021, justifying the non-inclusion of the first two days of the year due to the fact that there are no trading on the stock exchange during this period. Graph 3 shows the behavior of the closing price of the company's shares in the analyzed period.
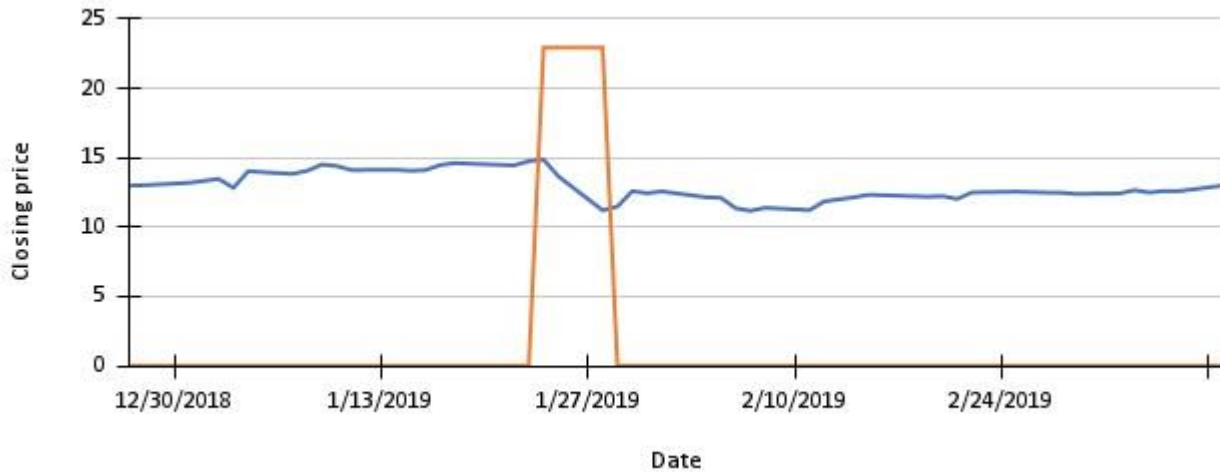
Graph 5.
Request to close Vale's shares from 2017 to 2021
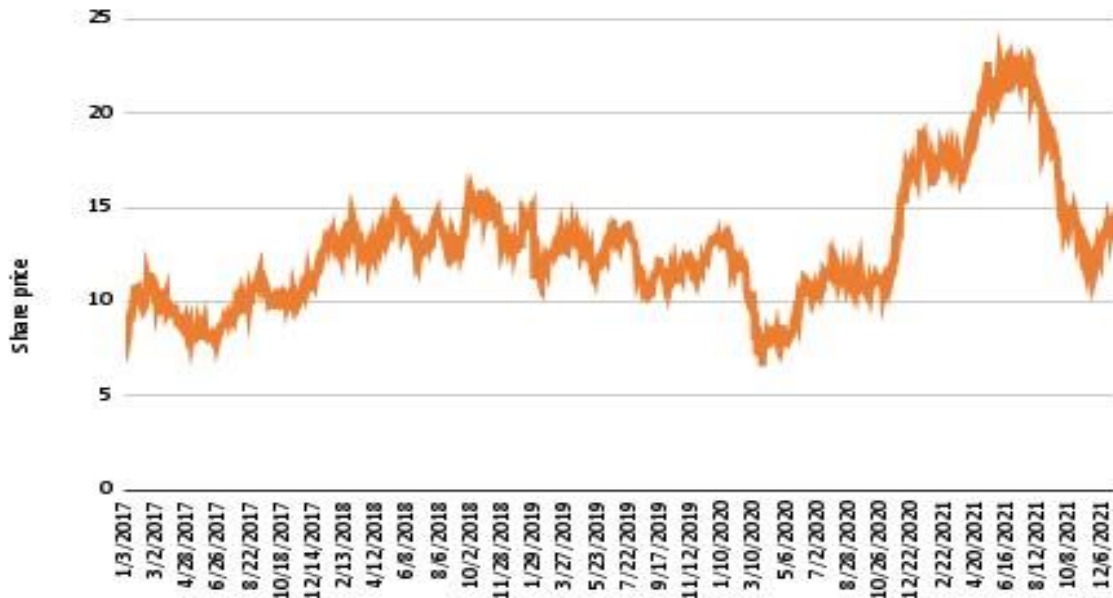
The analysis of Graph 5 shows that, in the long term, even with the failure of the Vale dam, the organization's image before stock market users managed to recover from crises and even show growth trends in recent periods, since in In the same year 2019, the company managed to maintain the level of its share price and ended 2021 with the price of its shares above the one obtained at the beginning of 2017. In addition, the year 2021 was the period in which the company achieved the highest appreciation of its securities. In Graph 6, the behavior of the closing price of the shares of Vale S.A. is shown. in the week of the Vale tragedy.

Graph 6.
Behavior of Vale's share price in the week of the Vale disaster

Although Góis *et al.* (2017) treats corporate reputation as being strategic in creating value, the Vale's image has not been impacted in the long term, it can be seen from the analysis of Graph 6 that in the short term the company's share price was severely affected. In the days before the disaster, the company's shares had a small upward trend, but on the day of the tragedy, they had a 10% devaluation, and in 3 days the company's shares accumulated a loss of 24.37%. After suffering this sharp drop in the week of January 25, 2019, the entity's share price reached a price level higher than what was traded before the disaster almost a year later, on April 12, 2020.

Conclusion

The present study achieved its objective of analyzing the impact of the Vale disaster, which occurred in 2019, on the corporate reputation of the company Vale. Thus, an investigation of the mining company's reputation was carried out on the dimensions: media, academia, company and society. In addition to these dimensions, the study also verified corporate reputation at the boundary between society and company dimensions.

The results showed that there is a synergy between the different dimensions and the behavior of the mining company's actions, and in all of them, the behavior was noticed that in the years prior to the dam failure, the company had a reputation that guaranteed its legitimacy. , but in the year of the incident, this reputation was strongly affected and in the years after the dam failure, Vale's organizational communication apparently managed to establish a façade behavior that put into effect a set of positive images capable of restoring the mining company's reputation and maintain the legitimacy for the company to continue operating.

The research identified that, after the disaster, the company sought to demonstrate a reformulation of its actions in its economic-financial and sustainability reports, wich according to the social action theory can be considered a façade behavior towards its stakeholders . The results confirmed the findings of Góis *et al.* (2017) when observing that the entity sought to regain its reputation, after the dam rupture, as a way of creating value and re-establishing its social pact, wich according to the legitimacy theory, means that the company sought to maintain its rights, towards society to operate. The studies by Góis and Soares (2019) were also reinforced by observing a greater competitiveness of the company when its reputation was not affected by the disaster. However, the period in which the company presented a loss, in its economic-financial reports, was in the year of the tragedy, so that considerable losses were also observed in the price of the company's shares, in which it took a year for the resumption of the pre-disaster price level.

As a limitation of the study, there is the failure to carry out questionnaires and the non-use of statistical tools, which could provide relevant information in the dimension of 'society'. It is suggested for future research, the analysis of other dimensions of the company, such as the 'State', which can be analyzed by observing the legislation and public policies related to the company and its economic sector. In addition, it is recommended the application of other research techniques capable of analyzing the company's reputation over a longer period of time. Finally, it is suggested to analyze the reputation of other companies with polluting potential.

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