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The Governance of Emergency Networks in Response to Grand Challenges in Brazil

A Governança das Redes Emergenciais em Resposta aos Grandes Desafios no Brasil

Otavio Rezende
Tecnológico de Monterrey, Campus Guadalajara[1]
otrezende@gmail.com

Rosileia Milagres
Fundação Dom Cabral

Jorge Verschoore
Universidade do Vale do Rio dos Sinos (UNISINOS)

Abstract: This paper explores the governance of emergency networks in Brazil, focusing on addressing grand challenges such as natural disasters. The study begins with a review of global humanitarian network governance, tracing the evolution of international disaster risk reduction policies up to the Sendai Framework, and examines their implementation and adaptation in the Brazilian context. Key elements such as the coordination of response systems, challenges these networks face, and their collaboration with international and regional partners are analyzed. The research employs an exploratory, qualitative approach, combining narrative literature reviews and document analysis. Findings reveal that a lack of centralized command and standardized terminology reduces efficiency, causing confusion and role overlap. It suggests that flexible governance could better manage emergencies, improve disaster preparedness, and enhance resilience in Brazil, highlighting the need for collaboration and integrated efforts.

Key-words: Grand Challenges; Networks Governance; Collaboration

Resumo: Este artigo explora a governança de redes de emergência no Brasil, com foco em abordar grandes desafios, como desastres naturais. O estudo começa com uma revisão da governança global de redes humanitárias, traçando a evolução das políticas internacionais de redução de risco de desastres até o Quadro de Sendai, e examina sua implementação e adaptação no contexto brasileiro. Elementos-chave como a coordenação de sistemas de resposta, desafios que essas redes enfrentam e sua colaboração com parceiros internacionais e regionais são analisados. A pesquisa emprega uma abordagem exploratória e qualitativa, combinando revisões narrativas de literatura e

[1] SKEMA Business School Brazil - Savassi, CEP 30110-036 Belo Horizonte (MG), Brasil

análise de documentos. Os achados revelam que a falta de comando centralizado e terminologia padronizada reduz a eficiência, causando confusão e sobreposição de papéis. Isso sugere que a governança flexível poderia gerenciar melhor as emergências, melhorar a preparação para desastres e aumentar a resiliência no Brasil, destacando a necessidade de colaboração e esforços integrados.

Palavras-chave: Grandes Desafios; Governança de Redes; Colaboração

Introduction

Grand challenges refer to complex global issues like climate change and poverty that impact large populations and defy simple solutions. These are dynamic, multidisciplinary, and deeply uncertain problems, with causes rooted in systems rather than individual actors. They require continuous reassessment and adaptation, as diverse stakeholders offer varying perspectives on solutions (Soriano & Hoffmann, 2015). They often manifest in disasters or extreme events, posing significant challenges to traditional management due to their complexity and urgency (Rittel & Webber, 1973). Extreme events, described as "discrete episodes that may result in extensive and intolerable consequences" (Hannah, Uhl-Bien, Avolio, & Cavaretta, 2009, p. 898), underscore the critical need for preparedness and resilience (Folke, Carpenter, Walker, Scheffer, Chapin, & Rockstrom, 2010).

Events like the dam failures in Mariana (2015) and Brumadinho (2019), and the floods in Rio Grande do Sul (2024), all of which ocurred in Brazil, demonstrate the severe impact on human life (Brinkmann, 2019) and the need for rapid, effective responses (Comfort, Boin, & Demchak, 2010). Despite its geographical location making it less susceptible to earthquakes, volcanic activity, and tropical cyclones, Brazil remains one of the most disaster-prone countries, particularly when it comes to geological and hydrological events. In 2008, the UN ranked Brazil as the 13th most disaster-affected country (Soriano & Hoffmann, 2015). Over the past two decades, emergencies due to droughts surged by 409%, and landslides increased nearly 22-fold. Between 2013 and 2020, there were 22,989 emergency incidents affecting 4,912 municipalities and 211.3 million people, with economic losses of approximately R$ 333.36 billion. Climate change is expected to worsen droughts, floods, and landslides, redefining vulnerable areas and disaster risk management needs (Marchezini, 2021, pp. 11-14).

Altogheter, these grand challenges pose a significant barrier to Brazil's development, which has seen a sharp increase in climate and human-induced disasters. Additionally, climate change

exacerbates social vulnerabilities, worsening issues such as income inequality and discrimination, while interconnected risk factors like poverty, inequality, unplanned urbanization, weak governance, and ecosystem decline are increasing vulnerabilities and causing compounded impacts (Fraga *et al*., 2024).

In this context, emergency management networks[1] play a crucial role in responding to major disasters. The first responses to a disaster typically come from those directly impacted, as they quickly mobilize to initiate the rebuilding of their damaged or destroyed communities (Fraga *et al*., 2024). Alongside local communities, organizations, and volunteers, they provide immediate assistance and support, often saving lives. This spontaneous and compassionate response complements the efforts of government and emergency agencies.

The collaboration between civil society and formal disaster management structures then accelerates support and strengthens community resilience in crisis situations. Humanitarian organizations that mobilize after a formal disaster notification are the ones prepared to monitor, understand, and manage the associated risks. They are equipped to provide structured humanitarian assistance. Therefore, promoting civic engagement and emergency preparedness is necessary for enhancing collective response capabilities. Humanitarian efforts rely on civil society[2], an independent space where citizens organize autonomously from the state (Fadel, 2008).

Globally, the Sendai Framework, established at the 3rd World Conference on Disaster Risk Reduction in 2015, outlines four key priorities for addressing major disasters: 1) understanding risks; 2) strengthening governance; 3) investing in disaster risk reduction for resilience; and 4) improving disaster preparedness and response (UNISDR, 2015). Priority 3 underscores the need for both public and private investment in disaster prevention and mitigation to strengthen resilience across economic, social, cultural, and environmental sectors (Costa, 2020, p. 19; UNISDR, 2015). The framework also emphasizes the value of international cooperation, including North-South, South-South, and triangular partnerships, to bolster national risk management capacities and promote social, economic, and health benefits. However, it notes that developing country cooperation should complement, not replace, the efforts of developed countries (UNISDR, 2015, p. 25).

[1] See Du, Feng, Tang, Kang, & Lu (2020) for detailed discussion on this theme.
[2] Avritzer (2012) notes that Brazil's current civil society model emerged from a response to technocratic urban development and authoritarian policies, fostering autonomous solidarity.

Despite the Sendai Framework's guidance, literature on emergency management networks often overlooks contextual factors such as institutional contexts and local conditions (Du, Feng, Tang, Kang, & Lu, 2020). These networks, involving governments, NGOs, and volunteers, face criticism for instability and opacity (Dentoni, Bitzer, & Schouten, 2018; Head & Alford, 2015; Sørensen & Torfing, 2009). Furthermore, addressing complex challenges requires innovative approaches and active stakeholder engagement to ensure shared understanding and effective solutions (Eisenhardt, Graebner, & Sonenshein, 2016).

For all these reasons and given the limited number of case studies on events ocurred in the Global South (Du *et al*., 2020, p. 10), this work highlights the emergency management network model adopted in Brazil, which integrates global guidelines with local regulations, seeking to answer the following question: *How is the governance of emergency networks organized to address major disaster-related grand challenges in Brazil?*

Our objective is to provide a detailed description of the network governance structure designed to address large-scale disasters. This narrative will encompass global frameworks, tailored strategies, and the specific methodologies implemented in Brazil. Through this exploration, we aim to highlight how these various approaches intersect and contribute to an effective disaster response system.

The article is organized into five sections. Following the introduction, we review the literature on global humanitarian network governance, tracing the evolution of international disaster risk reduction policies leading to the Sendai Framework. We examine how these models are implemented and adapted within the Brazilian context. The study method is then described, followed by our findings on the organization of emergency networks in Brazil, including their strategies, challenges, and solutions. We conclude by summarizing our contributions, proposing future research directions, and offering recommendations for practice and public policy.

Global Organizations' Impact on Humanitarian and Disaster Response

The international institutional cooperation scenario is shaped by key global organizations supporting the Sendai Framework (UNISDR, 2015, pp. 25-26): 1) the UN leads global disaster response strategy coordination; 2) the UN system allocates resources to help developing countries implement the Sendai Framework based on their specific needs; 3) the UN Office for Disaster Risk Reduction monitors and

updates the Sendai Framework, offering practical guidance and fostering country collaboration; 4) international financial institutions, such as the World Bank, provide financial support for risk reduction strategies; 5) other international organizations align their efforts with relevant frameworks, including the UN Global Compact, which underscores the importance of disaster risk reduction for sustainable development. In this setting, the UN Global Compact highlights disaster risk reduction as vital for sustainable development. At the end of the day, the UN ensures resources for vulnerable nations, while regional and local groups continue to advance disaster risk reduction efforts (UNISDR, 2015).

In international law, risk situations are addressed by International Humanitarian Law, which includes detailed rules to protect individuals during armed conflicts. The International Humanitarian Law is applied to conflict contexts. It has its own system of enforcement and universal jurisdiction, compelling Geneva Convention signatories to reprimand violations. Implementation may require additional domestic legislation and involves international and national mechanisms to ensure compliance (Swinarski, 2003). Modern humanitarianism extends beyond political crises, serving as a framework for peace and social development. It impacts three areas: normative principles adapted to local contexts, political choices and daily interactions, and broad social influence, shaping societal organization through continuous integration and transformation (Fadel, 2008).

However, International Humanitarian Law is somehow different from Human Rights when it comes to promotion and operationalization. Human Rights are globally institutionalized under UN guidelines and regionally through state adherence to norms (Buergenthal & Kiss, 1991, as cited in Cicco Filho, 2008, p. 106). In contrast, International Humanitarian Law is primarily represented by the International Committee of the Red Cross (Fadel, 2008). While International Humanitarian Law is relatively established, Human Rights regulations are more recent, traditionally considered domestic issues. International Humanitarian Law norms are contained in treaties that states join voluntarily (Canotilho, 1993, as cited in Cicco Filho, 2008, p. 107).

In summary, while Human Rights are promoted globally by the UN and regionally by states, International Humanitarian Law is mainly represented by the International Committee of the Red Cross, highlighting the varied institutionalization and distinct approaches in these fields. The core difference is that International Humanitarian Law applies to armed conflicts, whereas Human Rights are universal, safeguarding rights everywhere and always. So, in humanitarian crises and disasters, the Red Cross and Red Crescent Movement connect local actions with global initiatives, integrating international policies with local strategies through networks (Teixeira, 2001, as cited in Fadel, 2008).

Civil society organizations like the International Committee of the Red Cross strengthen their impact by forming networks around shared issues, fostering collaboration and the exchange of experiences. The Red Cross's horizontal structure supports globally coordinated efforts without the rigid hierarchy found in other organizations, enabling efficient collaboration. Addressing humanitarianism through these networks requires a blend of immediate relief, ongoing social challenge resolution, and long-term sustainable development. Organizations like the Red Cross and Green Cross[3] International play a crucial role in fostering effective collaboration between global and local actors, ensuring a comprehensive and sustainable approach to humanitarian challenges (Fadel, 2008).

Red Cross Impact on Humanitarian Law in Latin America and Brazil

The emergence of the International Red Cross and Red Crescent Movement marked a significant milestone in global humanitarian aid. The movement originated from Henry Durant's experiences during the Battle of Solferino, where he organized care for wounded soldiers regardless of nationality. Inspired by this experience, Durant founded the International Committee of the Red Cross in 1863 (CICV, 2024).

The organizational structure of the movement comprises three main components: the International Committee of the Red Cross, which aids conflict victims; the International Federation of Red Cross and Red Crescent Societies, which coordinates disaster response; and National Societies, which assist vulnerable populations within their territories (Arakaki, 2021). Hence, the movement operates as an interconnected network that functions locally through National Societies and globally through the International Committee and International Federation of the Red Cross, ensuring unity and broad reach. The movement now includes 191 National Societies worldwide, involves 80 million people, and serves over 230 million people annually (CICV, 2024). Today, the Red Cross also addresses humanitarian challenges in peacetime, such as epidemics and natural disasters, underscoring its continuous evolution and relevance (Fadel, 2012).

In Latin America, the International Committee of the Red Cross focuses on promoting and applying humanitarian law to alleviate suffering caused by armed conflicts and violence. The shared goal of the National Societies in Latin America is to strengthen the capacity of the International Red Cross Movement to address humanitarian consequences in sensitive contexts safely and sustainably.

[3] Green Cross International, founded by Mikhail Gorbachev in 1993, works in 30 countries to address security, poverty, and environmental degradation for a sustainable future (Green Cross, 2024).

The Red Cross reinforces its regional commitment by advocating for the ratification of international treaties and conventions. In South American countries without armed conflicts, the International Committee of the Red Cross emphasizes prevention through social awareness campaigns while assisting governments in ratifying and implementing humanitarian law, establishing relevant legislation, prosecuting war crimes, and addressing the issue of missing persons. The International Committee of the Red Cross operates nine offices in Latin America to coordinate its humanitarian efforts (Cicco-filho, 2008; CICV, 2024).

Nevertheless, Latin America faces significant challenges, such as social inequality and a lack of awareness, which create conditions conducive to the spread of armed conflicts. These challenges distinguish the region within the context of international humanitarian law. Persistent social inequality exacerbates conflicts, which, in turn, perpetuate this inequality, creating a vicious cycle. Overcoming these obstacles is crucial for regional development and the promotion of peace (Cicco-filho, 2008).

In Brazil, the International Committee of the Red Cross coordinates a network of military, academic, and civil society support using a network governance model. The dissemination of International Humanitarian Law is primarily targeted at the Armed Forces, integrated into military education, and adapted for specific missions. Police forces are also engaged through the Human Rights and Humanitarian Principles Diffusion Program, supported by the Ministry of Justice. Civil society, the media, and universities play crucial roles in spreading International Humanitarian Law, particularly focusing on youth participation and areas affected by urban violence. Even in non-conflict settings like Brazil, with political, socioeconomic, and cultural challenges, the International Committee of the Red Cross plays a key role in promoting International Humanitarian Law to maintain peace and prevent conflicts (Cicco-filho, 2008).

The Brazilian Red Cross, founded in 1908, operates in 21 states, aiming to prevent and alleviate human suffering while defending life, health, and dignity without discrimination. Independent of the government, it adheres to principles such as humanity, impartiality, neutrality, independence, voluntary service, unity, and universality. The Brazilian Red Cross assists vulnerable individuals facing threats to their survival, socioeconomic security, and human dignity (Arakaki, 2021). In turn, the Brazilian government recognizes the Red Cross as a voluntary, independent aid society, including support for military health services, and it is the only authorized national Red Cross organization in Brazil (CVB, 2024).

International organizations have a significant impact on Brazilian legislation (Marchezini, 2021). Key actors contribute to risk and disaster management in Brazil, with the Sendai Framework for Disaster Risk Reduction guiding national guidelines and standards. These entities collectively offer oversight, recommendations, and support in dispute resolution, improving governance by aligning Brazil with global civil protection standards.

International Disaster Risk Reduction Policies

International disaster risk reduction policy is crucial for developing collaborative models adopted by signatory countries. These treaties provide common guidelines that shape national civil defense structures, directing countries to increase their prevention, response, and recovery capacities in alignment with international standards (see Chart 1).

Chart 1

Evolution of International Disaster Risk Reduction Policies

1960-1969	**High-Impact Disasters**
Devastating natural disasters occurred, including the 1962 Buyin-Zara earthquake in Iran (12,000 deaths), the 1963 Skoplje earthquake in Yugoslavia (1,200 deaths), Hurricane Flora in the Caribbean (8,000 deaths), and the 1968 Dasht-e Bayaz earthquake in Iran (10,000 deaths). In response, the UN General Assembly adopted Resolution 2034 (1965), urging member states to report and use appropriate disaster assistance tools, reflecting a predominantly technical approach to large-scale disasters.	
1970-1979	**Planning and Coordination**
Emphasis shifted to improving disaster planning and coordination. Resolution 2717 (1971) promoted pre-disaster planning, scientific research, and international cooperation. This led to the creation of the UN Disaster Relief Office (UNDRO) through Resolution 2816 (1971), which appointed a Disaster Assistance Coordinator.	
1980-1989	**Increased Impact of Disasters**
Disasters such as floods in Sudan and Bangladesh, typhoons in the Philippines, hurricanes in Latin America and the Caribbean, and droughts in Africa heightened awareness of the need to mitigate natural disaster impacts. In 1989, the UN General Assembly established the International Day for Disaster Reduction and launched the International Decade for Natural Disaster Reduction (IDNDR) through Resolution 44/236 (1989) to reduce loss of life, property damage, and social and economic disruptions.	
1990-1999	**International Decade for Natural Disaster Reduction (IDNDR)**
A dedicated secretariat was established to implement the Yokohama Strategy and Plan of Action, which emphasized socio-economic factors and prevention (1994). The 1999 ECOSOC Resolution 1999/63 called for successors to the IDNDR, focusing on disaster prevention and sustainable economic growth, and proposed forming a task force and inter-agency secretariat.	
2000-2009	**Continuity and Strengthening of Actions**
The UN General Assembly Resolution 54/219 (2000) established the inter-agency secretariat for the International Strategy for Disaster Reduction (ISDR) to focus on minimizing disaster impacts. The 2005 World Conference on Disaster Reduction in Kobe led to the Hyogo Framework for Action 2005-2015 (HFA), aimed at enhancing response capacities and significantly reducing disaster impacts.	
2010-present	**Resilience and Sustainability**
Global efforts to address natural disasters have focused on enhancing resilience and promoting sustainability. Key events include the 2005 implementation of the Kyoto Protocol, which indirectly highlighted the link between sustainability and	

risk prevention, and the 2015 World Conference on Disaster Risk Reduction, where the Sendai Framework (2015-2030) was introduced, emphasizing strategies for risk anticipation, planning, and reducing underlying vulnerabilities.

Source: Adapted from MDR (2022, p. 14-18).

These decisions reflect the ongoing evolution in global disaster impact mitigation, aiming for a more resilient and sustainable future. While the Hyogo Framework outlined "what to do" for risk reduction, the Sendai Framework focuses on "how to do it." It sets goals and priorities for disaster risk governance, social participation, and sustainable development. The Sendai Framework emphasizes a collaborative approach across four key areas (UNISDR, 2015): 1) Understanding disaster risks and using this information to develop risk reduction policies; 2) Strengthening disaster risk governance by integrating risk reduction across sectors and ensuring legal and policy coherence; 3) Investing in disaster risk reduction for resilience, incorporating risk assessments into land use and urban planning; 4) Enhancing disaster preparedness and response, focusing on "Building Back Better" by updating prevention and contingency policies with stakeholder involvement and considering climate change impacts.

Over 30 years, the focus on disasters shifted from technical and scientific approaches to understanding them as socio-environmental processes linked to vulnerability and development challenges. This change has driven efforts towards a culture of prevention and resilience, emphasizing increased social participation and multi-institutional governance (MDR, 2021).

Integrating Risk Management and Civil Protection in Brazil

Disaster risk management is complex and multifaceted. Risks and disasters are not natural but arise from how society alters the environment, uses resources, and organizes activities. While threats may be natural, socio-environmental, or technological, risk stems from the interaction between socio-political, cultural, and economic development in vulnerable areas (MDR, 2021). Increasing inequalities and unplanned urban growth further expose vulnerable populations and underdeveloped regions to disaster impacts. Efforts to prevent, mitigate, prepare for, respond to, and recover from disasters can divert crucial resources from sustainable community development (Brasil, 2007).

In Brazil, the National Policy on Protection and Civil Defense defines a disaster as a devastating outcome of adverse events - whether natural or man-made - in a vulnerable ecosystem, causing significant human, material, environmental, and economic damage (Brasil, 2007, Brasil, 2012). The severity of a disaster depends on the event's magnitude and the affected system's

vulnerability, which guides the need for risk assessment. Effective disaster management integrates risk and disaster concepts to implement mitigation strategies and prepare responses (MDR, 2021).

The Sendai Framework encourages states to commit to Disaster Risk Reduction and strengthen resilience within the context of sustainability and poverty eradication. It integrates Disaster Risk Reduction into global, national, and local policies, emphasizing the need for preventive investment. States and organizations should tailor the four priority areas - understanding risks, strengthening governance, investing in risk reduction, and improving preparedness for response and recovery - to their capacities and laws, while seeking international cooperation to increase knowledge and capabilities, especially in developing countries. This framework forms the basis of Brazil's Civil Defense structure (UNISDR, 2015).

Civil protection and defense organizations in Brazil focus on prevention, relief, assistance, and recovery to minimize disasters and maintain public morale (Soriano & Hoffmann, 2015). The Federal Law No. 12,608/12, enacted in 2012, established the Policy on Protection and Civil Defense, which includes the National System of Protection and Civil Defense and the National Civil Protection and Defense Council. This law also authorized the creation of a disaster information and monitoring system, among other measures (Brazil, 2012). It mandates preventive and responsive actions, holding the Union, States, Federal District, and Municipalities responsible for Disaster Risk Reduction and emergency coordination (Fraga *et al*., 2024; Soriano & Hoffmann, 2015). The Policy on Protection and Civil Defense innovatively integrated "protection" into civil defense, aligning Brazil with international standards and emphasizing prevention and policy integration (MDR, 2022). The National System of Protection and Civil Defense implements the Policy on Protection and Civil Defense and can mobilize civil society for disaster response, coordinating logistical support. Municipal bodies are crucial as most disasters occur at the municipal level (Damacena, Pereira, Costa, & Marchezini, 2022). Thus, the Policy on Protection and Civil Defense sets guidelines to enhance disaster management in Brazil, the National System of Protection and Civil Defense oversees federal planning and coordination, while Municipal Civil Defense Coordinators (COMDEC) handle local disaster response, emphasizing quick and coordinated action.

The guidelines also focus on urban planning to prevent risky occupations and prioritize prevention through risk studies and assessments. Integrated interaction between government and communities is encouraged, supported by volunteer training programs and alignment with national social and environmental policies. Financial and technological support is sought to strengthen the civil

defense system, including educational initiatives that incorporate disaster risk reduction into school curricula and promote international cooperation for sustainable disaster management (Brasil, 2007). The primary goal of civil defense is to reduce disaster frequency and severity, protect against natural and man-made disasters, minimize damage, provide relief, rehabilitate affected areas, and coordinate the National System of Protection and Civil Defense (Brasil, 2007).

Over the past 30 years, civil protection and defense in Brazil have undergone significant, though gradual, changes. The adoption of new paradigms has been slow, but there are positive expectations for integrating technical discussions into daily practices in line with international agreements. Incorporating climate issues into risk management and viewing risk as a social construct could strengthen civil protection. This requires aligning practices with international agreements, enhancing understanding of climate and social risks, and reinforcing participatory approaches in risk communication (MDR, 2022).

Methodology

This study explores essential perspectives on the coordination and structure of emergency response systems within various government levels and organizations in Brazil. After outlining the structure of such emergency networks, we discuss the main challenges they face in effectively managing disaster-related crises. A key aim is to understand how these networks integrate and collaborate with international and regional partners to enhance their preparedness and response capabilities. Additionally, we consider the role of local communities and non-governmental organizations in the governance and operational dynamics of these emergency networks. This exploratory and descriptive research employs qualitative methods to investigate constructed realities (Flick, 2004). The study integrates a narrative literature review (Rother, 2007) with qualitative data collection to capture how emergency networks address Grand Challenges in the Global South, with a specific focus on Brazil.

Data Collection

Narrative literature reviews explore and discuss the current state of a topic, offering a critical analysis of existing research to keep readers informed and up-to-date (Rother, 2007). In addition to this, we employed a documental research (Junior, de Oliveira, dos Santos, & Schnekenberg, 2021). Various documents were collected. Several sources available, primarily online, allowed us to have a general description of emergency networks in detail. we also accessed books,

journals, websites, government records, research reports, manuals, statistical data on extreme event, laws, documents published by international humanitarian institutes, among others.

Chart 2

List of documents accessed

Type of doc	Author
P&DC and 30 years of disasters in Brazil (report)	MDR (2022)
International Committee of the Red Cross (website)	CICV (2024)
Brazilian Air Force (website)	FAB (2024)
Brazilian Red Cross (website)	CVB (2024)
Diagnosis of municipal capacities and needs in civil protection and defense (report)	Marchezini (2021)
Doctoral dissertation	Arakaki, D. H. (2021)
GIRD+10 - Technical notebook on risk and disaster management	MDR (2021)
Green Cross (website)	Green Cross (2024)
Operational Thematic Group (website)	GTO (2024)
National Civil Defense Policy (manual)	Brasil (2007)
National Civil Defense and Protection Policy (Law nº 12.608)	Brasil (2012)
SCO (Field Guide)	SCO (2024)
Operations Command System (Field Guide)	Oliveira (2010)
Sendai framework for disaster risk reduction 2015-2030 (Report)	UNISDR (2015)
UN Office for Disaster Risk Reduction. *Terminology* (website)	UNDRR (2024)

Source: Author's elaboration

These resources provided up-to-date information, allowing us to align insights with civil defense planning manuals, military guidelines, volunteer training models, concepts of Grand Challenges, humanitarian network governance, international models adopted in Brazil, and the institutions involved. This material was instrumental in accurately determining the roles, rules, practices, challenges, and benefits of building emergency networks. The document analysis allowed us to describe the current state of these networks in the country, tracing their historical development and the strategies adopted to establish them.

Data Analysis

The document analysis, notes, and observations made during the review of these documents helped construct a narrative and provide a detailed description of the phenomenon. We examined the

coordination and integration of emergency response systems, the roles played by local communities and non-governmental organizations, the challenges these networks face, and their collaboration with international and regional partners. We used Atlas.ti software, applying thematic content analysis techniques (Krippendorff, 2004). At this stage, the researchers collaboratively analyzed the material, integrating content analysis methods (Bardin, 2009; Krippendorff, 2004) with theoretical frameworks, which deepened our understanding of the observed phenomenon (Langley, 1999). This analysis identified specific features of emergency networks, including key constructs, their relationships, and their influence on governance models (Strauss & Corbin, 1990). This comprehensive approach allowed us to contribute to the understanding of emergency networks and to produce a descriptive paper that helps academics, researchers, and practitioners grasp how these networks are formed. All these insights are supported by the consulted literature.

Civil Defense Governance and Collaborative Disaster Risk Management

The challenge of Civil Defense in addressing disasters, threats, and risks is significant. Effective structuring of Civil Defense is crucial for Disaster Risk Management, encompassing material, organizational, financial, technological, and governance resources, as well as coordination mechanisms between state and non-state actors (Marchezini, 2021). Governance involves institutions, policies, and laws that oversee and coordinate risk reduction efforts to protect society during catastrophic events (UNDRR, 2024).

Civil Defense governance requires collaborative efforts to coordinate between state and non-state actors, establishing clear norms and responsibilities to ensure transparency and accountability. The governance structure is built on several key components essential for effective risk and disaster management: 1) legislation plays a crucial role, guided by international frameworks like the Sendai Framework, to ensure a robust legal model; 2) communication, as it facilitates interactions across different government levels and with the population, ensuring that information is disseminated efficiently; 3) education, promoting knowledge and awareness of civil defense among citizens; 4) coordination and support involve collaboration among entities within the national civil defense system, extending to local governments to guarantee mutual support during emergencies; and 5) community engagement, highlighting the importance of involving the community in risk and disaster management to foster a collaborative and inclusive approach (Figure 1):

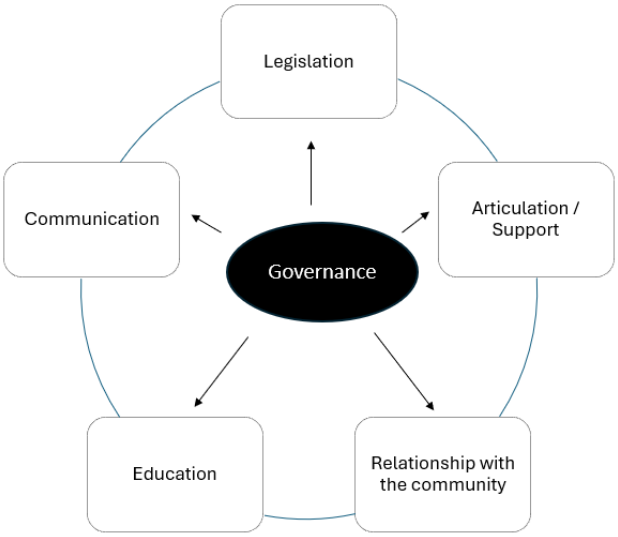

Figure 1

Key Components of the Governance of Civil Defense

Source: Adapted from Marchezini (2021, p. 39)

That being so, disaster risk management should be viewed as an ongoing social process, combining institutional efforts with community involvement (Fraga *et al*., 2024). This collaborative approach is crucial for addressing the unique vulnerabilities and threats of each region. Effective disaster risk management relies on the interaction between institutions and active community participation, ensuring a more integrated and efficient response to local needs.

The National Civil Defense adopts an "Incident Command System" (SCO) as the standard for emergency response and disaster management. The SCO is based on a blend of theory and practical experience developed over the years in various countries, ensuring safety for both response teams and others involved. It enables efficient and effective use of available resources to meet objectives and priorities (Oliveira, 2010).

The SCO coordinates the integrated actions of multiple agencies during critical situations (SCO, 2024). It has three fundamental characteristics: 1) systemic design, which uses a systematic approach to handle the complexity of disaster response through successive actions; 2) contingency-based structure, which adapts to each situation with modular and flexible command and communication structures; and 3) total adaptability, which allows for planning, organizing, directing, and controlling critical situations of any nature, regardless of size or complexity.

The SCO recommends assessing the scenario to understand the situation and predict its evolution, setting strategic objectives to save lives and stabilize the event, and defining clear tactical goals. It then involves choosing the best course of action, defining specific tasks, and implementing the action plan. During execution, progress is monitored, and actions are adjusted based on daily evaluations, correcting errors and adapting the plan as necessary.

In critical situations, the SCO provides a structured approach with three main components (SCO, 2024, p. 16-18): 1) the Command oversees the entire operation, including setting objectives, organizing resources, and ensuring safety and communication with external agencies and the media; 2) the Command Staff, under the Command's direction, handles specific roles; and 3) another group compounded by the Safety Advisors, who monitors and addresses safety risks, the Public Information Officer, who manages communication with the media and affected communities; and the Liaison Officer, who coordinates with external organizations and authorities (Figure 2).

The core SCO team includes the Command Staff, who leads tactical activities; the Operations Coordinator, who prepares resources; the Planning Coordinator, who documents and adjusts the plan; the Logistics Coordinator, who ensures essential support; and the Administration Coordinator, who manages financial aspects. Together, they ensure the effective execution of the action plan and address challenges as they arise (SCO, 2024).

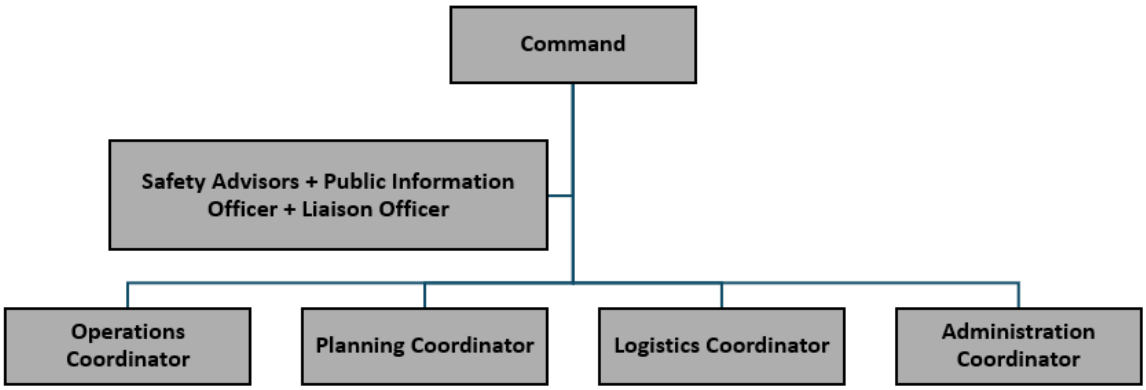

Figure 2

Organizational Chart of a SCO

Source: Adapted from SCO (2024, p. 21)

The SCO features a flexible structure that adapts to each situation's needs, expanding or contracting based on complexity and resources. This adaptability allows it to activate only necessary

components, with roles clearly defined to manage resources and achieve goals. The SCO adjusts its size following a precise logic to ensure effective and coordinated responses to crises of any scale, adapting as the situation evolves (SCO, 2024).

Collaborative Governance and Emergency Management Network in Brazil

Emergency management networks are crucial for effective disaster and crisis operations, referred to here as Grand Challenges. These networks involve a range of institutions with shared immediate objectives. Below, we describe their roles at the national level across strategic, tactical, and operational tiers. Each level comprises various actors with specific roles, contributing essential resources to achieve their goals.

But, first, it is important to recognize that emergency networks have two critical phases for coordinated and efficient responses: promptness and action. During the promptness phase, actors are trained and briefed on their roles when networks are activated. This phase involves both state institutions and civil society volunteers, often former military personnel who continue to dedicate their time and expertise to addressing significant social, environmental, economic, or climatic challenges.

To understand how emergency operations are triggered, it is essential to highlight the role of the Brazilian Air Force (FAB) in leading and managing disaster operations. The FAB is responsible for managing the COSPAS-SARSAT[4] system in Brazil, an international search and rescue system for aviation and maritime accidents.

This system covers incidents within national territory and maritime zones, including up to 200 nautical miles, with Brazil as a signatory. Consequently, the FAB oversees rescue operations involving vessels from sailboats to commercial and private ships within these areas. Additionally, the Navy and Army have their own smaller, specialized rescue teams that serve as auxiliary forces within the COSPAS-SARSAT system, under the coordination of the Air Force. In this way, whenever an emergency is reported to the authorities, the first step is to activate the COSPAS-SARSAT system, which will notify the Air Force about the incident. As a result, FAB is always the first institution to respond to the situation. They are also responsible for coordinating the involvement of other armed forces, government institutions, and civilian volunteers.

[4] This international program combines Russia's COMISCHESKAYA SISTYEMA POISKA AVARIVNICH SUDOV ("Space System for Emergency Vessel Search") with the American SARSAT ("Search and Rescue Satellite-Aided Tracking"), enhancing global search and rescue operations through advanced satellite technology (FAB, 2024).

Given Brazil's vast continental dimensions, risk management for rescue, search, and disaster response is organized into four main regions. The country has only eight rescue teams covering the entire federation, including the territorial sea areas. Each region has a designated military coordinator for operations. For example, the Legal Amazon (Group 4) covers nine states west of the 44th meridian and is known as Amazon Control. The other regions, including Southeast-South (Group 2), Midwest (Group 1), Northeast (Group 3), and the Legal Amazon, have a similar structure with specific coordination for each area.

We must remember that emergency operations are state functions carried out at three levels: federal, state, and municipal. Emergencies typically occur at the municipal level, where the emergency management networks are established. At the state level, operations are coordinated by Fire Departments, which operate independently under the command of their local governors. At the federal level, the three armed forces—the Army, Navy, and Air Force—manage and respond to major national events and crises.

The group of institutions involved at all these levels can be categorized into three administrative tiers: strategic, tactical, and operational. At the strategic level, the coordination of national and international policies is crucial for managing organizational interactions and conflicts. The National Civil Defense System is responsible for coordinating and promoting civil defense efforts across the country (Brasil, 2007). Key institutions at this level include the Brazilian Red Cross, the Joint Center for Peace Operations (CCOPAB), and the National Civil Intervention Corps (CINIC). The Brazilian Red Cross leads humanitarian actions, upholding International Humanitarian Law and coordinating efforts during conflicts. The CCOPAB focuses on peacekeeping operations preparation, while the CINIC manages national crisis responses. These organizations ensure that policies and practices align with humanitarian principles and are effectively implemented nationwide. At the tactical level, the Fire Department plays a crucial role in immediate disaster and emergency response. They handle rescues, prevention, and recovery within their jurisdiction and lead command posts for operations not related to aerial or maritime incidents. Using the SCO, they ensure a safer and more effective response, achieving the objectives and priorities set for emergency operations (GTO, 2024). At the operational level, direct engagement with crises is carried out by civilian volunteers, the Air Operations Battalion (BOA), and the Armed Forces, including the Air Force, Army, and Navy rescue teams. These entities are prepared for immediate action in emergencies. Thus, when an emergency beacon is activated, the COSPAS-SARSAT system receives the signal via satellites, which then relay

it to ground stations (named LUTs). These stations automatically process the signal and send the beacon's location to the Mission Control Centers (MCC) in the country responsible for the search and rescue region where the beacon was activated (FAB, 2024). Civilian volunteers play a crucial role, actively participating in crisis responses and receiving training to expand their skills and effectiveness.

In Brazil, military personnel involved in rescue operations are considered volunteers as they do not receive extra payment for these activities. Their motivation stems from a desire to serve and a sense of duty, shaped by their training and behavioral changes. In addition to military volunteers, civilian volunteers also step forward during emergencies. Rescue teams, comprising members from the Army, Navy, and Air Force, remain on standby, ready to act.

Besides, this tripartite structure - armed forces, trained civilian volunteers, and civil society - ensures a coordinated and effective response to disasters and emergencies, optimizing resource use and protecting affected lives. Each level and actor within this emergency network has complementary roles that, when properly executed, create a robust and resilient crisis response. In this context, collaborative governance poses a significant cultural challenge, especially when individual actions diverge from established protocols.

Challenges and Gaps in Brazil's Disaster Management and Governance

The intersection of Grand Challenges, risk and disaster management, network collaboration, and governance presents distinct features within the Brazilian context. To strengthen networked governance and stimulate discussion, we highlight three key areas: 1) Challenges in structuring, resources, training, capacity-building, and coordination; 2) Gaps in communication, information, resource limitations, funding, and inadequate training; 3) Issues concerning vulnerability identification, mapping, militarized, top-down approaches, and institutional continuity. Each area is further elaborated below

Challenges

In Brazil, rescue operations, coordinated by the State and Armed Forces across federal, state, and municipal levels, face challenges due to the country's vast size and resource decentralization. Unlike developed nations with advanced crisis coordination, Brazil's focus on rapid response often results in operational conflicts and limited planning (Fraga *et al*., 2024). The dominance of the Armed Forces, with their unique command and discipline structures, can influence individual behavior, potentially leading to conflicts between personal ambitions and institutional norms. This, in turn,

complicates coordination among organizations with differing priorities, making it difficult to establish shared goals. Additionally, the lack of common terminology and a well-defined command structure can result in confusion and overlapping roles, diminishing response efficiency (SCO, 2024).

The assessment of municipal civil defense identified key challenges: the need for more resources, clear job role definitions, region-specific training, and better internal and external communication. The primary obstacle is the lack of financial resources (Brasil, 2007, Damacena *et al*., 2022), which affects infrastructure and essential equipment acquisition. There is also a need to establish municipal funds for resource mobilization and legal support for relocating residents from irregularly occupied areas (Marchezini, 2021).

Although limited, municipal civil defenses can declare emergencies, interact with other departments, and assess material damage, they need more training in risk monitoring and alert systems. The lack of prior planning often results in rushed creation of legal and financial tools post-disaster, which undermines the effectiveness of emergency and preventive actions (Damacena, 2019, as cited in Damacena *et al*., 2022).

At the municipal level, where disaster response is critical, nearly half of the civil defenses are linked to the mayor's office, and 56% use social media for communication. Even so, only 9% offer training for Community Protection and Civil Defense Centers or have formal partnerships with other municipalities. Despite 69% having municipal legislation, governance challenges are primarily in enforcing and preventing construction in risk areas (Marchezini, 2021).

The main governance challenge faced by the 1,993 municipal civil defenses in Brazil (amongst 5,570 existing municipalities) is the lack of support for monitoring and controlling construction in risk areas. Other issues include preventive work with the population and recognition of the civil defense role by municipal administrations. Recognition issues are more prevalent in the Central-West region, while risk area monitoring is a major challenge in other regions, except for the South, where preventive work also stands out. Additionally, there are shortages of equipment, human, and financial resources (Marchezini, 2021).

Gaps

Communication and information dissemination on risks and prevention are still inadequate. Despite improvements in institutions and legislation, civil defense training remains rare, and communication

between the public and officials is ineffective. Risk information does not reach the population broadly, hindering disaster preparation and response (Soriano & Hoffmann, 2015).

With the rise in natural disasters, it is crucial to partner with municipal governments to train the public in risk prevention, disaster recognition, and emergency protocols through accessible courses and training (Fraga *et al*., 2024). Civil defenses need better training in monitoring and risk alerts, but high training costs are a barrier. The rushed creation of legal and financial measures post-disaster also affects the effectiveness and fairness of responses (Damacena, 2019, cited in Damacena *et al*., 2022).

Another critical issue for municipal civil defenses is the lack of financial resources and essential equipment, such as phones and vehicles, which hampers their proper organization (Marchezini, 2021). There is an urgent need to implement the Policy on Protection and Civil Defense and to explore federal funds, like the Climate Fund and the National Fund for Public Calamities (FUNCAP), to optimize resources and expand disaster response (Damacena *et al*., 2022). States and municipalities should consider creating funds similar to FUNCAP to improve emergency resource acquisition and supplement often inadequate emergency budgets (Damacena *et al*., 2022; Brasil, 2007). Damacena *et al*. (2022) recommend a decision matrix to identify the best funding alternatives, evaluating financial instruments, their uses, advantages, disadvantages, areas of focus, implementation timelines, and risks.

Discussion Points

Identifying and mapping vulnerabilities in Brazilian municipalities is crucial for developing effective monitoring infrastructures and databases. This approach supports disaster prevention and mitigation by emphasizing proactive measures rather than merely reactive responses (Pascoalino & Almeida, 2014).

Management challenges also arise from frequent political changes, staff turnover, and a lack of institutional memory, which undermine continuity and community relations. Additionally, the militarized and top-down approach, inherited from the Cold War era, treats disasters as external threats and often prioritizes inadequate technological solutions (Fraga *et al*., 2024).

In summary, Brazil's risk and disaster management faces several challenges, including structuring, vulnerability identification and mapping, risk mitigation, militarized approaches, resource and funding limitations, training, governance, institutional management, coordination, continuity of actions, and effective communication between the public and authorities. Addressing these issues in

an integrated and strategic manner is essential to enhancing community resilience and response capabilities.

Concluding remarks

Addressing disaster-related grand challenges in Brazil is an intricate and multifaceted endeavor that involves numerous dimensions of governance and response strategies. Our goal is to shed light on how emergency networks are governed in the Global South, with a particular focus on Brazil, by addressing the following key research question: *How is the governance of emergency networks organized to address major disaster-related grand challenges in Brazil?*

To achieve a detailed analysis of the phenomenon, we have examined the coordination and integration of emergency response systems, the challenges faced by these networks, and their collaboration with international and regional partners. Additionally, we have considered the roles played by local communities and non-governmental organizations.

The findings highlight several key aspects. First, it integrates knowledge and collaboration, since effective disaster risk management relies on the interaction between institutions and active community participation. This collaborative approach is essential for addressing the unique vulnerabilities and threats faced by different regions, ensuring a more integrated and efficient response to local needs. On this perspective, the study emphasizes the significant roles played by local communities and NGOs in emergency management, viewing their involvement as crucial for identifying best practices and lessons learned from Brazil's experiences, which can inform future strategies. Additionally, the paper identifies critical challenges faced by emergency networks, including the need for better coordination and integration of response systems. In this perspective, special attention should be given to the militarized and top-down approaches, which often treat disasters as external threats and prioritize inadequate technological solutions. This is a remarkable feature in terms of disaster risk management.

Recommendations for practice and policymakers include enhancing coordination among agencies by establishing a centralized command structure to improve communication and reduce confusion and overlapping roles during crises, leading to a more efficient response. Developing standardized protocols and terminologies for emergency management is crucial for facilitating better understanding and collaboration among stakeholders involved in disaster response. Additionally,

investing in training and resources is essential, with funds allocated for training programs to enhance the skills of civil defense personnel and community members in risk prevention, disaster recognition, and emergency protocols, thereby building local capacity and resilience.

Strengthening community involvement is also important, encouraging active participation of local communities and non-governmental organizations in emergency management processes to provide valuable insights and foster a sense of ownership in disaster preparedness efforts. Creating financial mechanisms, such as developing instruments and funds similar to FUNCAP, will support emergency resource acquisition and address the often-inadequate budgets faced by municipalities, improving their preparedness for emergencies. Promoting integrated disaster risk management through an approach that combines institutional efforts with community involvement will ensure responses are tailored to the unique vulnerabilities and needs of each region.

A focus on continuous improvement is recommended, encouraging ongoing assessment and adaptation of emergency management strategies based on lessons learned from past experiences to refine practices and enlarge resilience against future challenges. Finally, collaborating with international frameworks by aligning local policies with frameworks such as the Sendai Framework will ensure a comprehensive approach to disaster risk governance and resilience building. These recommendations aim to enhance the effectiveness of emergency networks in Brazil and can serve as a model for other regions facing similar grand challenges.

Addressing grand challenges requires continuous reassessment and adaptation of strategies, as these problems are dynamic and multidisciplinary. The integration of diverse knowledge and coordinated efforts is vital for improving crisis management and understanding the interconnected issues of disasters and extreme events. We recommend that future researches could amplify the understanding of practices in emergency governance, analysing this based on a perspective of strategy as practice. Overall, the paper contributes valuable insights into the governance of emergency networks, emphasizing the need for collaboration, community involvement, and adaptive strategies to enhance resilience in the face of grand challenges.

Throughout the descriptive and analytical aspects of this study, some answers have emerged, as outlined above. However, as anticipated, even more questions have surfaced. Among them are: (a) How do governance challenges, such as enforcing construction regulations in risk areas, differ across Brazil's regions, and what implications do these differences have for disaster preparedness and response? (b) How does poor communication between civil defense authorities and the public hinder

disaster preparedness and response in Brazil? (c) How can partnerships between municipal governments and civil defense agencies be enhanced to improve public training in risk prevention and disaster response? (d) What strategies can be employed to overcome the challenges posed by frequent political changes, staff turnover, and the lack of institutional memory within Brazilian civil defenses? (e) How does the militarized, top-down approach to disaster management in Brazil influence the effectiveness of risk mitigation and community resilience? (f) How can inter-municipal partnerships and formal training programs strengthen the coordination and capacity of local civil defenses in disaster management? In essence, what micro-governance factors within emergency networks need to be studied to develop models of excellence applicable to grand challenges?

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