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## DAMAGE TO LIFE IN NATURAL DISASTERS USING MITIGATORY ACTIONS: THE USE OF TECHNOLOGIES AND COMMUNICATIONS

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### ABSTRACT

Reflecting the greenhouse effect and the increasingly indiscriminate use of natural resources, the worsening of environmental conditions has led an increase in natural disasters around the world, the number of people affected and the costs related to damage caused; for that national and international organizations raise the tone in the measures for prevention and civil defense. Supporting greater performance from institutions and objectives for Disaster Risk Reduction. This study demonstrate the need to search efficient actions in the use of technologies and communications as determinant forms mitigating actions in the risks of damage to life in events of natural disasters. Information produced that has emerged as a primary object for speeding up the actions of agents and groups active in prevention, contingency and mitigation, determined by regional, local defense and protection plans. It is inexorable that the advancement and improvement of technologies and forms of communication in the last decades has made the world increasingly globalized and integrated in human relations, the speed of dissemination from large mass of data and information available today have brought countless opportunities and challenges, opportunities that enabled consolidate themselves in a single system, an agile and efficient way with various actions that act to face the risks of damage to life and property in the event of accidents and natural disasters.

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## INTRODUÇÃO

Increasingly severe intense climatic changes and damaging consequences all over the world, numerous cases of natural disasters are resulted in numerous damages to people's lives, especially those from metropolises and large cities. According to data presented by the United Nations Office for Disaster Risk Reduction - UNISDR between 2002 and 2011, 4130 disasters were resulting from natural hazards worldwide, where 1,117,527 people died and minimum loss of US \$ 1,195 billion was recorded. In the year 2011, 302 disasters killed 29,782 lives and affected 206 million people, causing a damage around US \$ 366 billion (UNISDR, 2012). The most frequent and serious natural disasters in the Brazilian territory, between 1991 and 2012, are those related to floods, landslides and droughts (CEPED /

UFSC, 2013). Brazil has been going through an intense process of urbanization since the 1960s, especially in the coastal zone, which presented the greatest changes in land use and occupation. Especially in the South and Southeast, because of the increase in the record of disasters, causing damage to life, material and economic cities with mountainous topography, they have received greater attention from governments (CEMADEN, 2008). Urbanization is spontaneous and urban planning is carried out for areas occupied by the middle and upper income population from the city. Without space planning, occupation occurs in risk areas, such as floods, landslides and frequent deaths during the rainy season (TUCCI, 2005). The growth population measure is proportional to the risks of damage linked to natural disasters, which directly affect life in society. Demanding common sense and governmental responsibility for new conducts of new paradigms generation, aligned with the prevention and protection

of people, in order to minimize and safeguard maximum damage to life and human dignity. With precautions and actions to prevention and protection from people are risk management and inclusion of technologies: to exemplify communications technologies that are increasingly daily in habitual life from population. The use of new technological information in communications, widely adopted in society, collaborate as a great ally in mitigating damage to life caused by natural accidents (LUDWIG & MATTEDI, 2018). Complexity and multifaceted recognition from risk nature and its perceptions, as well as the need to expectations of well-being and safety current societies promote confidence in risk management systems, resulting in a progressive valuation probability of communication (SOUSA, 2013).

The research theme was chosen by great losses and deaths in natural disasters in the city of Rio de Janeiro, despite the efforts of international and national institutes for Disaster Risk Reduction (DRR), exemplified by heavy rains happened in the beginning of March 2020, with great national repercussion, demonstrating needs and importances of efficient actions for Disaster Risk Management (DRM). This project was developed as a scientific article by methodological basis: bibliographic references, standards, scientific articles, magazines and specialized websites, showing the importance of communication technologies and link with society, its use as an extremely important apparatus associated elements on DRM system, its prevention and actions to damage caused by natural disasters in Rio de Janeiro city, to establish greater popular participation in the mitigation and disaster risk prevention, as accordance with the National Civil Defense and Protection Policy (NCDPP). This research demonstrate the importance and need in effective use of information technologies as an essential interface between information produced, agents directly involved and affected in actions to damage caused by natural disasters, contributing significantly to the victims and risks reduction in disasters, aligning the information by technologies present in the management system.

## REVIEW

**Legal and conceptual aspects:** In March 2014, in the Third DRR UN World Conference, in the city of Sendai in Japan, the Sendai Declaration was drafted, defining a new framework for DRR 2015-2030, with seven global goals for substantial reduction to be achieved for the period between 2015 and 2030 (UNISDR, 2014):

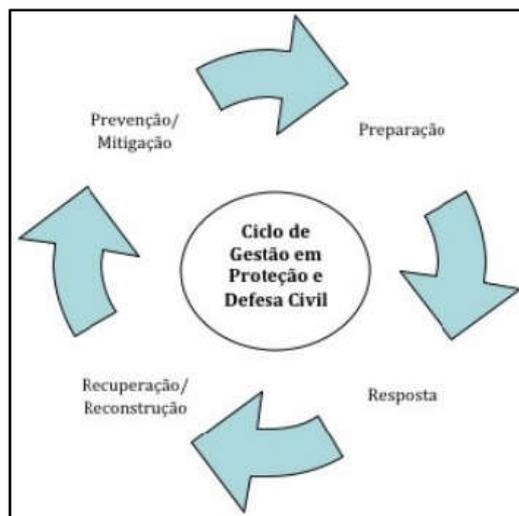
- World mortality caused by disasters;
- Number of people affected;
- Economic losses in relation to the national gross domestic product;
- Damage to fundamental infrastructure and disruption to basic services, including health and education services;
- Increase in the number of countries with national and local strategies for DRR;
- Included in these goals, greater international cooperation;
- Greater access on warning systems, in addition to more information and assessments on DRR (UNISDR, 2014).

In Brazil, for mitigating the serious problems caused by the disasters that plague our society, is directly linked through protection and civil defense, legally supported by law 12.608 of April 10th, 2012, instituted by National Policy for Civil Protection and Defense – NPCPD. National program which lists principles, objectives and instruments of how disaster and PRM will be implemented in the territory, on the purpose of ensuring adequate social, economic and environmental conditions to guarantee the population dignity and guarantee the sustainable development promoting in a shared and integral way with its entities (BRASIL, 2012, art. 3, sole paragraph). Protection and civil defense actions are regulated, by Decree No. 7.257, from August 4th, 2010, defining civil defense (CD) as being the set of preventive, distress, assistance and recovery actions aimed to avoid disasters and minimize their impacts on the population and restore social normality (BRASIL, 2010, art. 2, I). In this transcript,

observing actions for civil protection defense (CPD), as main objective cover actions to promote DRR, based on the NCPDP, covers five distinct and interrelated actions (BRASIL, 2012, art. 3):

- Prevention;
- Mitigation;
- Preparation;
- Answer;
- Recovery.

According to CEPED / UFSC (2014) these five actions are in accordance with the International Strategy for Disaster Reduction (UN / ISDR) are treated distinctively and interconnected, through a multisectoral model and in three levels of government (Federal, State and Municipal), requiring broad community participation (Figure 1)



Source: CEPED/UFSC (2014)

Figure 1. Civil Defense Management Cycle

The Prevention action is conceptualized by the ISDR (ISDR / UN, 2009):

Adverse impact of threats are avoided, employed to minimize environmental, and technological disasters. Depending on social, technical feasibility and cost-benefit considerations, preventive measures investment is justified in areas that are frequently affected by disasters. Public awareness and education related to disaster risk reduction, contribute to changing social attitudes and behaviors, as well as promoting a “prevention culture.

Regarding the Mitigation action the UN / ISDR conceptualizes as (ISDR / UN, 2009, Annex): "Structural and non-structural measures undertaken to limit adverse impact of natural and technological threats and environmental degradation". For the concept of preparatory action, the international place, through the Secretariat of International Strategy for DR (UN / ISDR), refers (ISDR / UN, 2009, Annex): “Activities and measures taken in advance to ensure a effective response to the impact of threats, including timely and effective issuance of early warning systems and temporary evacuation of population and properties from threatened area”.

The UN / ISDR defines response action as being (ISDR / UN, 2009, Annex):

... the provision of emergency services and public assistance during or immediately after occurrence of a disaster, with the saving lives purpose, reducing health impacts, ensuring public safety and meeting the basic subsistence needs of affected population. It covers an immediate, short or long term time scope.

The recovery action (RA) is related to (ISDR / UN, 2009, Annex):

Decisions and actions taken following a disaster with restoring the living conditions of the affected community, while promoting and facilitating, in turn, the necessary changes for DR. Recovery is an opportunity to develop and apply measures and reduce the risk of disasters.

In municipal level, Sub-Secretariat for Civil Defense of Rio de Janeiro City- SSCDRJC, a public agency of municipal direct administration, is an integral part of National System of Civil Protection and Defense - NSCPD, reorganized by federal Law 12,608 in compliance with National Protection Policy (NPP) and Civil Defense (CD) (SUBDEC, 2014).

Law accordings include other federal duties and responsibilities entities in RRD measures necessary. And considering the municipal hierarchy, as described (BRASIL, 2012):

Art. 8 The Municipalities responses:

- I - execute the PNPDEC at local level;
- II - coordinate SINPDEC's actions at local level, conjunction with the Union and the States;
- III - incorporate civil protection and defense actions in municipal planning;
- IV - identify and map DRA;
- V - promote the inspection of risks areas disasters and prohibit new occupations in these areas;
- VI - declare emergency situation and state of public calamity;
- VII - inspect buildings and risk areas and promote, preventive intervention and evacuation population from high-risk areas or vulnerable buildings;
- VIII - organize and manage temporary shelters to assist population in a disaster situation, adequate conditions of hygiene and safety;
- IX - keep population informed about risk areas and occurrence of extreme events, as well as prevention and alert protocols on emergency actions in disasters circumstances;
- X - mobilize and train radio amateurs to act in disaster events;
- XI - regularly perform simulated exercises, according to CPDCP;
- XII - promote the collection, distribution and control of supplies in disaster situations;
- XIII - proceed with the assessment of damages and losses in affected areas by disasters;
- XIV - keep the Union and the State informed about disasters occurrence and civil protection activities in the Municipality;
- XV - encourage the private entities participation, voluntary associations, service clubs, non-governmental organizations, class and community associations in SINPDEC actions and promote the training of voluntary associations to work together with the supported communities; and
- XVI - provide temporary housing solution to disasters affected families (BRASIL, 2012, art. 8).

These attributions and motivated by the unpreparedness lack of rains that occurred in April 2010, aligned with the needs to stimulate prevention actions, aiming at the operational preparations of great events that were approaching: 2014 World Cup and Olympic Games and Paralympic Games 2016, the Rio de Janeiro Operations Center - COR was created, an organization that coordinates and monitors the daily life of the city of Rio de Janeiro for operations, control and prevention in cases of: cultural events, traffic management, events rain, winds, catastrophes and pandemics. According to a document published by the City of Rio de Janeiro, Rio Resiliente - Diagnosis and Areas of Focus, COR has the coordination of more than thirty departments and concessionaires (RIO DE JANEIRO, 2014).

The resilience effort is ongoing. To be resilient is act preventively, anticipating acute shocks and chronic stresses that can take the city out of normality and cause damage and tragedy. To be resilient is prevent, monitor, mobilize, communicate and learn, so that the city and its residents are

increasingly able to face challenges (RIO DE JANEIRO, 2014, preface).

With the coordination of more than thirty departments, COR is the "brain" of the city and works 24 hours a day, seven days a week. We incorporate high technology and information processing capacity, mobilizing municipal resources from private partners, and we have population support (RIO DE JANEIRO, 2014, presentation).

### Technology, information and volunteer participation

According to Sendai report, media must achieve to a clear understanding of disaster risk, assuming an active and inclusive role at all levels of participations: global, national, regional and local. Contributing to people's awareness and understanding. Disclosing accurate and non-confidential information about disaster risk, danger and its course; including small-scale disasters, easy to understand and in a simple, transparent and accessible way. In close cooperation with the authorities (UNISDR, 2014).

Invest, develop, maintain and strengthen multisectoral and people-centered, early warning and forecasting systems, disaster risk and emergency communications mechanisms, social technologies and telecommunications systems for risk monitoring; develop such systems through a participatory process; adapt them to the needs of users, including social and cultural requirements, in particular gender; promote the application of simple and low-cost equipment and facilities for early warning; and expand launch channels for early warning information on natural disasters (UNISDR, 2014, p. 20).

According to Ludwig & Mattedi (2018), information is one of the most important resources in communication flows for disaster risk management, as it is found and produced by each person, place and organization. For this reason, risk communication flows can be considered decision making basis. Guiding how information is communicated between users: victims, volunteers, leaders, professionals, researchers, citizens and institutions, before, during and after a disaster can lead to new and good risk management practices. The use and operationalization of information and communication technologies in disaster risk management must be constantly developed.

The NPCDP, in its text deals with the competence of the municipality, records the function of:

Encourage private entities participation, voluntary associations, service clubs, non-governmental organizations, class and community associations in SINPDEC actions and promote the training of voluntary associations to work together with the supported communities (BRASIL, 2012, art. 8th, XV).

Involvement of the population during prevention, mitigation, preparation, response and recovery actions is essential for complete risk management. Through the CPCDN, community organizations that work in civil protection and defense, not nominally provided for in the current National Civil Protection and Defense Policy, the orientation for the formation of community structures should be encouraged remains and strengthened (SEDEC, 2017).

NUPEDECs are included in the voluntary community organizations provided for SINPDEC. These centers are organized into districts, towns, villages, neighborhoods, blocks, large buildings, schools, industrial districts, etc. They must function as links between the community and the municipal government, through the protection and defense agency and they aim to support local risk management, participating in prevention, mitigation, preparation, response and recovery actions. The installation of NUPDECs is more important in the areas of heightened risks, as they support the actions of information, organization and preparation of the local

community. Sometimes these groups are formed autonomously, but in most cases, external institutions encourage their formation (SEDEC, 2017).

Information being one of the most important resources in the communication flows for risk management system and is the multiplier object of these groups, counting on people from the community themselves, who know the area and who can act jointly with the agency defense and protection, guiding others on risks during the period of heavy rains. According to Freitas (2014) health professionals working in communities, are monitored by the system, exercise their functions and act as important interlocutors and multipliers of this information and practices voluntarily to the system, as well as the voluntary actions of residents exercise community leadership, as demonstrated by Pinheiro & Borges (2012).

Professionals who work directly with the population, such as Community Health Agents, Health Surveillance Agents, Endemic Agents and Civil Defense Agents. These professionals are interlocutors between the various sectors that make up the Unified Health System (UHS), NSCPD and the communities in which they work. In this way, we believe that this profile brings together conditions to articulate, mobilize educational practices, carry out preventive actions and early responses to natural disasters (FREITAS, 2014).

Pinheiro & Borges (2012) study that community leadership has a decisive role in the local development process. A community, coordinated and managed by a local leadership, is able to develop in a sustainable way, being aware of the interdependence of its members, knowing that the success of all depends on the success of each and that the success of each depends on the everyone's success, even with the awareness that their emergence does not happen spontaneously and that the emergence of a leadership will not solve all the community evils, but it is undeniable that the ability of people to be agents of their history, seeking the fulfillment of their needs and community cooperation, creating bonds of trust, organizing in networks and partnerships, around common values and objectives.

The community's contribution can occur through a participatory planning process, in which the actions are implemented within the sense of community vision will be discussed, taking into account their contribution and their potential (PINHEIRO & BORGES, 2012).

### **History on landslide disaster prevention**

The experience from Rio de Janeiro municipality in the prevention of disasters due to landslides and has been gaining national prominence and importance, including initiatives to reproduce this model by the state government with the implementation of the Alert and Alarm System (AAS) in mountainous cities region of the state of Rio de Janeiro (SUBDEC, 2012). Despite this technological political evolution, from January to March 2020, occurrences of heavy rains caused damage and displaced hundreds of people in Rio de Janeiro, exposing difficulties for civil and governmental prevention society, defense and mitigation of natural events. According to Amorim & Busch (2011) the unpreparedness to face natural tragedies had already been recognized by the Brazilian authorities in 2010, in a report sent by the NSCD of the United Nations, UN.

According to the document sent by the country to the UN, in 2009, only 77.36% of the municipalities had officially created to deal with disasters. The government admitted limitations on its capacity to monitor and disseminate data on the vulnerability of the territory and also recognized that lack of planning for occupation and the use of geographical space, disregarding areas of risk, in addition to local inspection absence, contributed to increasing the vulnerability of communities. (AMORIM & BUSCH, 2011).

In 2005, Brazil participated in the Second World Conference on Disaster Reduction, when the Hyogo Action Plan 2005-2015 was adopted: Building Resilience of Nations and Communities to Disasters was adopted. The countries participating in the event have committed themselves to drawing up a risk reduction plan to deal with disasters.

The Hyogo Framework defines five global priority actions and their respective key activities to be adopted by countries, organizations and other actors involved in the disaster risk management process according to the existing contexts, circumstances and capacities (ISDR / UN, 2009): 1 - Ensure that disaster risk reduction is a national and local priority with a strong institutional basis for its implementation; 2 - Identify, assess and monitor the risks of disasters, and increase the prior alerts; 3 - Use knowledge, innovation and education to build a culture of security and resilience; 4 - Reduce the fundamental risk factors; 5 - Strengthen disaster preparedness for an effective response at all levels of risk management (POZZER et al, 2014).

According to Pereira (2014), disasters risk is a matter of recent concern and has led to the construction of new principles and standards that seek to reduce the damage caused by environmental catastrophes. Prevention is best to be avoided. The relevant information allows better planning of the city, avoiding that was built in risk areas. The access to information produced by the various technologies, in the imminence of the disaster, makes it possible to make a decision on the evacuation of the places that will be affected, among other measures, in order to reduce the catastrophes risk. Ludwig & Mattedi (2018) clarifies another aspect that must be considered is the compatibility between different technologies and different actors in the system [...] the flow of risk communication varies according to type of actor and his relationship with disasters. Thus, cooperation to occur, is necessary involve, expand, encourage and increase the discussion on the role of different actors in the GRD production and dissemination of knowledge. Information and communication technologies are the necessary connection between the ones generated by an event, in all multidimensions, meanings and directions, and the understanding and communication of this to users and decision makers. Pereira (2014) declares that the international community aware of the climatic changes that occurs in the world, through climate conferences, develop documents that will contribute to reduction of risks. Efforts to policies, plans and programs for sustainable development, poverty reduction, good governance and disaster risk reduction promoted by International Agencies and several nations are evident. To deal with new challenges brought about climate change, States must redouble their efforts to provide communities with the necessary actions to control and reduce disaster risks, seeking a culture of security and resilience for communities.

In this link between the State and the community: local actors have been carrying out important actions ranging from prevention to responses to reduce their effects. That not only require the involvement of different sectors, such as Civil Defense and Health, but mainly the action of communities and local agents who live and know these realities. From this interface, the Oswaldo Cruz Foundation, through the Center for Studies and Research in Emergencies and Disasters in Health - CEPEDS, in partnership with the Federal Universities of Rio de Janeiro and also the Undersecretary of Civil Defense of the City of Rio de Janeiro - SUBDEC, developed Between 2012 and 2014, Local Agents in Natural Disasters pilot project: civil defense and health in risk reduction, targeting people from different sectors and working in risk areas and who can contribute to reducing risks of natural disasters at the local, challenging level of the task in creating a work methodology and didactic material elaborated from knowledge between researchers, teachers, managers and agents. The latter, countless times, were the voices of the communities most affected, as in addition to working directly with the vulnerable population, many are residents from risk areas (FREITAS, 2014). Local agents are multiplier that interconnect any challenging process of managing accident risks. Cooperation and collaboration are essential elements for disaster risk reduction. The

State, civil society, volunteers from grassroots organizations, the scientific community, technologies, the media and the private sector are essential actors in the system. Community participation should be encouraged in disaster risk reduction through the promotion of networking and strategic management of voluntary human resources, aligning information, technologies, means of communication and other entities according to a management vision approach to disaster risk management.

Disaster risk management is now understood by the Secretariat of the International Strategy for Disaster Reduction (ISDR / UN) as the systematic process of using administrative, organizational guidelines, operational skills and capacities to implement strategies, policies and improve the capacity to face the danger (threats), in order to reduce their adverse impacts and the possibility of disaster occurring. It is sense that disaster risk management aims to prevent, reduce or transfer the adverse effects of hazards (threats), through prevention, mitigation and preparation actions, activities and measures (POZZER et al, 2014).

## METHODOLOGY

The present work has an exploratory character regarding its nature, being carried out by a case study, with a qualitative and quantitative approach to the problem. Exploratory studies allow increased knowledge about a given phenomenon, enabling clarifications necessary for the development of further research, which require prior further study (TRIVIÑOS, 2009). In turn, the case study consists of an empirical approach in the investigation of a phenomenon in the face of a specific context, aiming to deepen knowledge about specific aspects (YIN, 2015). The qualitative approach presupposes the analysis, interpretation and understanding of facts, as opposed to the quantitative approach in which the measurement and use of statistical instruments predominates (BEAUD, 2014). In the data collection, the analysis of documents was used, using secondary sources. According to Minayo (2013), the secondary sources cover all the bibliography already made public in relation to the proposed theme: secondary source: Data were collected through analysis of documents, books, scientific papers, academic papers and research on the subject; analysis: the data were analyzed and interpreted in the light of the research objectives. This case study was carried out based on the following techniques (SEVERINO, 2017): bibliographic research, for the construction of a theoretical framework; documentary analysis of the applicable legislation, as well as technical reports and official records, as part of the exploratory phase for data collection, greater familiarization with the case and delimitation of the study.

## CONCLUSION

Scenario that has been presented to Brazil and the world in the last decades, reveals the relentless reflexes resulting from the severe climatic changes in the whole world, caused notably by deep interventions in the ecosystems and in its dynamics, by the demographic expansion, for the constant decrease in natural resources, for serious socioeconomic crises, for the vulnerability of occupations and among other social factors, which have been exposing the population of the planet to dramatically adverse events and their harmful consequences. Environmental disasters have increased in number and frequency in recent years, causing public health problems and losses for the population, and it is necessary to rethink risk reduction actions, mainly regarding the use of technologies and information produced for the communication process to affected agents and people. In this work we carry out the analysis of the legality and scope of the actions and rules in force, the alignment of the work of the state sectors with international organizations, the importance of the interfaces of the promulgated actions with the sectors involved, with civil society, with the community and local volunteers and finally the deficient aspects that hinder the efficiency of the use of technologies and communications

in the flow of actions to combat the risks of accidents, in situations of natural disasters in the city of Rio de Janeiro, in order to reduce the time of issuing alerts in situations where everything emerges at the same time, without violating the basic principles of institutional protocols. Among the difficulties related to the organizational and systemic structure, there are constant changes in administrative management of the state that interfere in the continuity of actions, the lack of applicability and inspection of urban norms, the continuity of educational works and multipliers of agents such as Freitas, 2014 and the elaboration of campaigns for the engagement of volunteers. In this sense, Rocha, 2009, says that organized citizen participation from the perspective of civil and defense protection as a right and not only as a volunteer could contribute so that programs and projects envisaged through public policies are effective in disaster situations. The completeness of a contingency plan with its professionals, institutions, agents and volunteers must be guided by technologies and communications. In which everyone involved must know the concepts of emergency, disaster, vulnerability, risk and threat according to the PNPDEC, and that everyone involved in disaster management must know theirs and the role of other actors in this plan, whether institutional or not.

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