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Climate risk perception and media framing

Media framing

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Abstract

Purpose – This study aims to analyze the media coverage of the impact of extreme weather events (EWE) and related risk management activities in Brazil.

Design/methodology/approach – Using a documentary analysis, the authors examined the media coverage of droughts and floods from 2003 to 2013 with concomitant official reports.

Findings – The results indicate that although media coverage conveys the direct impact of floods and droughts on society, it underemphasizes the importance of risk management activities. Moreover, the private sector rarely engages in risk management and mitigation activities, despite the documented supply chain disruptions.

Research limitations/implications – This study focuses solely on media coverage as provided by wide-circulation newspaper in Brazil and would benefit by being extended to all media platforms.

Practical implications – The results highlight the need for private sector involvement in risk management activities to facilitate the adaptation to climate change.

Social implications – The study reveals the deficiency of existing reports and lack of awareness regarding EWE.

Originality/value – The study contributes by focusing on climate awareness and how society can adapt to climate change, as well as how businesses can improve supply chain operations to facilitate smoother risk management.

Keywords Climate change, Risk management, Risk perception, Extreme weather events, Media coverage

Paper type Research paper

1. Introduction

Extreme weather events (EWE) represent an increasing challenge for society and businesses (Guha-Sapir, Hoyois, & Below, 2015; Howard-Grenville, Buckle, Hoskins, & George, 2014). In coming years, the EWE provoked by climate change are expected to intensify in terms of frequency and severity (IPCC, 2012). At the same time, the

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complexity of interconnected businesses as well as the increased population have augmented the societal vulnerability to EWE (Sodhi, Son, & Tang, 2012; van der Vegt, Essens, Wahlstrom, & George, 2015). Nonetheless, awareness of EWE impact is still surprisingly low (Mohor & Mendonado, 2017).

Environmental awareness and risk perception are important antecedents of risk management behavior (van der Linden, 2015; Wachinger et al., 2010). The risk perception is built upon the collection, selection and interpretation of signals regarding the uncertainty and the impact of EWE (Wachinger et al., 2010). However, individuals judge risks according to heuristics and images that are moderated by sources of information and opinion, namely, the media (Asplund, Hjerpe, & Wibeck, 2013; Kellens, Terpstra, & De Maeyer, 2013; Tversky & Kahneman, 1974; Wachinger, Renn, Begg, & Kuhlicke, 2013). Media coverage plays an important role in shaping risk perception in the general public (Chung, 2011; Kasperson et al., 1988) by providing information on the impacts and risk management priorities (Kasperson et al., 1988; Miles & Morse, 2007), as well as amplifying the perceived vulnerability to future events (Wachinger et al., 2013).

Media narratives also provide meaning to climatic events by communicating scientific knowledge about climate change and evidencing, or silencing, the risks involved (Asplund et al., 2013; Chung, 2011). The portrayal of the events also influences the attitudes and priorities of the government and private companies during the disaster response, recovery, mitigation and preparedness phases (Kasperson et al., 1988; Miles & Morse, 2007). While the large events get the attention of the overall public, the impacts and locations of small and recurrent natural disasters tend to be neglected.

Therefore, this study analyzes the role of media coverage of EWE and related risk management activities in Brazil to answer the following questions:

- Q1. What aspects of EWE are captured by media coverage?
- Q2. How media contributes to the perception of risk of EWE and related risk management activities?

During the past decade, Brazil has featured among the top ten countries in terms of disasters damages (2012) and reported events (2013, 2011 and 2010) (EM-DAT, 2019). Recent studies have demonstrated the augmented vulnerability of certain regions as well as major cities in southern Brazil (Filho, Lapola, Torres, & Lemos, 2016). Therefore, it is important to investigate what influences climate awareness and the willingness to act toward adapting to it.

This study is based on the combined literature of climate change and EWE (Linnenluecke, Griffiths, & Winn, 2012), also incorporating disaster operations (Altay & Green, 2006; O'Brien, O'Keefe, Rose, & Wisner, 2006), media framing and risk perception (Kasperson et al., 1988; Wachinger et al., 2013). As such, this study contributes by linking climate awareness with the disaster's operations phases and responsibility attribution, and highlighting risk perception for businesses and supply chain operations. Moreover, our results reinforce the need for deeper awareness and preparedness from all private and public organizations in terms of planning and mitigation of risks from EWE.

2. Theoretical review

2.1 Extreme weather events (EWE)

EWE are defined by their frequency of occurrence and impact on the environment (CRED & UNISDR, 2015). In terms of hazards, events can be classified in accordance to their

predictability and speed of occurrence as slow-onset events (such as droughts) or sudden-onset events (floods, storms, hurricanes) (Guha-Sapir, Hoyois, & Below, 2013). Over the past decade, 90 per cent of the disasters were caused by weather-related events (EM-DAT, 2019). In the coming future, the annual impacts of weather-related events is expected to surpass US \$250bn and affect more than four billion people (CRED & UNISDR, 2015). Largely publicized events, such as hurricane Katrina in New Orleans, USA, have amplified the perceived risk of natural disasters (Elliott & Pais, 2006; Miles & Morse, 2007). However, apart from notorious events, hundreds of less publicized smaller occurrences also demand attention.

The impacts of EWE include social, environmental and economic losses (CRED & UNISDR, 2015; Howard-Grenville et al., 2014). Social losses unfold into a wide range of impacts on human activity, including death, injuries, homelessness, epidemics and human suffering (Kasperson et al., 1988; Strömberg, 2007). The increased EWE frequency along with population growth have augmented the human vulnerability to climatic events (Filho et al., 2016; Strömberg, 2007). The environmental damages include the destruction of ecosystems and the natural landscape, forest fires, and soil constitution (IPCC, 2012; Sanghi & Mendelsohn, 2008). Finally, the economic impacts of disasters can be aggregated into first-order effects as the immediate losses to the affected communities and higher-order effects resulting from inter-industry linkages and supply chain networks (Loayza, Olaberria, Rigolini, & Christiaensen, 2012). While first-order effects are more evident, the higher-order effects may be overlooked in terms of impacts and the risk management analysis (Loayza et al., 2012).

Economic higher-order effects are not negligible. Modern supply chains are particularly vulnerable to disruptions, given their global scope and complexity (Howard-Grenville et al., 2014; Sodhi et al., 2012). Supply chains involve business sectors and organizations with different exposure to climate risks and different resilience capacity (Sá, Miguel, Brito, & Pereira, 2019). Moreover, global supply chains involve different countries with unequal resilience capacity and preparedness affecting the whole supply network. Among different sources of risk that can affect supply chains, natural disasters are being considered as the ones that deserve increasing attention (Allianz, 2018; Wagner & Bode, 2006).

2.2 Disaster operations and risk awareness

Should an EWE occur, disaster operations take place as “a set of activities that are performed before, during, and after the disaster with the goal of preventing loss of human life, reducing its impact on the economy, and returning to a state of normalcy” (Altay & Green, 2006, p. 476). Although there are different approaches to disasters operations, most authors recognize four common phases: mitigation, preparedness, response and recovery (also called rehabilitation) (Altay & Green, 2006; Van Wassenhove & Pedraza Martinez, 2012). The mitigation phase is characterized by activities of prevention, to avoid and reduce risk, whereas preparedness focuses on the activities that prepare to reduce the expected impacts. The response phase is characterized by emergency procedures to preserve life and overall structures, while recovery aims to restore normalcy and rebuild structures (Altay & Green, 2006).

The process of response and adaptation to the risk exposure demands coordination between actors, individuals, civil society, private sectors and government (Lal et al., 2012). Grand challenges, such as climatic events, have called for the involvement of not only public and private sectors, but also the civil society to enhance societal resilience (van der Vegt et al., 2015). Such a process starts with the recognition of the existence of risk and the development of action plans to prevent, reduce, transfer and share knowledge regarding the events (Brindley, 2004). Furthermore, the perspective of increasing frequency and intensity

of weather events demands long-term planning and adaptive responses (Lal et al., 2012). The awareness and willingness to act are needed to avoid major losses, therefore risk awareness is a necessary step in reducing vulnerability of organizations and systems (Mohor & Mendiolo, 2017).

The basis of risk judgment is built by individual and collective heuristics that represent the common-sense reasoning strategies (Wachinger et al., 2010). Initial judgments can be reviewed with additional information, knowledge, logical reasoning and inferential statistics – and this is precisely where media coverage is relevant (van der Linden, 2015; Wachinger et al., 2010).

Mental models and risk assessment mechanisms are developed based on past experience as well as social and cultural learning (van der Linden, 2015; Wachinger et al., 2010). The evaluation of the probability of events is influenced, among others, by the availability of information regarding previous occurrences (Tversky & Kahneman, 1974). In that sense, past experience with EWE is a valuable source of information, as individuals start to perceive themselves to be more vulnerable to future events (van der Linden, 2015). However, images and narratives provided by the context are important sources of risk judgment (Kellens et al., 2013; van der Linden, 2015; Wachinger et al., 2013). This aspect is increasingly relevant for the context of urban areas, where the population is not connected to ecosphere and its evolution and therefore do not perceive the eminent risks of weather events (Mohor & Mendiolo, 2017). The importance of issues is often influenced by the topics that are available in recent memory, which is highly determined by the media (Kahneman, 2011).

2.3 Role of the media

Risk communication encompasses activities that circulate information and knowledge to the population and influence attitudes and behavior (Kellens et al., 2013). Risk communication is not confined to media and comes from different channels, such as public agencies, social groups, scientist, personal networks and the news media (Kasperson et al., 1988). However, mass media plays a crucial role not only in propagating risk information but also in framing and interpreting risk issues (Chung, 2011; Kahneman, 2011). Stories and images can motivate people to prepare for possible risks (Wachinger et al., 2013).

Additionally, media is an important force in the social amplification of risk, which entails the process of intensifying or attenuating signals during the transmission of information (Kasperson et al., 1988). Applied to risk communication, the process of amplification or attenuations derives from the selection of issues and interpretation of risk signals which format the judgment of risks to the public (Chung, 2011; Kasperson et al., 1988).

Typical media coverage will start by the portrayal of the event and the assessments of the impact on humans and damages to the environment (Kasperson et al., 1988). The direct impact is more evident, whereas the indirect impact is more intricate, both because it cannot be easily traced to the event and because it involves the institutional arrangements of risk management and control (Kasperson et al., 1988). After the coverage of the impact, the attention is redirected to the events' aftermath activities (Asplund et al., 2013; Barnes et al., 2008).

Media plays an important role in all different phases of a disaster. The coverage of the disaster and risk management activities are important to the public perception (Bohensky & Leitch, 2014; Perez-Lugo, 2004). During the mitigation phase, media coverage conveys awareness to population; in preparedness, the media provides factual information to prepare for the impact; and in response and recovery, the media provides estimates of the damages and losses as well as the activities' responsibilities (Asplund et al., 2013; Perez-Lugo, 2004),

given that media framing conveys the idea of severity of a given event and how it should be handled and by whom (Asplund et al., 2013; Elliott & Pais, 2006). Media coverage influences the way that public evaluates investments in risk management activities (Kellens et al., 2013; Miles & Morse, 2007). Moreover, media coverage influences the public agenda and policymakers' actions (Barnes et al., 2008). Finally, media influences future adaptation strategies by promoting a reflection on learning from each event (Bohensky & Leitch, 2014).

Empirical studies regarding social amplification of risks have analyzed different aspects, such as: the quantitative amplification (Chung, 2011), the priorities given to each type of capital affected (natural, human, social and built) (Miles & Morse, 2007), the attribution of responsibilities (Olausson, 2009), the influence on donations and public policies (Devitt & O'Neill, 2017; Strömberg, 2007) and the influence on the hazard perception (Rashid, 2011). However, most studies do not address the role of media in risk management activities and the involvement of the private sector.

Based on the available literature and on the social amplification of risk framework, we propose a model of investigation of media framing (Figure 1). The model integrates the analysis of the impact, including first- and higher-order economic consequences, with risk and disaster management activities in the different phases and the assigned responsibilities. With this model, we analyzed the media framing of EWE in Brazil.

3. Methodology

We applied a longitudinal qualitative documentary analysis to investigate the media coverage of EWE and the related risk management activities in Brazil. Document analysis is a systematic procedure to evaluate printed or online documents and is appropriate for exploring and obtaining descriptions of a specific phenomenon (Bowen, 2009), such as the framing of weather extremes in Brazil. This method has been extensively used in the qualitative and longitudinal analysis of the relations among media coverage and natural disasters (Bohensky & Leitch, 2014; Devitt & O'Neill, 2017; Rashid, 2011).

Brazil represents a good context for that investigation for different reasons. According to the Emergency Events Database, Brazil has been repeatedly figured as a top ten country in the Annual Disaster Statistical Review (EM-DAT, 2019). The reports reveal that the country has suffered the intensity of events, with great number of victims as well as damages from natural disasters (EM-DAT, 2019). In terms of response, studies demonstrate that less developed economies tend to suffer higher losses with EWE (Klomp & Valckx, 2014; Schumacher & Strobl, 2011). Additionally, the population density has augmented the climatic vulnerability of some areas in Brazil; however, adaptation measures still lag behind the global standard (Filho et al., 2016; Mohor & Mendiando, 2017).

To select the temporal window of analysis of weather events, we used the EM-DAT data regarding the economic and human impact from natural disasters. The EM-DAT data is categorized under two disasters subgroups: meteorological (short-lived extremes) and climatological (long-lived extremes). The data analysis reveals that the number of disasters

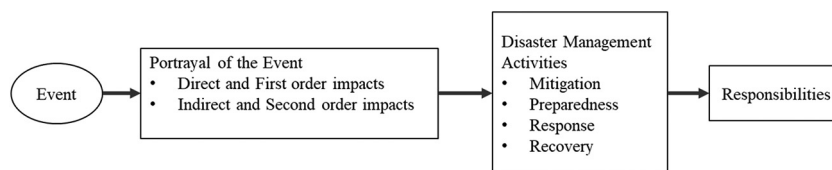


Figure 1.
Representation of
media framing of
event impact and risk
activities

caused by meteorological and climatological events increased between 2003 and 2013, and therefore, we selected that period.

3.1 Data collection

To analyze the media coverage, we targeted a newspaper of major circulation in the country for its social relevance. *Folha de São Paulo* was classified as the main newspaper in terms of circulation volume as per the national association (*Associação Nacional de Jornais*). The news articles published in the period between 2003 and 2013 were retrieved from the electronic archives of the newspaper using keywords, related to the most recurrent EWE, drought (*seca, estiagem*) and floods (*enchente, inundação, enxurrada, alagamento*). We focused on the content pages, excluding sections of classified ads. The initial mechanical search returned 3,477 pages with various content that had to be carefully analyzed as described in the next section.

The media information was compared with the information from three other sources:

- (1) Civil Defense information from 1991 to 2010 compiled by Centro Universitário de Estudos e Pesquisas sobre Desastres at Universidade Federal de Santa Catarina (CEPED-UFSC, 2012);
- (2) Civil Defense information in the annual reports (Brasil, 2011, 2012, 2013); and
- (3) risk management information collected by Instituto Brasileiro de Geografia Estatística (IBGE).

The Civil Defense reports (Brasil, 2011, 2012, 2013) and the CEPED-UFSC (2012) compilation provided data regarding the frequency of events and level of impact in terms of deaths and affected people. The IBGE's (2013) survey provides a profile of Brazilian municipalities, including data regarding the risk management activities. The reports revealed that drought and floods were the most relevant EWE in Brazil, both in terms of frequency and impact. Therefore, we selected drought and floods as the focus of the media investigation.

3.2 Data analysis

The content analysis of the media articles was conducted in two rounds. At first, a group of researchers revised the retrieved pages to analyze the articles and exclude those that were beyond the scope of the research (weather/climate extremes). In the second round, two researchers performed a content analysis and the coding of the articles. The articles were coded according to their main content, and the themes were further grouped into categories considering the reported impact, disaster management activities, type and location of the events. We also coded information regarding direct and indirect impact, actors involved and attributed responsibilities. The results from the two independent analysis were checked for validation, and the researchers agreed on most of their classifications (above 80 per cent),

Table I.
Media articles per
category

Articles selection	Drought	Flood	Total
Total pages retrieved	2,307	1,170	3,477
Total articles first selection	317	1,008	1,325
(–) Not applicable or repeated	185	659	844
Total articles	132	349	481

and they discussed the discrepancies to decide for the inclusion or not. During this process, we eliminated duplicates, reducing the total to 481 valid articles [Table I](#). **Media framing**

We analyzed the data in terms of frequency, longitudinal evolution as well as the amplitude of the coverage of the topics by the media. In the findings, we present data from the official reports, and then we compare it with the media reporting. Next, we analyze media reporting in terms of risk management activities and present the configuration of the media portrayal.

4. Findings

Brazil is characterized by different climates in different regions, and several phenomena influence the EWE. The compilation of Civil Defense reports demonstrates the recurrence of EWE and the predominance of drought and floods as the most harmful events in terms of people affected (including deaths, injured, sick, homeless, displaced and disappeared people). [Table II](#) provides the aggregate data of people affected between 2000 and 2010 as well as the annual numbers between 2011 and 2013. The data reveals that more people were affected by droughts (49 per cent) than floods (41 per cent).

In terms of risk management activities, the [IBGE's \(2013\)](#) report brought information regarding awareness and planning related to floods and landslides ([Table III](#)). According to the report, 50 per cent of all the 5,568 Brazilian municipalities were affected by floods in the previous five years, 20 per cent had a contingency plan in place and only 9 per cent had a risk management plan for those events ([IBGE, 2013](#)). Among those municipalities that were affected by floods, 30 per cent had a contingency plan and 15 per cent a risk management plan in place ([IBGE, 2013](#)). The numbers demonstrate that the experience of past disasters helps to convey the perception of risk exposure and the development of risk management

Events	Affected people (in thousands)								Total	(%)
	2000 to 2010*	(%)	2011**	(%)	2012**	(%)	2013**	(%)		
Drought	48,437	50	1,309	10	8,957	53	11,953	64	70,656	49
Floods	38,671	40	9,274	74	7,066	42	4,357	23	59,367	41
Other	9,113	10	1,953	16	955	6	2,247	12	14,268	10
TOTAL	96,221		12,535		16,978		18,557		144,291	

Sources: *Atlas Brasileiro de Desastres Naturais ([CEPED-UFSC, 2012](#)); **Anuário Brasileiro de Desastres Naturais ([Brasil, 2011, 2012, 2013](#))

Table II.
Compilation of total
affected by EWE

Geographic region	Total municipalities	Affected municipalities	Contingency		Risk management	
			(%)	plan	(%)	plan
Northeast	1,793	729	41	240	13	131
South	1,191	674	57	246	21	102
Southeast	1,667	995	60	486	29	239
Center-west	467	161	34	42	9	16
North	450	207	46	76	17	38
Total	5,568	2,766	50	1,090	20	526

Source: Perfil dos Municípios Brasileiros ([IBGE, 2013](#))

Table III.
Municipalities
affected by floods
and landslides and
risk management
activities

Figure 2.
Total number of
events of natural
disasters in Brazil
between 1991 and
2010*

activities. The survey, however, did not cover other extreme weather situations such as drought.

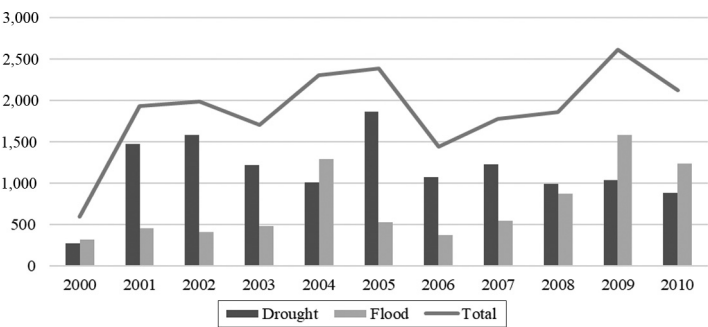
The public reports bring light to the frequency of the events, their relevance in terms of human impact as well as to the relative unpreparedness of municipalities to tackle those situations. However, there was no reference to the economic impact.

4.1 Frequency of media coverage

The compilation of the news articles demonstrates the novelty of theme, and that major attention was given to the subject after 2007 (Figure 3). Figure 3 also demonstrates that floods were the major event category covered in all the analyzed period, representing 73 per cent of all articles.

Comparing the news coverage (Figure 3) with the compiled data regarding the occurrence of the events (Figure 2) (CEPED-UFSC, 2012), we noted that the frequency of the news articles was not strongly correlated ($r = 0.35$) to the frequency of the occurrence of events.

We analyzed the distribution of the articles in terms of the regional coverage. The distribution reveals that there was a higher coverage to events in the southeast (56 per cent), the region that concentrates the major economic activities and is the main target market of the newspaper (State of São Paulo). The importance of the southeast region is corroborated



Sources: Atlas Brasileiro de Desastres Naturais (2011). *The Atlas Brasileiro de Desastres Naturais covers only the period between 1991 and 2010

Table IV.
Distribution of
articles per theme

Theme	No. of articles	(%)
Impact	336	70
Direct	175	
Indirect	93	
Direct and indirect	68	
Disaster management activities:	173	36
Mitigation	54	
Preparedness	15	
Response	47	
Recovery	57	
Impact and disaster management activities	28	6

Source: Analysis of the *Folha de São Paulo* articles (2003-2013)

by IBGE's data (Table III), as the region that concentrates metropolitan areas and is highly susceptible to floods. Media framing

4.2 Media coverage – impact of the events

Table IV brings the breakdown of the articles in terms of the content. Most of the articles (70 per cent) mentioned the events impact, whereas a minority (36 per cent) treated the disasters aftermath activities and disaster management activities. The coverage was primarily focused on the report of the direct impact and immediate effects of the EWE. Even though the frequency of articles increased in time (see Figure 3), the topics did not change in the analyzed period.

Table V brings the major categories of direct impact reported for the cases of droughts and floods. Flood events were primarily pictured in terms of their impact on humans, manifested by the number of fatalities and homeless, as well as the damages to infrastructure. Droughts were more associated with environmental damages (dried-up rivers and forest fire) and to losses in agriculture production.

We grouped the media coverage of indirect impact into four main categories (Table VI). We found evidence of economic impact, including production loss, supply shortage and price increase. Flood damages caused properties' devaluation. In case of droughts, the water

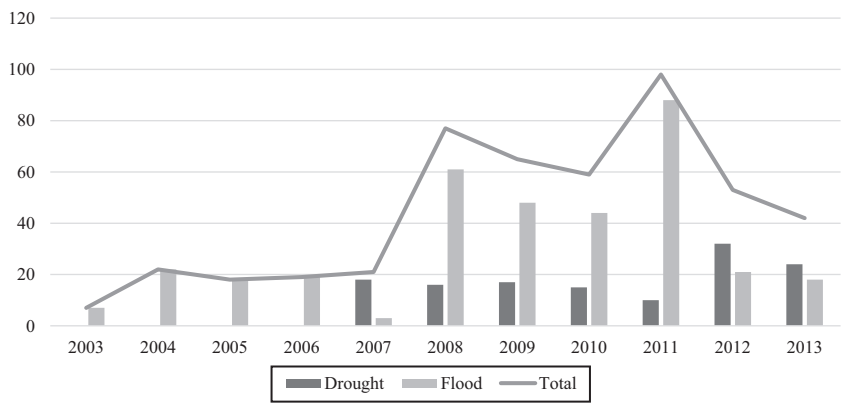


Figure 3.
Distribution of
articles in the period
(2003-2013)

Source: Analysis of the *Folha de São Paulo* articles (2003-2013); *N* = 418

Direct impact	Drought	Flood
People affected	People affected by water shortage	Death, injuries and homelessness
Damages to natural environment	Dry rivers, forest fire	Breaking dike, river overflow
Losses in agriculture production	Crop failure, loss of livestock	Crop failure
Infrastructure damages		Building collapse, streets, ports and airports damage

Table V.
Reported direct
impact from floods
and droughts

Source: Analysis of the *Folha de São Paulo* articles (2003-2013)

Table VI.
Reported indirect
impact from floods
and droughts

Indirect impact	Drought	Flood
Economic Impact	Economic losses, cancelation of local festivities, prices increase, use of thermoelectric	Property devaluation, tourism decay, prices increase
Logistic impact	Inability to navigate rivers	Disrupted transportation (people and goods)
Infrastructure impact		Closing of buildings and roads, utilities supply disruption
Social impact	Rural exodus, fire in indigenous areas, protests, dehydration	Schools shutdown, shops looting, protests, leptospirosis and diseases outbreak

Source: Analysis of the *Folha de São Paulo* articles (2003-2013)

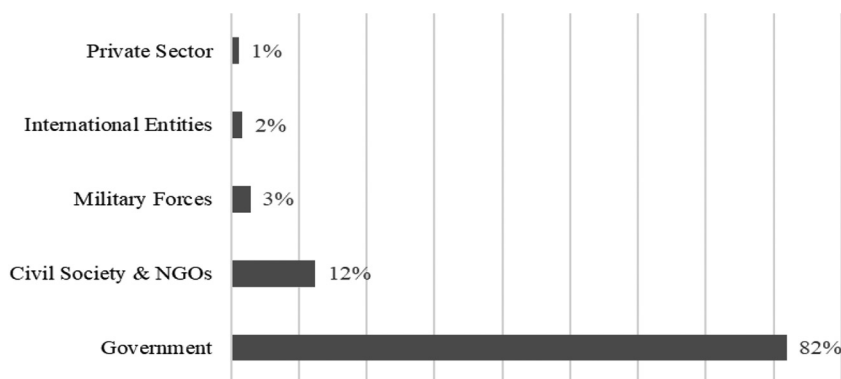
shortage affected the capacity of energy generation, and the intensification of the use of thermoelectric plants, increasing the cost of energy. Logistic problems were reported as affecting the outflow of production, the capacity of local supply as well as the transportation of people. In terms of infrastructure, major attention was given to the disruption on the utilities supply and obstruction of roads. In terms of social impact, the droughts events caused farmers and indigenous people to leave their land. Floods were frequently followed by disease outbreaks, shops looting and protests.

4.2.1 Risk and disaster management activities. The media coverage of disaster management activities was concentrated on the aftermath activities rather than on preparedness (Table VII). Activities related to the recovery, such as social and economic assistance, and reconstruction reconstruction works were more frequent (33 per cent). Mitigation activities and preventive measures (31 per cent) included zoning and control of risky areas for floods as well as new technologies such as permeable asphalt. The mitigation of droughts consisted of new technologies of water retention and drip irrigation. Finally, there were the response activities (27 per cent), such as humanitarian assistance, donations and medical aid, and preparedness actions (9 per cent), such as emergency alerts and planning.

Table VII.
Reported activities
from floods and
droughts

Disaster phase	Flood	Drought	Flood (%)	Drought (%)	Total (%)
Recovery	Social and economic assistance	Social and economic assistance	26	7	33
Mitigation	Reconstruction works				
	Test of new technology	Search and test of new technology	27	5	31
	Zoning and control	Planning			
	Discontinuation of preventive measures				
Response	Humanitarian assistance	Humanitarian assistance	26	1	27
	Donations to victims	Donations to victims			
	Medical aid				
Preparedness	Emergency alert	Emergency alert	8	1	9
	Emergency planning				
Total (N)			86	14	173

Source: Analysis of the *Folha de São Paulo* articles (2003-2013)



Source: Analysis of the *Folha de São Paulo* articles (2003-2013)

Figure 4.
Actors involved in disaster management activities ($N = 173$)

In as much as natural disasters affect the whole society, the government was the main actor associated to the risk management activities in all different phases (Figure 4). The Civil Defense was the main party responsible for emergency planning and early warning to society. Response activities involved the Civil Defense, civil society and non-governmental organizations (NGOs), such as volunteers and the Red Cross. Civil society, private firms and international governmental entities were involved in donations initiatives. According to the media coverage, most of recovery activities relied on the government in providing social and economic assistance.

The coverage about mitigation often featured problems and discontinuity of activities carried on by the government. In 2012, there was a national initiative from the federal government for the development of a risk management plan for natural disasters, a report without further follow-up. Few mitigation initiatives involved private firms and NGOs in the process of risk mitigation, some of them related to new technology and experimental procedures.

4.3 Media portrayal

Droughts and floods were portrayed as events of different impact on society. For example, in the cases of floods, the media coverage focus was primarily on the impact on human and built capital. Yet for droughts, it was on natural and social capital. Even though the occurrence of droughts was more frequent and affected more people in the analyzed period, the media portrayed droughts as less harmful than floods. One possible explanation regards the nature of slow-onset disasters, i.e. their impact is more difficult to estimate (Birkmann, 2007).

	Portrayal of the Event	Risk Management Activities	Responsibilities
Drought	<ul style="list-style-type: none"> Damages to nature Economic impacts Social problems 	Search and test of new technology	<ul style="list-style-type: none"> Government Private Initiative
		Social & economic assistance	<ul style="list-style-type: none"> Government Civil Society & NGOs
Flood	<ul style="list-style-type: none"> Human damages Infrastructure impacts Logistic problems 	Reconstruction works	<ul style="list-style-type: none"> Government

Figure 5.
Portrayal of the events

However, it is important to highlight that this communication creates a bias toward the type of event. The long duration of slow onset events, such as droughts, and the absence of visible physical damages can lead to undervaluation of the overall impacts (Below, Grover-kopec, & Dille, 2007). Moreover, as media focuses on direct and immediate impacts of the events, long-term effects may go unnoticed (Figure 5).

We also found evidence that media coverage was more concentrated in the events close to the metropolitan areas (Mohor & Mendiondo, 2017). Studies demonstrate that the assistance to disasters in locations that are culturally and geographically distant from the major centers may be neglected in favor of “high-profile” emergencies (Strömberg, 2007). Therefore, a media report can contribute to the idea that specific neighborhoods suffer disproportionately and influence the allocation of resources and donations to specific events (Strömberg, 2007).

The media coverage conveys the sense of vulnerability and the urgency in the disaster and risk management activities (Wachinger et al., 2013). However, we found that risk management was a secondary issue in media coverage, the activities of which were under the responsibility of the public administration. The government was also responsible for reconstruction works after floods. Yet, private initiatives were only occasionally involved. Thus, the under-involvement of the private sector and civil society might convey the idea that the task can be solved by the public sphere on its own.

5. Conclusions

This paper investigated how media portrays EWE and how it contributes to risk perception of those events. The results demonstrate that the occurrence of EWE has gained more attention in media coverage; however, there is still lesser interest for risk management activities. Media coverage of drought and floods was unevenly distributed, and the two events are framed differently in terms of impacts to society and risk management responsibilities. Additionally, our results highlight the difference of media coverage in the cases of slow- and sudden-onset events.

Our study contributes to the field in several ways. The first contribution regards the organization of risk management activities and the dynamic of the attributed responsibilities. The media portrayal conveyed the scale of risks involved in EWE (Asplund et al., 2013; Chung, 2011) and reinforced the responsibilities in risk management activities (Miles & Morse, 2007). However, we found reduced attention to risk management activities, particularly for mitigation and preparedness phases. Moreover, the risk management activities were led by the government, as a main protagonist, whereas other private organizations and civil society are mere supporting actors. There was little evidence of long-run measures of risk management, and more importantly, we found few connections of the events with climate change.

The belief on the responsibility of the authorities diminishes the perception of vulnerability and the investment in preparedness (Asplund et al., 2013; Gutiérrez, Engle, De Nys, Molejón, & Martins, 2014). However, risk management activities cannot be delegated to one actor or government, and firms need to contemplate it in the analysis of their business vulnerability. Our results suggest that the coordination between actors and involvement of private sectors is a relevant issue in disaster management in Brazil. Government action may serve as a coordinator for efforts of supporting organizations. However, the mere existence of such structure does not imply success (van der Vegt et al., 2015). As organizations differ in their mandates and expertise, their involvement (or lack thereof) is one of the main challenges in disaster response (Kovács & Spens, 2009). While public adaptation to the climate change risk is

essential to anticipate the necessary measures to overcome long-term climate vulnerabilities, private adaptation is important to develop complementary mitigation activities and innovative solutions to reduce impact (IPCC, 2012).

The second contribution refers to the impacts on the supply chain. The aftermath of EWE goes beyond the direct impact and inevitably culminates in economic impacts locally and regionally. In higher-order effects, suppliers and buyers were affected by shortage, whereas distributors faced vulnerability of the logistic system. Additionally, the consumer market faced scarcity of goods and services and rise of prices. The intensification in supply chain complexity and outsourcing decisions do not always contemplate the analysis of vulnerability and exposure to climatic events (Khan & Sayem, 2013; Sodhi et al., 2012; Wagner & Bode, 2006).

From the business perspective, the challenge is to protect assets, infrastructure and operations from the increasing occurrence of EWE (IPCC, 2012) as well as from the cumulative effects of events, such as droughts. In general, industries based on long-term capital investment (e.g. energy), dependent on natural resources (e.g. mining and agriculture) and with extended supply chains (e.g. retail) are more susceptible to the impact of climate change (Wilbanks et al., 2007). Our results also evidence the vulnerability of sectors, such as agribusiness and tourism to EWE.

The third contribution refers to the importance of data availability in the process of risk communication and awareness. The media coverage was not representative of the occurrence of the events in time and space. At the same time, official reports were discontinued and did not bring systematic information regarding the EWE and their impacts. The insufficient information does not contribute to the communication of climate risks. The dissemination of knowledge and awareness depends on the availability of data, and that is a clear deficiency of governmental sources (Kellens et al., 2013).

Our study also presents some limitations. In terms of data source, we trusted our analysis in the media documents provided by the major newspaper in terms of circulation in the country. In that sense, future studies may provide a comparative analysis of different media vehicles using programming for the data analysis. Future studies may also profit from the continuation of new reports released by the government, given that they are continued.

Overall, our results endorse that climate-related events affect human life, social organization and economic activities; for all these matters, the public and private sectors should not ignore the increasing relevance of those events.

References

- Allianz. (2018). *Allianz Risk Barometer 2018*, Vol. 4. Retrieved from <https://www.agcs.allianz.com/content/dam/onemarketing/agcs/agcs/reports/Allianz-Risk-Barometer-2018.pdf>
- Altay, N., & Green, W. G. (2006). Or/MS research in disaster operations management. *European Journal of Operational Research*, 175, 475–493. <https://doi.org/10.1016/j.ejor.2005.05.016>
- Asplund, T., Hjerpe, M., & Wibeck, V. (2013). Framings and coverage of climate change in Swedish specialized farming magazines. *Climatic Change*, 117, 197–209. <https://doi.org/10.1007/s10584-012-0535-0>
- Barnes, M. D., Hanson, C. L., Novilla, L. M. B., Meacham, A. T., McIntyre, E., & Erickson, B. C. (2008). Analysis of media agenda setting during and after Hurricane Katrina: Implications for emergency preparedness, disaster response, and disaster policy. *American Journal of Public Health*, 98, 604–610. <https://doi.org/10.2105/AJPH.2007.112235>

- Below, R., Grover-Kopec, E., & Dille, M. (2007). Documenting drought-related disasters. *The Journal of Environment & Development*, 16, 328–344.
- Birkmann, J. (2007). Risk and vulnerability indicators at different scales: Applicability, usefulness and policy implications. *Environmental Hazards*, 7, 20–31. <https://doi.org/10.1016/j.envhaz.2007.04.002>
- Bohensky, E. L., & Leitch, A. M. (2014). Framing the flood: a media analysis of themes of resilience in the 2011 Brisbane flood. *Regional Environmental Change*, 14, 475–488. <https://doi.org/10.1007/s10113-013-0438-2>
- Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal*, 9, 27–40. <https://doi.org/10.3316/QRJ0902027>
- Brasil. (2011). *Anuário brasileiro de desastres naturais*. Ministério da Integração Nacional. Secretaria Nacional de Defesa Civil Brasília. Centro Nacional de Gerenciamento de Riscos e Desastres CENAD, Brasília, Brazil.
- Brasil. (2012). *Anuário brasileiro de desastres naturais*. Ministério da Integração Nacional. Secretaria Nacional de Defesa Civil Brasília. Centro Nacional de Gerenciamento de Riscos e Desastres CENAD, Brasília, Brazil.
- Brasil. (2013). *Anuário brasileiro de desastres naturais*. Ministério da Integração Nacional. Secretaria Nacional de Defesa Civil Brasília. Centro Nacional de Gerenciamento de Riscos e Desastres CENAD, Brasília, Brazil.
- Brindley, C. (2004). *Supply chain risk*, Aldershot, United Kingdom: Ashgate.
- CEPED-UFSC. (2012). *Atlas brasileiro de desastres naturais 1991-2010*, Florianópolis, Brazil: CEPED-UFSC.
- Chung, I. J. (2011). Social amplification of risk in the internet environment. *Risk Analysis*, 31, 1883–1896. <https://doi.org/10.1111/j.1539-6924.2011.01623.x>
- CRED & UNISDR. (2015). *The human cost of weather-related disasters: 1995-2015*. Brussels, Belgium: CRED. Retrieved from <http://cred.be/HCWDRD>
- Devitt, C., & O'Neill, E. (2017). The framing of two major flood episodes in the Irish print news media: Implications for societal adaptation to living with flood risk. *Public Understanding of Science*, 26, 872–888. <https://doi.org/10.1177/0963662516636041>
- Elliott, J. R., & Pais, J. (2006). Race, class, and Hurricane Katrina: Social differences in human responses to disaster. *Social Science Research*, 35, 295–321.
- EM-DAT. (2019). *The emergency events database*. Retrieved from www.emdat.be
- Filho, J. P. D., Lapola, D. M., Torres, R. R., & Lemos, M. C. (2016). Socio-climatic hotspots in Brazil: How do changes driven by the new set of IPCC climatic projections affect their relevance for policy? *Climatic Change*, 136, 413–425. <https://doi.org/10.1007/s10584-016-1635-z>
- Guha-Sapir, D., Hoyois, P., & Below, R. (2013). *Annual disaster statistical review – the numbers and trends*. Retrieved from http://cred.be/sites/default/files/ADSR_2013.pdf
- Guha-Sapir, D., Hoyois, P., & Below, R. (2015). *Annual disaster statistical review 2014: the numbers and trends*, Brussels, Belgium: Centre for Research on the Epidemiology of Disasters.
- Gutiérrez, A. P. A., Engle, N. L., De Nys, E., Molejón, C., & Martins, E. S. (2014). Drought preparedness in Brazil. *Weather and Climate Extremes*, 3, 95–106. <https://doi.org/10.1016/j.wace.2013.12.001>
- Howard-Grenville, J., Buckle, S. J., Hoskins, B. J., & George, G. (2014). From the editors: Climate change and management. *Academy of Management Journal*, 57, 615–623. <https://doi.org/10.5465/amj.2014.4003>
- IBGE. (2013). *Perfil dos municípios brasileiros*. Retrieved from <https://ww2.ibge.gov.br/home/estatistica/economia/perfilmunic/2013/>
- IPCC. (2012). Managing the risks of extreme events and disasters to advance climate change adaptation. In C. B. Field, V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, . . . P.M.

- Midgley (Eds.), (p. 594). Cambridge, United Kingdom: Cambridge University Press. Retrieved from https://www.ipcc.ch/pdf/special-reports/srex/SREX_Full_Report.pdf
- Kahneman, D. (2011). *Thinking fast, thinking slow. Interpretation*, London, United Kingdom: Tavistock.
- Kasperson, R. E., Renn, O., Slovic, P., Brown, H. S., Emel, J., Goble, R., . . . Ratick, S. (1988). The social amplification of risk: a conceptual framework. *Risk Analysis*, 8, 177–187. <https://doi.org/10.1111/j.1539-6924.1988.tb01168.x>
- Kellens, W., Terpstra, T., & De Maeyer, P. (2013). Perception and communication of flood risks: A systematic review of empirical research. *Risk Analysis*, 33, 24–49. <https://doi.org/10.1111/j.1539-6924.2012.01844.x>
- Khan, M. A. U., & Sayem, M. A. (2013). Understanding recovery of small enterprises from natural disaster. *Environmental Hazards*, 12, 218–239. <https://doi.org/10.1080/17477891.2012.761593>
- Klomp, J., & Valckx, K. (2014). Natural disasters and economic growth: A meta-analysis. *Global Environmental Change*, 26, 183–195. <https://doi.org/10.1016/j.gloenvcha.2014.02.006>
- Kovács, G., & Spens, K. (2009). Identifying challenges in humanitarian logistics. *International Journal of Physical Distribution & Logistics Management*, 39, 506–528.
- Lal, P. N., Mitchell, T., Aldunce, P., Auld, H., Mechler, R., Miyan, A., . . . Zakaria, S. (2012). National systems for managing the risks from climate extremes and disasters. In C. B. Field, V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, . . . P. M. Midgley, (Eds.), *Managing the risks of extreme events and disasters to advance climate change adaptation* (pp. 339–392). New York, NY: Cambridge University Press.
- Linnenluecke, M. K., Griffiths, A., & Winn, M. I. (2012). Extreme weather events and the critical importance of anticipatory adaptation and organizational resilience in responding to impacts. *Business Strategy and the Environment*, 21, 17–32. <https://doi.org/10.1002/bse.708>
- Loayza, N. V., Olaberria, E., Rigolini, J., & Christiaensen, L. (2012). Natural disasters and growth: Going beyond the averages. *World Development*, 40, 1317–1336. <https://doi.org/10.1016/j.worlddev.2012.03.002>
- Miles, B., & Morse, S. (2007). The role of news media in natural disaster risk and recovery. *Ecological Economics*, 63, 365–373. <https://doi.org/10.1016/j.ecolecon.2006.08.007>
- Mohor, G. S., & Mendiondo, E. M. (2017). Economic indicators of hydrologic drought insurance under water demand and climate change scenarios in a Brazilian context. *Ecological Economics*, 140, 66–78. <https://doi.org/10.1016/j.ecolecon.2017.04.014>
- O'Brien, G., O'Keefe, P., Rose, J., & Wisner, B. (2006). Climate change and disaster management. *Disasters*, 30, 64–80. <https://doi.org/10.1111/j.1467-9523.2006.00307.x>
- Olausson, U. (2009). Global warming — global responsibility? Media frames of collective action and scientific certainty. *Public Understanding of Science*, 18, 421–436. <https://doi.org/10.1177/0963662507081242>
- Perez-Lugo, M. (2004). Media uses in disaster situations: a new focus on the impact phase. *Sociological Inquiry*, 74, 210–225. <https://doi.org/10.1111/j.1475-682X.2004.00087.x>
- Rashid, H. (2011). Interpreting flood disasters and flood hazard perceptions from newspaper discourse: Tale of two floods in the Red River valley, Manitoba, Canada. *Applied Geography*, 31, 35–45. <https://doi.org/10.1016/j.apgeog.2010.03.010>
- Sá, M. M. D., Miguel, P. L. D. S., Brito, R. P. D., & Pereira, S. C. F. (2019). Supply chain resilience: the whole is not the sum of the parts. *International Journal of Operations and Production Management*, 39, 25. <https://doi.org/10.1108/IJOPM-09-2017-0510>
- Sanghi, A., & Mendelsohn, R. (2008). The impacts of global warming on farmers in Brazil and India. *Global Environmental Change*, 18, 655–665. <https://doi.org/10.1016/j.gloenvcha.2008.06.008>
- Schumacher, I., & Strobl, E. (2011). Economic development and losses due to natural disasters: the role of hazard exposure. *Ecological Economics*, 72, 97–105.

- Sodhi, M. S., Son, B., & Tang, C. S. (2012). Researchers' perspectives on supply chain risk management. *Production and Operations Management*, 21, 1–13.
- Strömberg, D. (2007). Natural disasters, economic development, and humanitarian aid. *Journal of Economic Perspectives*, 21, 199–222.
- Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, 185, 1124–1131.
- van der Linden, S. (2015). The social-psychological determinants of climate change risk perceptions: Towards a comprehensive model. *Journal of Environmental Psychology*, 41, 112–124. <https://doi.org/10.1016/j.jenvp.2014.11.012>
- van der Vegt, G. S., Essens, P., Wahlstrom, M., & George, G. (2015). From the editors: Managing risk and resilience. *Academy of Management Journal*, 58, 3. <https://doi.org/10.1163/18770703-00503003>
- Van Wassenhove, L. N., & Pedraza Martinez, A. J. (2012). Using or to adapt supply chain management best practices to humanitarian logistics. *International Transactions in Operational Research*, 19, 307–322. <https://doi.org/10.1111/j.1475-3995.2011.00792.x>
- Wachinger, G., Renn, O., Begg, C., & Kuhlicke, C. (2013). The risk perception paradox-implications for governance and communication of natural hazards. *Risk Analysis*, 33, 1049–1065. <https://doi.org/10.1111/j.1539-6924.2012.01942.x>
- Wachinger, G., Renn, O., Domènech, L., Jakobson, I., Kuhlicke, C., Lemkow, L., . . . Marchi, B. D. (2010). Risk perception and natural hazards. *Natural Hazards*, 9, 1–111.
- Wagner, S. M., & Bode, C. (2006). An empirical investigation into supply chain vulnerability. *Journal of Purchasing & Supply Management*, 12, 301–312. <https://doi.org/10.1016/j.pursup.2007.01.004>
- Wilbanks, T. J., Romero, L. P., Bao, M., Berkhout, F., Cairncross, S., Ceron, J.-P., & Zapata-Marti, R. (2007). Industry, settlement and society. In M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden, & C. E. Hanson, (Eds.), *Climate change 2007: Impacts, adaptation and vulnerability. Contribution of working group II to the fourth assessment report of the intergovernmental panel on climate change*, (pp. 357–390). Cambridge, United Kingdom: Cambridge University Press.

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