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2008+10. An analysis of the changes in the new communication technologies in the recent history of the disasters of Blumenau, Brazil

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Abstract
In 2008, Blumenau suffered the greatest socio-environmental disaster in history. Ten years after the tragedy, this paper brings together some reflections on the change in the use of communication technologies in the coverage of such phenomena. The methodological framework is constituted, from a qualitative perspective, in a bibliographic investigation, adopting an exploratory and descriptive approach. The analysis focused on describing how this process developed in the last decade, taking into account that the change of technical and political procedures for the confrontation of such phenomena coincides with the transformations by which communication technologies have passed. The research contributed to provide clues about the role that newspapers, radio and television broadcasters, virtual social networks and mobile applications played in Blumenau in building public perceptions of risks, and the implications of such frameworks for disaster management.
Keywords: Disasters. Communication technologies. Development. Blumenau.

2008+10. Uma análise sobre as mudanças das novas tecnologias da comunicação na história recente dos desastres de Blumenau, Brasil

Resumo
Em 2008, Blumenau sofreu o maior desastre socioambiental da história. Passados dez anos da tragédia, o presente trabalho reúne algumas reflexões sobre a mudança no emprego das tecnologias de comunicação na cobertura de fenômenos semelhantes. O quadro metodológico se constitui, desde uma perspectiva de ordem qualitativa, em uma investigação bibliográfica, adotando um enfoque exploratório e descritivo. A análise

centrou-se em descrever como dito processo se desenvolveu na última década, tendo em conta que a mudança dos procedimentos técnicos e políticos para a confrontação de referidos fenômenos coincide com as transformações pelas quais as tecnologias da comunicação passaram. A pesquisa contribuiu para fornecer pistas sobre o papel que jornais, emissoras de rádio e de televisão, redes sociais virtuais e aplicativos móveis exerceram em Blumenau na construção da percepção pública dos riscos, e as implicações de tais enquadramentos para a gestão dos desastres.
Palavras–chave: Desastres. Tecnologias de comunicação. Desenvolvimento. Blumenau.

2008 + 10. Un análisis sobre los cambios de las nuevas tecnologías de la comunicación en la historia reciente de los desastres de Blumenau, Brasil

Resumen
En 2008, Blumenau sufrió el mayor desastre socioambiental de su historia. Pasados diez años de la tragedia, el presente trabajo reúne algunas reflexiones sobre el cambio en el empleo de las tecnologías de comunicación en la cobertura de fenómenos semejantes. El marco metodológico se constituye, desde una perspectiva cualitativa, en una investigación bibliográfica, adoptando un enfoque exploratorio y descriptivo. El análisis se centró en describir cómo dicho proceso se desarrolló en la última década, teniendo en cuenta que el cambio de los procedimientos técnicos y políticos para la confrontación de dichos fenómenos coincide con las transformaciones por las cuales las tecnologías de la comunicación pasaron. La investigación contribuyó a proporcionar pistas sobre el papel que periódicos, emisoras de radio y televisión, redes sociales virtuales y aplicaciones móviles ejercieron en Blumenau en la construcción de la percepción pública de los riesgos, y las implicaciones de tales marcos para la gestión de los desastres.
Palabras clave: Desastres. Tecnologías de comunicación. Desarrollo. Blumenau.

1 Introduction

According to Spence, Lachlan & Griffin (2007), communication in times of crisis seeks to prevent or reduce the negative results of a specific episode and, above all, serves two functions: one informative and the other persuasive. First, messages must create a rational understanding of risk and then encourage the public to take measures to avoid a possible threat or mitigate the consequences of such events. Crisis management requires planning, mobilizing, and integrating public power and private institutions, the body of volunteer agents, afflicted communities, and the media. Information or lack of it can positively or negatively influence all phases of the disaster. In this sense, the media plays a critical role in communicating and understanding disasters (Pantti, Wahljorgessen & Cottle, 2012).

The media gain prominence in the tasks of involving different actors, promoting relief and support for victims, and generating trust among those affected. This perspective is based on the perception of a series of previous works according to which, during a disaster, the media is the most important mitigation tool available to the authorities because their performance creates a public perception about the risks of the event (Miles & Morse, 2007; Pérez-Lugo, 2001).

In this context, the present study adds to the previous efforts of the Regional Media Studies Research Group, aimed at understanding the role of the media during disasters (Reis & Zucco, 2012; Reis, Zucco & Darolt, 2013; Reis & Cardoso, 2014; Cardoso, Darolt & Reis, 2015; Reis, Mattedi & Reimondo Barrios, 2017; Reis, Cardoso & Reimondo Barrios, 2018, among others). To address these concerns,

the work aims to analyze the change in the use of information and communication technologies in disasters in the Blumenau region since 2008. The methodological framework is constituted, from a qualitative perspective, in a bibliographic investigation, adopting an exploratory and descriptive approach. Its objective is to provide indicators of how such technologies have developed in the last decade, taking into account that the change in technical and political procedures for confronting such disasters coincides with the transformations that information and communication technologies have undergone.

The first section of this article discusses some theoretical reflections on the development of social media as vehicles for distributing information in the various stages of disasters. Likewise, some trends in scientific research on the subject in recent years are presented, highlighting aspects related to social media and public participation in disaster situations. Then, an overview of the catastrophes that hit the Itajaí Valley, specifically in Blumenau, is presented, emphasizing the evolution of the media in its coverage. Finally, it discusses how new tools and technologies have changed the understanding, response, and socialization of disasters. In the final considerations, we reflect briefly on the transformation identified in the communicative process in situations of vulnerability, resulting from the technological phenomenon and the effect of connectivity.

2 Media and disasters

According to Quarantelli (1991), most of what people know about disasters is what they learn through the media. In this sense, the role of the media in disasters cannot be reduced only as a tool to communicate and describe what happened and keep the public informed. Guion, Scammon & Borders (2007) argue that the media, in addition to being one of the most important vehicles for distributing information about certain risks and dangers to people, is used extensively during the various phases of a tragedy. On this subject, Leitch & Bohensky (2014) indicate that the media should contribute to individual and community preparation, and to help to identify potential threats. Also, allow communities to take advantage of the potential and local experiences to adapt to crises, disasters, and other challenges, as well as providing a forum for community planning on post-disaster reconstruction.

With the increase in natural and anthropogenic catastrophes and the development of social media in recent years, researchers in the area have been concerned with reflecting and deepening studies on the subject. In a recent study about trends and patterns in scientific research on media and disasters over the past 20 years, Reis, Mattedi & Reimondo Barrios (2017) note the significant percentage increase over the years 2000 of studies on media and disasters. Several works paid particular attention to the narratives of media coverage of disasters. Themes such as religion, racial issues, and resilience are a point of interest in the reports produced by the media. Sonnett, Johnson, and Dolan (2015) point out that in the post-Hurricane Katrina coverage, many studies presented racially biased and stereotyped representations of the affected population. On the other hand, McLaughlin (2016) indicates that after the March 2011 disasters (earthquake, tsunami, and nuclear accident) in Japan, the media narrative focused on conveying

a favorable image of the religious activists who provided aid in the regions affected by disasters. Other studies have focused on the use of the Internet and new media for news coverage during disasters (Laituri & Kodrich, 2008; Macias, Hilyard & Freimuth, 2009).

As of 2017, 78% of Brazilians own and use smartphones (IBGE, 2018). The adoption of this technology provided people with immediate and unprecedented access to rapid consumption and production of information. Commensurate with the increase in mobile communication, it has been a corresponding addition to the use of social media as a tool for sharing news and networks. Eighty percent of the use of social media occurs via mobile technologies, and 58% of Brazilians, about 122 million people, use social networks such as Facebook, Twitter, YouTube, among others (IBGE, 2018). Social media is increasingly changing the way society communicates before, during, and after disaster events, as they operate outside traditional information and aid intermediaries. The information generated on social media sites is quickly becoming new sources of data to aid decision-making during extreme weather events and emergencies.

For Cooper et al. (2015), these social media represent a valuable opportunity to promote the objectives of disaster risk management related to mitigation, preparedness, response, and recovery. However, it should be considered that the technical devices establish significant differences in the dynamics of the activities, which indicates that reporting the impact through a tweet is different from the production of a television report (Reis, Mattedi & Reimondo Barrios, 2017). Laituri & Kodrich (2008) indicate that online media has been effective in facilitating the interactive communication of relevant information, connecting with a larger audience that can indirectly participate in the disaster.

Social media has visibly opened up the discussion on the issue of public participation in disasters and has changed how society interacts and responds. Through social media, an increasing number of texts, photos, videos, maps, and other information from eyewitnesses contribute to the information available around crisis events. In the meantime, emergency management organizations are working to understand how to respond to new content and communication platforms (Hughes, Palen & Peterson, 2014). For example, since 2011, some researchers have warned that more than 45% of the members of the International Association of Emergency Managers use Facebook for emergencies; and about 43% used Twitter to collect information and communicate with the public during emergencies.

Regarding the use of social networks during disaster situations, it is necessary to highlight an important issue: information overload. The term refers to sending/transmitting a lot of information on social media during emergencies, which makes it impossible for individuals to find, recognize and respond easily, let alone organize, make sense and act on these occasions (Hiltz & Plotnick, 2013). In general, messages received are not sufficiently organized by topic or content, making it difficult to monitor crises. In response to this challenge, researchers have designed and created several systems that filter and analyze social media streams in times of crisis. Thus, the aim is to increase efforts to understand and integrate information.

Facebook, for example, activated the "Safety Check" in 2014, a tool that aims to communicate to online contacts that a user is safe. It makes it possible to find out if other users are also at risk. The main functionalities of the service allow: a) to warn about the safety of a user, who triggers the checkmark "I am safe" and a notification is sent by the news feed; b) verify that other people in the disaster area are safe; c) tag friends, if they are also in risk regions. The tool is triggered if a sufficient number of people in the affected area publish about a particular incident. The social network checks the location marked on the user's profile and his last geolocation - which must be enabled - used to access the web. The project was inspired by the 2011 Fukushima nuclear disaster in Japan, which affected 12 million people in the country and another 400,000 had to leave the area. During the state of emergency, it was noticed how the population used social networks to communicate in these places.

As an example, it can be seen in Figure 1 how Facebook users used "Safety Check" during the floods that occurred in São Paulo in 2016.

Figure 1 - Activation of the Safety Check in São Paulo, Brazil.

Source: Disclosure / Facebook.

On the other hand, Twitter launched in 2013 "Twitter Alerts". With it, users receive alerts about emergencies involving public security, accessibility, environmental disasters, and situations in which communication vehicles may be inaccessible. The service was initially made available to the United States, Japan, and South Korea. Subsequently, the resource reached Brazil, the United Kingdom, Ireland, Australia, Ecuador, and other countries. Users can receive alerts from all countries where Alerts is already in operation. In the specific case of Brazil, only a few organizations use the tool: the Operations Center of the City of Rio de Janeiro (COR), the Integrated Command Center of the City of Porto Alegre, and the City of Curitiba. To receive alerts, follow one of the profiles, and when the organization issues an emergency tweet, it will be marked with an orange bell and the hashtag #alert. The alerts can be viewed in the Twitter feed on the web and in mobile applications via push notifications (on the device's lock screen). It is worth

mentioning that COR (@OperacoesRio) was the first agency in Brazil to make this functionality available to users.

In addition, there are different initiatives by intragovernmental and intergovernmental institutions working together to map and monitor the different environmental disasters that are plaguing the country. They stand out among them: AlertaRio (http://alertario.rio.rj.gov.br/); National Water Agency (ANA - http://www2.ana.gov.br/); Pernambuco Water and Climate Agency (APAC - http://www.apac.pe.gov.br/); National Center for Risk and Disaster Management (CENAD - http://www.mi.gov.br/web/guest/defesa-civil/cenad)); CIAGRO, Mineral Resources Research Company (CPRM - http://www.cprm.gov.br/); Airspace Control Department (DECEA - https://www.decea.gov.br/); Department of Mineral Resources RJ (DRM / RJ - http://www.drm.rj.gov.br/); Santa Catarina Agricultural Research and Rural Extension Company (EPAGRI / CIRAM - http://www.ciram.epagri.sc.gov.br/); Ceará Meteorology and Water Resources Foundation (FUNCEME - http://www.funceme.br/); Geological Institute (IG - http://igeologico.sp.gov.br/); Brazilian Institute of Geography and Statistics (IBGE - http://www.ibge.gov.br/), among others.

It is important to mention that in addition to social networks, other information and communication technologies (ICTs) contribute to the measurement, collection, analysis, and dissemination of data in the different phases of the disaster. Radio, television, geographic information systems (GIS) and remote sensing, mobile applications (apps), mobile telephony and SMS, alert systems, and amateur radio are some of the technologies that can be used in disaster risk management to support the response and reconstruction processes as well as to mitigate and prevent the increase in vulnerability (LUDWIG, 2017).

3 Media and disasters in Blumenau, Brazil

Blumenau is a municipality in the state of Santa Catarina in southern Brazil. It is located in the Mesoregion of Vale do Itajaí and is the host city of the metropolitan region. It is the third most populous city in the state and has a territorial area of 518,619 km². Blumenau has one of the highest human development indexes in Brazil (0.806 IDMH) and is one of the main industrial, technological, and university centers in Santa Catarina.

The history of the Itajaí Valley disasters takes into account three interconnected facts, according to Frank (1995). The first concerns the colonization and ethnic identity of its protagonists; the second to socioeconomic development, which was based on the textile industry and the consequent urbanization process in the territory; and finally, the intensification of environmental depredation and the problem of disasters. Concerning the historical process, it is a fact that the colonizers of the Itajaí Valley were instrumental in opening up communication between the coast and the plateau. However, the urban expansion associated with the occupation of flooded areas and the appropriation of the slopes triggered an intense history of tragedies, placing Blumenau in particular as a vulnerable territory. There is a growing number of floods since 1910, a period that coincides with the principle of the development of colonization in the entire watershed. On the subject, Moura, Frenzel, and Moura (2019) point out that the process of occupation

and distribution of the population in the urban environment is closely related to economic dynamics.

Floods are part of the city's memory and mark its ability to overcome tragedies and enhance local culture. With heavy rainfall, its territory forms a channel for the passage of water, which becomes an uncontrollable condition in times of considerable incidence (Reis & Cardoso, 2014). With almost all the hills turned into residences and the amount of rain higher than that estimated as normal, they descend on its slopes that flood and take several houses, lives, and dreams. Natural and social conditions come together to form disasters, such as those observed in the last decades in the Itajaí Valley. In this sense, such events should be called socio-natural or socio-environmental, since nature alone does not cause them. Its intensity is linked to human interference (Mattedi, 2000).

During disasters, the media play a crucial role in providing services. The catastrophes recorded in the region have become more dependent on the media in relation to how they were known, responded to, and socialized. Thus, the disasters that hit the Vale do Itajaí, especially the city of Blumenau, are highlighted below, with emphasis on the evolution of the media in covering such catastrophes.

Period 1980-2008

For years, the newspaper, radio, and television were the media that spread warning messages, preparation tips, and evacuation information to the public before, during, and after disasters. In the multiple floods, floods, landslides, and other major socio-natural disasters that hit Blumenau between 1980 and 2008, the highlight in communications was the medium that is present in homes, the radio (Reis & Darolt, 2009). It was for many residents the leading source of information during the catastrophe. Radio stations, Rádio Blumenau, Rádio Nereu, and Rádio União can be mentioned among the broadcasters that carried out the information in the period. Their transmitters located in a flood-free area and the use of their energy generators allowed them to remain in the air for several days. , passing on information of public utility.

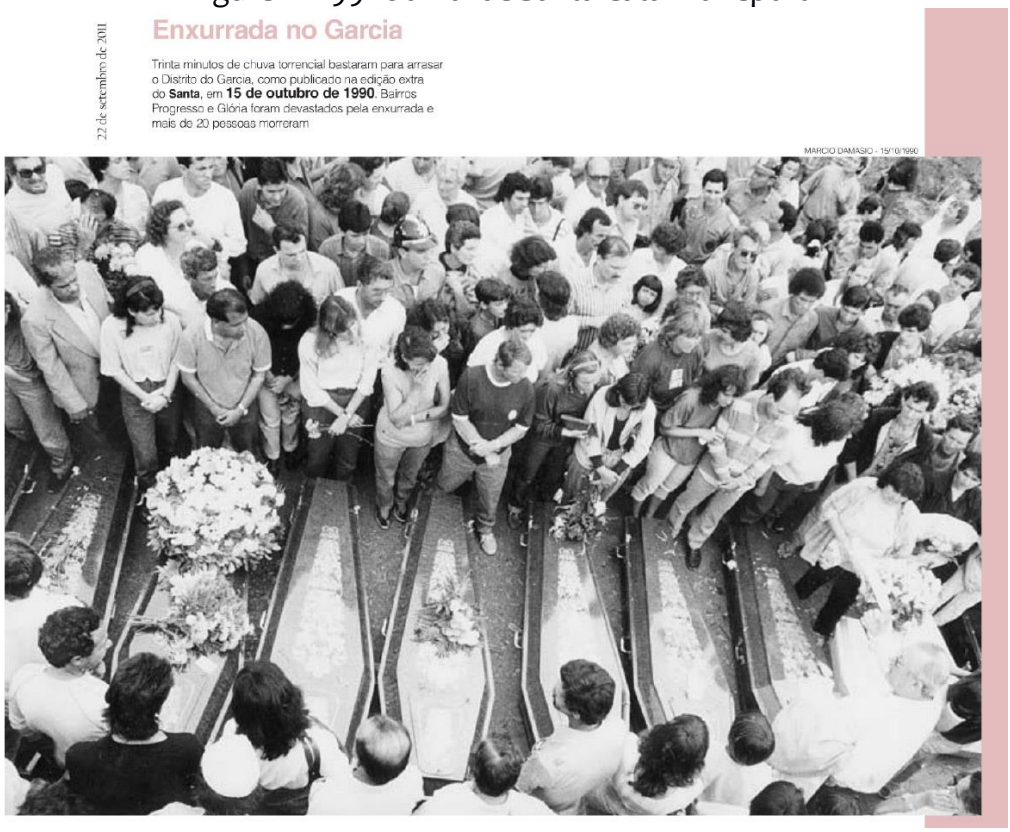
The radio's work in these decades was exceptional, despite the obvious improvisation, lack of equipment, technical problems, amateurism, and precariousness (Reis & Darolt, 2009). Nevertheless, these elements did not overshadow their significant importance in the tragic moments experienced by the society of Vale do Itajaí. The radio contribution was a cardinal and strategic factor in the information provided to the affected population. The support of radio amateurs was vital, as they formed a chain to help the neediest people. It was a period when listeners placed a high value on the work of communicators, honoring their favorite broadcasters with a loyal audience.

Television news also helped to convey, or sometimes create, a sense of national expression. In tragic events such as the floods of 1983 and 1984, the performance of RBS TV stood out. The station had the building completely hit by the waters, but the studio was transferred precariously to the Embratel building, where transmissions were made from Vale do Itajaí to Florianópolis. Rede Globo has signaled for information about the catastrophe to be transmitted to all of Brazil and abroad through the solidarity chain, sending the news to the population in a

precarious way, but still, of paramount importance during the events (Darolt, Garrote & Reis, 2011).

The tragic mass and flood movements that devastated the Glória and Progresso neighborhoods in 1990 reached 1,310 houses, of which 286 were damaged, and 66 were destroyed, leaving 754 people homeless (Bacca, 2000). This case had special coverage by Jornal de Santa Catarina, which reported the drama of the situation (Figure 2).

Figure 2 - 1990 Jornal de Santa Catarina report



Source: Jornal de Santa Catarina, 2011

Debuting in the 1990s, the Internet began to become a source of information on disasters and news related to emergencies. Such technological advances allowed the population of Blumenau to access information more comprehensively than in previous floods. The news spread through the web on portals such as Terra, G1, UOL, Folha de S. Paulo, and Estado de S. Paulo, which replicated the information produced by Jornal de Santa Catarina to echo the events that plagued the city.

Another technological differential was mobile telephony, which allowed data transmission via SMS (short message service). It is worth mentioning that this modality appeared between 1999 and 2000. Before that date, the devices could not send or receive data packets. In this sense, many affected have used this resource to communicate during disasters. In the past, fixed-line telephones were distant from each other and were not accessible to everyone, due to the high cost of their acquisition and depended on the network cabling to work.

In the 2008 socio-environmental disaster, radio coverage was highlighted again. The journalistic follow-up of Rádio Nereu Ramos provided newsletters of the

events, and the population used this medium to search for news, ask for help, and help from the Civil Defense. The substantial difficulty in transmissions was the lack of electricity. Several network cables were damaged, making it impossible for energy to arrive in the localities. In addition to AM radio, information coverage of the 2008 disaster was differentiated from other floods in the local media. FURB-FM (university broadcaster) was the communication channel that remained on the air during the entire period, also broadcasting the programming of FURB-TV, TV Galega, and TV Legislativa. The time that the others spent transmitting varied considerably. Some managed to stay on the air longer, while others were unsuccessful (Darolt & Reis, 2010).

Period 2008-2018

In 2008, after months of continuous rain that saturated the soil, Blumenau was subjected to an unprecedented tragedy. The landslides, accelerated by the existing conditions (steep valleys, clay soil, irregular occupation of risk areas, removal of protective vegetation, and lack of drainage), constituted a new phenomenon in the history of the Itajaí Valley disasters. This catastrophe was the first serious event in Brazil in the age of the Internet (Global Voices, 2009). For the press, it was complex to analyze the situation that was occurring and pass on information to the population about the proportion of events. In this way, and with the help of new communication tools and technologies, the previously passive audience has become an active participant in the creation and dissemination of news about the disaster. Social networks like Twitter, Facebook, YouTube, and some blogs allowed the population to search and distribute information in real-time that traditional media could not offer.

On Twitter, users reported what they saw through the window. Volunteers and victims used the #blumenau channel to exchange messages and to get the latest news (Reis & Zaboenco, 2010). On Orkut, Internet users posted photos, maps of blocked roads and organized forums for discussion that addressed different topics: establishments that abusively increased the price of goods, curfews, collection points for donations, or short videos and questions about the increase in the value of FGTS loot for victims, among other issues (Reis & Zaboenco, 2010). In the case of YouTube, as it is the leading destination for Internet users to share videos, it was crucial for the dissemination of images of the tragedy. Service users contributed to the formation of content that was published on other virtual networks, serving directly as a source of information.

One of the first ways to report the 2008 incidents was a blog, Notícias de Blumenau, known as Alles Blau. Space was more agile in coverage than the traditional media, bringing the news before any other means of communication. The blog appeared to gather the information that was scattered on the network: what was published on Twitter, what was debated on Orkut, what was seen on YouTube, and what radio stations broadcast, especially when the crisis took on dramatic contours. For several days, the blog was the one who gave news about the situation in Blumenau to those who were not in the region since the large media corporations followed the subject with relative distance. When Alles Blau's popularity spread over the network, Internet users started sending photos and

reports directly to the blog, which became a source of consultation (Reis & Darolt, 2009).

2010 was a landmark year for the coverage of Jornal de Santa Catarina concerning the incorporation of new technologies. By exploring its website (www.santa.com.br) and using hyperlinks, videos, photo galleries, infographics, real-time updates, blogs, and virtual social networks, the vehicle created a new paradigm for flood coverage in Vale do Vale Itajaí. It allowed them to get closer to the reader, who had the opportunity to comment and participate in the publications. Such tools gave mobility and agility in the distribution of information, which allowed breaking the limits of time and space in the news coverage.

In September 2011, the floods of the Itajaí Açu River marked once again. The population, the authorities, and the media were already familiar with the use of digital media. They knew how to take advantage of them to fulfill the role when traditional media were unable to operate.

The information conveyed by "Santa" was crucial for the population, as is the case with news about the supply of drinking water and electricity in different regions. As well as being a source of information, the newspaper also sought to be the representative for various authorities (mayor, governor, and president of the republic). The purpose was to review the actions that were being taken to mitigate the effects of the climate phenomenon in the community. Along the same lines, professionals and technicians (Secretaries of Works, Civil Defense, meteorologists), and scholars from different areas had their guidelines retransmitted to guide the population on how to proceed in that situation. These procedures were also used in the 2013 and 2014 floods, which put the region on alert and some municipalities in an emergency.

The 2015 floods were marked by the implementation of a digital tool associated with mobile. An application that would change the form of connection between users in Brazil, called WhatsApp. The app created in 2009 by Jan Koum and Brian Acton was acquired in 2014 by Facebook but had its rise in Brazil in 2015, and currently leads the preference of Brazilians. It is present in more than 180 countries, bringing together approximately 1 billion users. The service started as an alternative to the SMS system and currently supports sending and receiving a variety of media files, such as photos, videos, documents, geolocation sharing, texts, audio, and voice calls. This set of facilities was absorbed by users, changing communication practices, and processes.

WhatsApp was the significant differential in the 2015 disaster. However, its users were also exposed to the proliferation of rumors, for not realizing when the news was factual or not, unaware of the data sources. In this line of reasoning, there was also the sharing of "bad faith", which aims to publicly discredit someone's image, often evoking people's political commotion as a motivating factor for virtualization. The high connection in this disaster sparked more chaos among the community than benefits.

In the same year 2015, the Blumenau City Hall developed the AlertBlu application through the Systems Directorate of the Municipal Government Management Secretariat. It provides information and services to the community in the event of forecasts of heavy rains, floods, runoff, landslides, and emergency traffic situations to assist drivers. Besides, the application allows users to monitor

the level of the Itajaí-Açu River, the level of flooding in the streets and provides a list of shelters activated in emergencies, as well as useful telephones (Fire, Civil Defense, and Military Police). In general, the 2015 and 2017 floods were marked by applications and the instantness of facts and news pulsing in the palm of users' hands. With that, there was a mismatch of information due to the possibility of everyone being able to produce and distribute content.

4 Information overload

The world has been a spectator of rapid changes, and the changes have become constant. According to Kovach & Rosenstiel (2001), every time there was a period of significant changes, social, economic, and/or technological, there was a transformation in the news. This happened in the years 1830-1840 with the advent of the telegraph; in the 1920s with the radio; and in the 1950s with television. The arrival of the Internet, followed by mobile technologies and social networks, brought about the latest and most dramatic change in news. Within this context, communication processes in times of crisis were also impacted and modified. Real-time Tweets, amateur videos on YouTube, and private profiles on Facebook filled the "news vacuum" that until a few years ago characterized coverage of crisis events (Bruno, 2011).

As a starting point, and to better understand the impact of the change in the employment of new information and communication technologies in the Blumenau disasters in the last ten years, it is necessary to address the following questions: How did the new media and technologies change the coverage of disasters between 2008 and 2018? To what extent has user-generated content replaced traditional media communication in emergencies?

To answer these questions, it is presumed that that new tools and technologies have profoundly changed the understanding, response, and socialization of disasters in two main aspects: (1) how disasters are framed in media news coverage and (2) who reports such events. Regarding the first element, some individuals consumed the information in a context of isolation to another model, in which the audience is integrated due to the networked environment. The faster the technological context changes, the greater the speed in changing the communicational paradigm, which moves from the scarcity of information to the abundance of data.

As seen earlier, in the 1980-2008 period, news coverage of the region's disasters generally depended on official sources and concentrated on traditional media (newspaper, radio, and TV). However, in the last decade, the development and expansion of new media and tools have altered the flow of communication, weakening traditional official sources and, consequently, replacing the vertical-centralized communicative model used by the government, emergency managers, and the traditional media. On the other hand, the news coverage of the disaster takes on a larger scale in terms of global reach thanks to new media. They offer opportunities to witness the impact of disasters worldwide (Cottle, 2013). Thus, after 2008, social networks and other Internet resources communicated images and information to the rest of the country regarding the events that affected Blumenau.

These tools mobilized people, added information, created campaigns, and led the front line of support that Santa Catarina received (Reis & Zaboenco, 2010).

Media coverage of disasters was also affected by the accelerated speed and immediacy shown by virtual social networks. Although the benefits of using social media during disasters are well documented, real-time information has reached a point where immediacy has replaced traditional information analysis and management practices. Thus, this speed, aggravated by the quantity, can obscure the image of the situation, making it difficult for managers to make accurate and timely decisions (Hughes, Palen & Peterson, 2014). It was the case with the floods in Blumenau after 2008 when the rise of rumors on social networks and instant communication applications spread a real digital panic among users. To this was added an increasing erosion in the users' confidence concerning public institutions, which were the pillars from which the official communication started.

This leads to the second aspect of the change, which is related to who reports such events. On the subject, Bowman & Willis (2003) explain that:

> The venerable profession of journalism finds itself in a rare moment in history, where, for the first time, its hegemony as a news carrier is threatened by not only new technologies and competitors but, potentially, by the audience it serves (Bowman & Willis, 2003, p.7).

As emergency management organizations began to consider how to include social media in their communication activities, the discourse around public participation in the crisis began to change. Previously, public communication channels were one-way paths that flowed from emergency response organizations to members of the public (Palen & Liu, 2007). However, with the emergence of digital applications and social networks, audiences gained significant opportunities to participate in the process of creating, consuming, and distributing news. In this way, "the participatory nature of news coverage has blurred the line between those affected by the news and those covering the news" (Haddow & Haddow, 2008).

Armed with smartphones in hand, social network users become potential communicators in disaster situations. Communication noises, however, are placed to hinder the propagation between senders and receivers. It is appropriate to recall that whoever communicates subjugates the consequences of their actions, and whoever shares the mistake is complicit in the act, generating a feeling of panic in the digital environment. In the last decade, Blumenau has witnessed such situations.

Social media offers multiple support resources that can reduce risk during crises, and individuals need to rely on them as a source of information needed to make critical security decisions. Citizen empowerment and its involvement in participatory journalism and formal emergency response efforts raise questions about credibility, trust, and responsibility. These three aspects become defining and permanent factors in disaster news coverage. The "tweet first and check later" approach demonstrates the transformation that has affected news coverage. This strategy is opposed to one of the golden rules of journalism: each news must be verified before publication (Bruno, 2011).

Both the content and the source play crucial roles in the way the information is perceived. Valuable knowledge can appear from anywhere, and these days, it is

being generated by the audience through social networks. In this context, the technological revolution that connected the majority of users created, in a way, a lack of credibility, confidence, and professional capacity to deal with the new reality of communication.

It is not just the number of sources that are growing, but also the amount of information. Information overload remains a barrier to the effective use of social media during disasters (Hiltz & Plotnick, 2013). It often generates large volumes of content that are not entirely related to the specific situation, are not directed to emergency managers, or are simply out of date. Agencies and organizations looking to successfully use online disaster management strategies should, therefore, consider more effective methods of dealing with information overload. The same tool that transformed the communicational paradigm - from too little information to too much information - is the key to restoring the trust and credibility of the media through the promotion of users' technological education.

The table below shows the development of media and technologies between the 1980s and 2018 in Blumenau. In this way, it is possible to contextualize the transformations that communication technologies have undergone, and which coincide with the vehicles that Blumenau used to disseminate information on the preparation, response, and recovery from the disasters that affected the region.

Table 2 - Means of communication available in the 1980s to 2018

1980	2000	2018
Newspaper Radio Television	Newspaper Radio Television Internet	Newspaper Radio Television Internet Blog Social networks Applications

Source: Elaborated by the authors

This picture provides clues about the role that printed newspapers, radio and television stations, internet virtual social networks, and mobile applications played in building a public perception of the risks associated with disasters. Likewise, it raises an analysis of the implications of such frameworks for disaster management. Based on the case analyzed, it is suggested that this fog of ambiguity and overload generated by new media and social networks during disasters be resolved before it can be reasonably considered as a reliable communication tool for making operational decisions.

5 Final considerations

The focus of this work was to analyze the change in the use of communication technologies in Blumenau disasters since 2008. To achieve this goal, indications were initially provided on how these technologies developed in the last decades (1980-2018) in situations of emergency that hit the municipality, taking into account that the change in technical and political procedures for confronting

disasters coincides with the transformations that communication technologies have undergone. Subsequently, there was a reflection on the transformation identified in the communicative process in situations of vulnerability, resulting from the technological phenomenon and the effect of connectivity.

In general terms, it can be concluded that it is not only the number of sources that have grown but also the amount of information. If applications and digital platforms allowed, on the one hand, the public to feel close to facts, news, and alerts during the socio-environmental disasters that affected the region, on the other, this ease of access had a strong influence on the creation and distribution of news and information. The democratic nature of the technology caused a crisis of confidence in the interlocutors who habitually provided information in states of emergency. Social media has generated a fetish for amateurs, undermined confidence in experts, content creators, graduate professionals, and analysts once recognized by the audience. Thus, if information overload can be a barrier to the effective use of social media during disasters, the management of this reality becomes essential.

In this fast-moving scenario, a question remains unanswered: how can the effort of digital volunteers effectively ally with the initiative of emergency managers and traditional media during disaster situations? Such a situation requires a new look at how information is created, consumed, and distributed in response to emergencies. The continuous monitoring of the development of technologies and tools of communication will allow us to diagnose to what extent such changes affect the relationship between media and disasters.

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