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STRATEGIC LOGISTICS AS A CONTINGENCY FOR FOOD AND NUTRITION SECURITY (FNS) IN DISASTERS: THE CASE OF RIO DE JANEIRO'S MOUNTAINOUS REGION IN 2011[∞]

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ABSTRACT

This Technical Report presents an analysis of the Strategic Logistics adopted in response to the case of the Mountainous Region of Rio de Janeiro in 2011 from the Food and Nutritional Security perspective. The research was based on a documentary search of the official websites of the Civil Defense of the State of Rio de Janeiro and the Ministry of Defense, among others, as well as the databases of scientific literature available on the Capes website. The challenges faced in disasters have increased significantly, hindering the flow of supplies that is normally directed to the affected region. Thus, a Contingency Plan ensures adequate planning for activities to support vulnerable communities in emergency situations, guaranteeing greater security and resilience for the country in this situation.

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Key words: *Strategic logistics; food and nutrition security; contingency plan; national defense.*

LA LOGÍSTICA ESTRATÉGICA COMO CONTINGENCIA PARA LA SEGURIDAD ALIMENTARIA Y NUTRICIONAL (SAN) EN DESASTRES: EL CASO DE LA REGIÓN MONTAÑOSA DE RÍO DE JANEIRO EN 2011

RESUMEN

Este Informe Técnico presenta un análisis de la Logística Estratégica adoptada en respuesta al caso de la Región Montañosa de Río de Janeiro en 2011 desde la perspectiva de la Seguridad Alimentaria y Nutricional. La investigación se basó en una búsqueda documental de los sitios web oficiales de la Defensa Civil del Estado de Río de Janeiro y del Ministerio de Defensa, entre otros, así como de las bases de datos de literatura científica disponibles en el sitio web de la Capes. Los desafíos que enfrentan los desastres han aumentado significativamente, lo que dificulta el flujo de suministros que normalmente se dirige a la región afectada. Así, un Plan de Contingencia asegura una adecuada planificación de las actividades de apoyo a las comunidades vulnerables en situaciones de emergencia, garantizando mayor seguridad y resiliencia para el país en esta situación.

Palabras clave: *Logística estratégica; seguridad alimentaria y nutricional; plan de contingencia; Defensa Nacional.*

A LOGÍSTICA ESTRATÉGICA COMO CONTINGÊNCIA DA SEGURANÇA ALIMENTAR E NUTRICIONAL (SAN) EM DESASTRES: O CASO DA REGIÃO SERRANA DO RIO DE JANEIRO EM 2011

RESUMO

Este estudo apresenta uma análise da Logística Estratégica adotada em resposta ao caso da Região Serrana do Rio de Janeiro em 2011 sob a perspectiva da Segurança Alimentar e Nutricional. A pesquisa foi construída a partir de busca documental nos sites oficiais da Defesa Civil do Estado do Rio de Janeiro, do Ministério da Defesa entre outros; bem como, nas bases de dados da literatura científica disponível no Portal Capes. Os desafios enfrentados em desastres aumentaram significativamente dificultando o fluxo de suprimentos que normalmente é direcionado para a região afetada. Assim, um Plano de Contingência garante um planejamento adequado para as atividades de apoio às comunidades vulnerabilizadas nas situações emergenciais garantindo maior segurança e resiliência para o país nessa situação.

Palavras-chave: *Logística estratégica; segurança alimentar e nutricional; plano de contingência; defesa nacional.*

1. INTRODUCTION

The profound and far-reaching impacts of climate change have been relentlessly afflicting the world, generating catastrophic disasters across continents. Nations that have not yet achieved the economic and structural maturity characteristic of developed countries tend to experience disproportionately greater damage and longer lasting consequences when struck by such phenomena (Paulo; Mendes, 2014). In large-scale disasters whose repercussions persist over time, one aspect that remains insufficiently explored and under-researched concerns the dimension of *Food and Nutritional Security (FNS)* among the affected populations.

Over recent decades, natural disasters have not only become more frequent but also increasingly severe in both scale and intensity. The *Brazilian Atlas of Natural Disasters*, prepared by the *University Center for Studies and Research on Disasters (CEPED)*, reveals that, between the years 1991 and 2023, more than 230 million individuals across the country were affected by disasters, and a total of 5,142 deaths were officially recorded. Droughts represented the predominant type of disaster, followed closely by events associated with intense rainfall, floods, and landslides – occurrences that, when combined, accounted for 33.5% of all registered events (CEPED, 2024). In the critical phase following the onset of these disasters, beyond the immediate losses of life and the large-scale displacement of people, countless individuals lose their ability to sustain their own livelihoods and secure access to food.

The poorest and most vulnerable segments of the population, often residing in precarious housing and in areas of high environmental risk, suffer the most acutely in the aftermath of such calamities. These citizens not only see their homes and communities destroyed but also experience severe disruptions to their food supply which, as noted by Queiroga, Luz, and Filgueira (2022), “is the very foundation upon which the continuation of life depends.” In the weeks or even months following these disasters, victims are frequently unable to secure food, water, or basic means of subsistence, since entire regions are often rendered inoperable with transportation networks, communication systems, and markets all severely compromised. Under such conditions, *direct and coordinated State intervention* becomes indispensable in order to implement logistical mechanisms capable of guaranteeing adequate *Food and Nutritional Security* for those affected.

In this context, although Brazil has long faced recurring disasters linked to climate change, particularly those stemming from heavy rainfall and subsequent flooding, the tragedy that struck the region of Serrana in Rio de Janeiro in 2011 stands out as a particularly devastating and emblematic event. It is worth recalling that, in merely two days, January 11 and 12 of that year, torrential rains impacted the municipalities of Nova Friburgo, Petrópolis, Areal, São José do Vale do Rio Preto, Teresópolis, Sumidouro, and Bom Jardim. These seven municipalities were overwhelmed by violent floods and massive landslides that resulted in: [...] 910 confirmed deaths and 662 individuals reported missing by February 18. Nova Friburgo recorded 426 deaths, Teresópolis 382, Petrópolis 74, Sumidouro 22, and São José do Vale do Rio Preto, Santo Antônio de Pádua, and Bom Jardim each reported 2 fatalities (Avzaradel, 2015, p. 7).

“In only 48 hours, rainfall surpassed the cumulative precipitation of the first two months of 2010, during which merely 170 mm were recorded, whereas in this event a staggering 281.6 mm were measured.” (Cavalcante Filho et al., 2011, p. 18).

According to a comprehensive case study conducted by the *National School of Public Administration (ENAP)*, this catastrophic climatic event was recognized by the *United Nations (UN/ONU)* as the 8th largest landslide disaster in the world over the past 100 years. The sheer intensity of the mudslides generated by the massive movement of destabilized soil was so overwhelming that it completely obliterated roads, bridges, and entire neighborhoods (Busch; Amorim, 2011).

Despite the magnitude of the tragedy, the *Federal Government* only mobilized its Armed Forces to assist the affected municipalities beginning on January 14 following an official visit by the then-President of the Republic, Dilma Rousseff. From that moment onward, the *Brazilian Army* was formally tasked through *Ministerial Directive No. 01/2011*, issued by the *Ministry of Defense*, with appointing a Commander of Military Forces to oversee the coordination and deployment of Federal Troops in support of the *Civil Defense* operations in the devastated region (Brazil, 2011). However, it was not until January 15 that tangible measures were taken to facilitate the movement of people, supplies, and communications, an outcome that only became possible with the effective arrival of federal logistical infrastructure (Busch; Amorim, 2011). Only then did the organized distribution of food to displaced populations commence. These circumstances strongly suggest that there was *no pre-existing Contingency Plan* at the National Civil Defense level to assist municipalities struck by major disasters resulting from climate change.

Food and Nutritional Security (FNS) remains a relatively under-explored topic within disaster research, despite its critical interconnection with *Strategic Logistics* and its implications for *national Security, Development, and Defense*. FNS is a matter of national importance, as it directly pertains to human survival and societal stability. In recent years, it has become a central focus of international policy dialogues, including in Brazil itself (Queiroga; Luz; Filgueira, 2022). In countries that possess well-established and coherent State policies, food security considerations are integrated within the broader framework of *National Security Strategy*, and vulnerabilities in this domain are often interpreted as potential threats to sovereignty and stability (Bertolini, Reis Neto, and Andrade Lima, 2023). The strategic relevance of food security can be clearly illustrated by examining the approaches of major powers such as China and the United States:

“Among the multiple dimensions of security that comprise a comprehensive State policy, food security occupies a position of exceptional importance. Nations such as China (Lin, 2017) and the United States (United States, 2021), each in their distinctive way, have incorporated food security into their overarching State strategies, using it as a tool to ensure national security, political and social stability, and the expansion of economic power.” (Bertolini; Reis Neto; Andrade Lima, 2023, p. 321).

Thus, the integration of *Strategic Logistics* with *Security, Development, Defense, and Food and Nutritional Security* constitutes a fundamental link that binds together these essential pillars of national resilience and prosperity. For instance, “since ancient times, China has regarded food security as a vital component of its national security and defense strategy.” (Bertolini; Reis Neto; Andrade Lima, 2023, p. 325).

Ensuring *Food and Nutritional Security* depends upon the coordinated action of public agents, formally designated at various administrative levels, to carry out complex logistical operations that enable the continuous flow of food to disaster victims. As emphasized by Souza (2012), such actions can and should be anticipated within *Contingency Plans* developed during the preparedness phase of disaster management, designed to ensure efficient responses to urgent demands that emerge following natural catastrophes. Therefore, it is of utmost importance to examine how *Humanitarian Logistics* and *Food and Nutritional Security* can interact synergistically to enhance disaster response mechanisms throughout Brazil, thereby reducing human suffering and promoting social recovery.

This research, therefore, seeks to investigate the intersection between *Strategic Logistics*, particularly in its *Humanitarian* dimension, and *Food and Nutritional Security* in the context of disaster response within Brazil. More specifically, it aims to identify the significance and operational role of FNS in natural disaster responses by analyzing the case of the catastrophic event that devastated the region of *Serrana* in the State of Rio de Janeiro in 2011.

Research Objective

This study aims to investigate how the Brazilian government can effectively integrate strategic humanitarian logistics with food and nutritional security policies to strengthen disaster response. Specifically, it seeks to analyze the role of contingency planning in ensuring the efficient, timely, and equitable distribution of food to populations affected by natural disasters. The research also examines how coordination across governmental agencies and logistical networks can overcome physical, infrastructural, and administrative barriers that impede relief efforts. Ultimately, the study intends to provide evidence-based recommendations for improving policy design and operational strategies, thereby reducing vulnerability, mitigating human suffering, and enhancing the resilience of communities exposed to natural hazards.

2. METHODOLOGY

This study adopted a qualitative methodological approach, characterized by a descriptive and interpretive orientation, whose foundation rested upon an extensive and in-depth review of the literature. The review explored the importance of strategic logistics, with particular emphasis on its humanitarian dimension, and its complex and dynamic interaction with food and nutritional security (FNS) within the broader framework of large-scale natural disasters and emergency response operations. This methodological choice was based on the recognition that qualitative research allows for a more nuanced understanding of social phenomena, institutional coordination, and the multifaceted relationships between logistics, public policy, and humanitarian aid systems in times of crisis.

To accomplish this objective, the collection of data and information drew upon multiple and diverse sources, including official reports, academic and scientific articles, books, web pages, specialized online databases, national and international journals, and official government documents. These materials were analyzed in order to identify theoretical foundations, practical applications, and case evidence that could elucidate the interplay between strategic logistics and food security management during disaster situations. The selection of sources prioritized materials that discussed both the theoretical aspects of hu-

manitarian logistics and the applied mechanisms observed in real-world disaster response contexts.

For the case study which focused specifically on the tragedy provoked by the intense rainfall in the *region of Serrana* in Rio de Janeiro in 2011, a documentary research procedure was carried out. This included the examination, collection, and analysis of official documents issued by public agencies and institutions that participated in the emergency response during the 2011 event. Additionally, news articles, press releases, and journalistic reports were reviewed with the purpose of identifying the existence and implementation of public policies directed toward *Food and Nutritional Security (FNS)*, as well as the operational presence of Contingency Plans and Strategic Logistics frameworks applied in areas affected by natural disasters.

The documentary base of information that supported this research was systematically constructed through comprehensive searches of official websites and institutional repositories, including those of the *Ministry of Defense*, the *Civil Defense of the State of Rio de Janeiro*, and other relevant governmental bodies. These searches sought to obtain laws, decrees, ordinances, ministerial directives, resolutions, and official guidance manuals relevant to emergency logistics and food security policies.

In addition to governmental sources, the study incorporated academic and scientific documentation retrieved from recognized digital libraries and databases, particularly those made available through the *CAPES Journal Portal*. This included peer-reviewed articles, theses, dissertations, and technical papers addressing disaster management, humanitarian logistics, contingency planning, and the coordination of food and nutrition responses in crisis situations.

Through the triangulation of these diverse sources of information, combining official documentation, scientific literature, and empirical data from media and institutional reports, it was possible to construct a rich and multifaceted analytical foundation. This methodological framework ensured not only the credibility and consistency of the findings but also provided the necessary depth to examine the relationships between *strategic logistics*, *food and nutritional security*, and *disaster response capacity* in Brazil, using the *region of Serrana* case as an illustrative and representative example.

3. FOUNDATIONS OF THE INTERFACE BETWEEN HUMANITARIAN LOGISTICS AND FOOD AND NUTRITIONAL SECURITY (FNS)

3.1 FOOD SECURITY

The term *food security*, according to Gomes (2003), began to be used shortly after the end of the First World War, as the traumatic experiences and widespread shortages caused by the conflict revealed that a nation could exert domination or even subjugation over another by controlling the supply and distribution of food. From this historical perspective, it becomes evident how essential and strategic *Food and Nutritional Security (FNS)* truly is, particularly in regions and communities severely affected by natural or human-induced disasters and tragedies, where access to adequate food becomes immediately threatened.

“Natural events are characterized as disasters when they occur in populated areas, causing the destruction of local infrastructure and leading the population into a state of deprivation, insecurity, and suffering” (Costa et al., 2015). In agreement with Lopes (2024), it cannot be denied that the effects of these natural catastrophes are felt in multiple dimensions, especially with respect to the guarantee and maintenance of *Food and Nutritional Security (FNS)*, since food systems, supply chains, and local livelihoods are directly and profoundly impacted.

For the purposes of this study, the concept of *Food and Nutritional Security* adopted is that established in Article 3 of Law No. 11,346 of September 15, 2006, known as the *Organic Law on Food and Nutritional Security – LOSAN*, which states:

Food and Nutritional Security (FNS) is the realization of the right of all individuals to have regular and permanent access to quality food, in sufficient quantity, without compromising access to other essential needs, based on food practices that promote health, respect cultural diversity, and are socially, economically, and environmentally sustainable (Brazil, 2006).

This definition underscores that *food and nutritional security* is not merely the availability of food, but also encompasses equity of access, nutritional adequacy, and cultural relevance, making it a central pillar in the social and humanitarian response framework, particularly during periods of crisis or large-scale disasters.

3.2 NATURAL DISASTERS

According to the United Nations Office for Disaster Risk Reduction (UNDRR), the term *disaster* is defined as:

A serious disruption in the functioning of a community or society at any scale, resulting from hazardous events interacting with conditions of exposure, vulnerability, and capacity, leading to one or more of the following outcomes: human, material, economic, or environmental losses and impacts. (United Nations, 2022).

Additionally, the *Disaster Risk Prevention Guidebook*, produced by the Herbert de Souza Laboratory, which contributed to the creation of the *Working Group on Climate Change, Poverty, and Inequalities* within the framework of the *Brazilian Forum on Climate Change*, defines a disaster as:

[...] the result of adverse events, either natural or human-induced, occurring within a vulnerable ecosystem, which may cause harm to people, as well as material and/or environmental damage - and consequent economic and social losses. (Jungles, 2012, p. 6).

Thus, natural disasters are understood not merely as the occurrence of natural phenomena, but as the interaction between hazardous events and vulnerable social systems, where the lack of infrastructure, preparedness, and institutional coordination amplifies the extent of damage and human suffering.

3.3 STRATEGIC LOGISTICS IN ITS HUMANITARIAN DIMENSION

In the article *From Logistics to Supply Chain Management: The Road Ahead in the Humanitarian Sector* (our translation), produced by the **Fritz Institute**, a non-profit organization based in California that promotes the adoption of best practices for rapid and effective disaster response and recovery, the following definition of *humanitarian logistics* is presented:

The process of planning, implementing, and controlling the efficient and cost-effective flow and storage of goods and materials, as well as the related information, from the point of origin to the point of consumption, with the purpose of alleviating the suffering of vulnerable people. The function encompasses a series of activities, including planning, preparedness, transportation, procurement, warehousing, monitoring, and tracking. (Thomas & Kopczak, 2005, p. 4, our translation).

Humanitarian Logistics constitutes a specialized branch of logistics, responsible for designing and implementing the procedures necessary for the mobilization of people, resources, and expertise aimed at serving communities affected by disasters (Souza, 2012, p. 1).

According to Thomas and Kopczak (2005, p. 2), *humanitarian logistics* can also be described as the process of efficiently planning, executing, and controlling the flow of information and the movement of goods and materials from the point of origin to the point of consumption, with the explicit objective of assisting and alleviating the suffering of populations in need.

It is important to emphasize that *humanitarian logistics* differs significantly from both *commercial* and *military* logistics. Unlike commercial systems, where both supply and demand can be forecasted, or military operations, where supply lines are tightly controlled, humanitarian logistics operates under conditions where both demand and supply are uncertain, unpredictable, and highly dynamic. Thus, the humanitarian context demands a delicate balance between efficiency and equity, striving to deliver relief fairly and effectively - even though measuring its impact remains inherently difficult (Wassenhove & Martinez, 2012, p. 308, our translation).

This humanitarian dimension of logistics integrates operational efficiency with ethical and social responsibility, ensuring that relief efforts are conducted in a manner that respects human dignity and promotes recovery, resilience, and sustainability in the aftermath of disasters.

3.4 CONTINGENCY PLAN

According to the Contingency Plan for Intense Rainfall of the State of Rio de Janeiro (2023),

A contingency is an uncertain situation concerning an event, adverse occurrence, or emergency condition that may or may not occur during a given period of time.

Thus, a *Contingency Plan* can be defined as:

[...] a pre-established plan designed to guide actions of preparedness and response to a specific risk scenario, should the adverse event actually occur. It defines emergency response actions in a given region and assigns the responsibilities of each participating entity. The plan also contains information about the characteristics of the area and the systems involved. Its main purpose is to train, organize, guide, facilitate, expedite, and standardize the necessary actions for controlling emergencies and abnormal situations. The Contingency Plan serves as a support instrument to:

- a) Facilitate preparedness activities;
- b) Optimize response operations;
- c) Anticipate and allocate the necessary resources;
- d) Define roles, duties, and responsibilities; and
- e) Guide training exercises, simulations, and other capacity-building initiatives aimed at feedback and the continuous improvement of processes through its regular updating (Rio de Janeiro, 2023, p. 12).

In accordance with Normative Instruction No. 02 of December 20, 2016, the *Civil Defense Contingency Plan (PCPDC)* may be understood as a document that consolidates the planning derived from the study of a given disaster scenario, establishing the operational procedures and institutional responsibilities to be followed (Brazil, 2016).

The United Nations defines a *Contingency Plan* as:

[...] a set of organized and coordinated courses of action, with clearly identified institutional functions and resources, information processes, and operational arrangements for specific stakeholders at times of need. Based on scenarios of possible emergency conditions or hazardous events, it enables key actors to anticipate, forecast, and address the problems that may arise during disasters. The contingency plan is an essential component of overall preparedness. Such plans must be regularly updated and exercised. (United Nations, [2022?], n.p., our translation).

Similarly, the European Union establishes that a *Contingency Plan* must respond to:

Three fundamental questions: (1) What is going to happen? (2) What will we do? (3) What can we do in advance to prepare ourselves? Based on scenarios of potential emergencies or hazardous events, it allows key actors to foresee, anticipate, and resolve problems that may emerge during disasters. Emergency planning is an essential component of general preparedness and must function in a collaborative manner. (European Commission, 2021, p. 70, our translation).

Therefore, it becomes clear that the integration of strategic logistical aspects within the framework of *Food and Nutritional Security (FNS)* and the various *Contingency Plans* designed to ensure rapid and coordinated responses to natural disasters is of utmost im-

portance. Such integration ensures that resources are mobilized efficiently, that affected populations receive timely support, and that resilience mechanisms are strengthened to mitigate the effects of future crises.

4. THE TRAGEDY IN THE MOUNTAIN REGION OF SERRANA IN RIO DE JANEIRO 2011

The severe natural calamity that affected the Serrana region of Rio de Janeiro in January 2011 revealed, in a dramatic and devastating way, the urgent necessity for a comprehensive, well-structured, and strategically coordinated Contingency Plan. Such a plan, if developed and executed through specialized logistical cells operating within a humanitarian dimension, would have allowed for a more agile, coherent, and effective response to the needs of the affected populations. In particular, it would have enhanced the capacity to procure, manage, and transport essential supplies, including food, drinking water, and hygiene materials-resources whose timely delivery is vital to preserving human life in the aftermath of natural disasters.

From a logistical perspective, the existence of a strategic contingency framework could have ensured that Food and Nutritional Security (FNS) was preserved as a central pillar of emergency response. This would mean that, even under extreme conditions of infrastructure collapse, isolation of communities, and interruption of supply chains, victims would still have had access to food in adequate quantity, quality, and nutritional value, thereby reducing the secondary humanitarian consequences of the disaster.

In this sense, the European Union (EU) offers a relevant and contemporary conceptualization of the *Contingency Plan*, describing it as a vital instrument for reinforcing the resilience and adaptability of the food system in the face of crises. The EU highlights that such planning is not limited to short-term emergency management but rather forms part of a broader and more integrated vision of preparedness and resilience building:

In broader terms, it is possible to conceive of the strengthening of food system resilience as a key strategy for being better prepared to confront crises. Contingency planning may be understood as one of the multiple and interdependent components of food system resilience, while also being defined by its distinct operational nature. For example, the contingency plan generally has a short-term and action-oriented focus, whereas “resilience,” in this more restrictive sense, should be perceived from a medium- to long-term perspective, encompassing the ability to adapt, reorganize, and recover. (European Commission, 2021, p. 70, our translation).

This understanding reinforces the idea that contingency planning, when designed in alignment with strategic humanitarian logistics, represents not only an operational tool but also a preventive and adaptive mechanism that strengthens the national capacity to respond to emergencies. Even during catastrophic circumstances such as those experienced in the region of *Serrana*, where heavy rainfall triggered massive landslides, floods, and infrastructure destruction, effective contingency planning could have preserved the operational flow of essential goods and services, ensuring that Food and Nutritional Security remained accessible and uninterrupted for the affected populations.

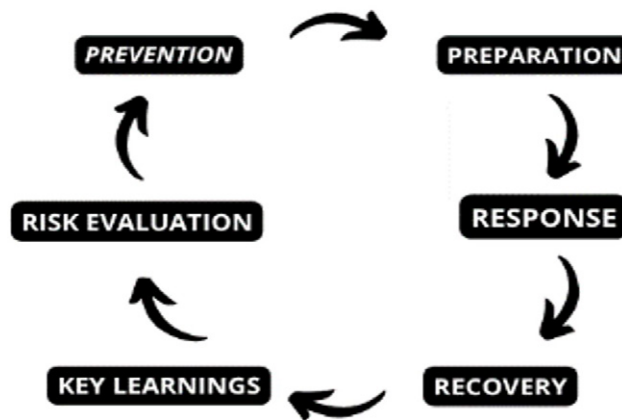
It is essential to emphasize, as the European Commission (2021) observes, that contingency planning should be viewed within the broader Crisis Management Cycle, which encompasses multiple, interrelated phases designed to ensure a state of readiness before, during, and after a disaster. According to the Commission:

“The contingency planning process can be understood within the broader context of the crisis management cycle (see Figure 1), where the principal focus lies on preparedness and response, while maintaining a strong awareness of the ongoing importance of the other components of the cycle, such as prevention, recovery, and reconstruction.” (European Commission, 2021, p. 70, our translation).

This cyclical model demonstrates that contingency planning and Food and Nutritional Security are not isolated components but rather interconnected elements that form part of a continuous process of preparation, action, evaluation, and improvement. In the specific case of the region of *Serrana*, the absence of such a structured and integrated plan at the national and regional levels contributed to delays in the distribution of aid, logistical bottlenecks, and the prolongation of suffering among those affected.

Therefore, it becomes evident that the articulation between humanitarian logistics, strategic contingency planning, and Food and Nutritional Security is indispensable. Together, they provide the technical, organizational, and operational foundation necessary to safeguard life, maintain dignity, and promote recovery in the face of large-scale natural disasters such as the one that devastated the *region of Serrana* in 2011.

Figure 1 – The Crisis Management Cycle.



Source: Adapted from Pursiainen (2021).

For the development and implementation of this intervention, it is essential that the Federal Government, through the National Civil Defense, and with direct support from the Ministry of Defense, the Ministry of Agriculture, the Ministry of Health, and other relevant institutions, design and establish a comprehensive Contingency Plan. This plan should for-

mally define the humanitarian logistics framework to be employed in emergency situations, ensuring that the victims of natural disasters have continuous and reliable access to Food and Nutritional Security (FNS) in the shortest possible time.

Furthermore, this plan must be conceived as a living and adaptive instrument-one that incorporates structures capable of being activated in any region of the country, regardless of geographic, climatic, or socioeconomic differences. It must also be subject to periodic revisions, technical updates, and regular training exercises with simulated crisis scenarios for all stakeholders, from federal and state agencies to local volunteers and humanitarian organizations. These simulations would serve to refine coordination, improve response times, and strengthen institutional preparedness.

In addition, the plan should foresee the creation of strategically located Distribution Centers throughout the national territory. These centers must maintain stockpiles of high-quality, non-perishable food items, water, and essential goods to be distributed immediately to disaster-affected populations. The choice of locations for these centers must consider transportation accessibility, population density, and regional vulnerability to natural disasters such as floods, landslides, and droughts.

To ensure efficiency, these stock points should operate as part of an integrated logistics network, allowing mutual support and the exchange of supplies among them. This interconnection would help balance resources in response to regional crises and unexpected surges in demand. Each center should employ strict inventory management systems to monitor product quality and expiration dates. Through a system of constant stock rotation, items nearing expiration could be safely redirected and donated to families in vulnerable conditions who are already registered in federal social assistance programs. In this way, the plan would simultaneously reduce waste, sustain preparedness, and promote social equity.

It is vital to maintain a network of warehouses equipped with materials that can be dispatched without delay to areas impacted by disasters. Equally important is the existence of a detailed logistical plan that enables the rapid mobilization of transportation assets-such as trucks, helicopters, boats, and aircraft-as well as the operation of efficient and redundant communication systems capable of functioning even under adverse conditions.

In the immediate aftermath of a disaster, victims require not only emergency shelter but also access to standardized assistance kits. These kits should contain ready-to-eat, nutritionally balanced meals similar to military field rations, as well as hygiene and sanitation items such as water purification tablets, soap, toothpaste, toothbrushes, and towels. Sleeping kits including mats, sheets, pillows, and blankets should also be distributed, ensuring minimum comfort and hygiene. Even clothing could be standardized-such as simple, practical, and durable unisex jumpsuits-to facilitate rapid distribution and reduce logistical complications.

All these standardized kits should be permanently stored and maintained in Civil Defense facilities located at strategic points within regions most exposed to natural disasters. These hubs must be operational 24 hours a day, with clear chains of command and communication, allowing for the immediate deployment of supplies and trained personnel whenever an emergency occurs (Souza, 2012, p. 5).

Another essential element of the plan concerns the organization of human resources. Personnel mobilized to respond to emergencies—whether volunteers or officially assigned workers—must be structured into cohesive teams, each under the supervision of a qualified leader trained by Civil Defense authorities. These leaders should possess not only organizational and leadership skills but also a fundamental understanding of food handling, hygiene, and nutritional principles, ensuring that distributed meals are safe, appropriate, and free from contamination. This structure would prevent improvisation and strengthen the consistency and safety of relief operations.

Finally, the plan must include the identification and pre-positioning of machinery and equipment required to transport, store, and distribute food and other essential goods from the Distribution Centers and other supply sources, such as donations or regional contributions, to the points of need. Whenever possible, equipment already being employed in disaster mitigation or recovery operations should be repurposed to support the logistics chain. The involvement of the Ministry of Defense is crucial in this regard, as the Brazilian military possesses the logistical infrastructure, technical expertise, and mobility necessary to overcome the terrain and accessibility challenges that often arise in post-disaster environments.

Moreover, the Contingency Plan should incorporate guidelines that promote long-term resilience among the affected populations. Beyond the immediate response, its purpose should extend to helping victims rebuild their lives, restore their livelihoods, and recover their capacity to maintain food self-sufficiency. This holistic approach would transform disaster response from a temporary relief mechanism into a sustainable framework for recovery and social reintegration, ensuring that communities emerge from tragedy not only with their basic needs met but with strengthened resilience against future crises.

5. RESULTS AND DISCUSSION

The application of Strategic Logistics knowledge, particularly within its humanitarian dimension, for the design and implementation of a Contingency Plan that ensures Food and Nutritional Security, serves as a fundamental instrument for mitigating the impacts caused by the destruction of inhabited regions as a result of climate change. The development of such a plan provides the structural foundation necessary to coordinate the actions of multiple agents and institutions, clarifying the specific functions of each team involved in emergency operations. It also enables the organization of training programs and simulation exercises, the definition of responsibilities and hierarchical authority, and the identification of the technical resources, machinery, and vehicles required for an effective response. Furthermore, the plan delineates the detailed flow of food supplies—from their departure at Distribution Centers to their final delivery to consumers—establishes clear procedures for food handling and storage, and defines the initial response steps that must be taken immediately after a disaster, as well as the bases required to guarantee the resilience and recovery of affected populations.

In this framework, the Contingency Plan assumes the primary role of preparing both the population and governmental agencies for emergency situations. It encompasses the mapping of escape routes toward designated shelters, the establishment of safe and hygienic refuge areas, and the assurance of continuous access to food, potable water, medicine, and other essential goods. The implementation of these mechanisms significantly

reduces the risks of food and nutritional insecurity and strengthens the adaptive capacity, resilience, and social cohesion of the communities involved.

To effectively prevent food and nutritional vulnerability among populations exposed to climate-related disasters, the Contingency Plan must explicitly define and operationalize several key components:

1. *Strategic Food Stockpile*: Establish and maintain strategically located reserves of non-perishable food in secure, climate-controlled, and easily accessible facilities. These reserves must be organized for rapid mobilization and equitable distribution to affected communities. An efficient inventory management system should be employed to ensure proper rotation of stock, preventing losses and maintaining the nutritional value of stored items.
2. *Resilient Logistics Chain*: Design and manage a logistics chain capable of maintaining operations under adverse or unpredictable conditions. This chain should ensure the safe, rapid, and traceable transport of food, medicine, and other critical resources to disaster zones. It must include contingency routes, backup communication systems, temporary storage sites, and strategic partnerships with public and private transport sectors.
3. *Intersectoral Coordination*: Promote the integration of civil defense agencies, food security institutions (such as CONAB, MDS, and MRE), and other organizations working in health, infrastructure, and nutrition. This coordination ensures that all actors operate under a unified command and with complementary mandates, preventing duplication of efforts, optimizing the use of available resources, and ensuring a coherent and efficient response that minimizes disruptions to nutrition and public health.

According to Sheu (2011), an agile and efficient humanitarian logistics system is indispensable for meeting urgent relief needs following natural disasters, thereby reducing the extent and duration of suffering in affected regions. Such responsiveness depends upon a Contingency Plan that takes into account the inherent complexity of food supply chains, particularly regarding procurement, transportation, and distribution, given that the destruction of infrastructure often restricts the use of conventional transport modes. As Costa et al. (2015) note, “in humanitarian operations, the supply chain must be flexible and capable of responding rapidly to unpredictable events, while maintaining effectiveness and efficiency under severe budgetary constraints.”

Busch and Amorim (2011) provide a relevant example in their analysis of the 2011 disaster in the Serrana Region of Rio de Janeiro. During that event, widespread landslides rendered major roads impassable, and it was only several days after the peak of the tragedy that the Army succeeded in reopening key routes, thereby reestablishing a supply line for food and relief materials. Measures of this nature, when already anticipated within a Contingency Plan, can be implemented much more swiftly, leading to improved results, reduced human suffering, and more efficient use of logistical and financial resources.

An even more striking example of the consequences of inadequate contingency planning can be found in the 2010 earthquake in Haiti. Costa et al. (2015) report that, in the absence of prior coordination and logistical planning, food was distributed in open truck

containers or dropped from aircraft and parachutes, resulting in disorganization and chaos. A significant portion of the food was lost or damaged, and the lack of control and equitable distribution led to violent disputes among survivors competing for scarce supplies. This episode underscores the critical importance of pre-established logistical frameworks in humanitarian operations and the dire social and ethical costs of improvisation.

By contrast, Japan's response to the 2011 earthquake and subsequent tsunami in Fukushima illustrates the positive outcomes of comprehensive preparedness. Despite the enormous scale of destruction, the flow of essential goods was fully restored within days. This effectiveness was due largely to the fact that "all governmental bodies had pre-existing and frequently tested disaster response plans" (Costa et al., 2015). A comparison of these three cases—Serrana, Haiti, and Fukushima—demonstrates that even in countries with advanced infrastructure and institutional readiness, the absence of consistent training and coordination in logistical operations can cause delays in the initial phases of emergency response. Hence, it is essential that the exercises and simulations established in the Contingency Plan be conducted periodically, their results rigorously evaluated, and their protocols continuously updated to ensure improvement and adaptability to new circumstances.

The role of Distribution Centers in the Contingency Plan deserves special emphasis. These centers "serve as a mechanism to reduce delivery time variability and demand volatility" (Scarpin et al., 2013). Although maintaining such facilities entails financial and operational costs, these are fully justified by the critical advantage they provide in enabling immediate humanitarian response once a disaster occurs. Moreover, the presence of pre-established centers helps prevent the so-called "push effect," in which "donors push their surpluses through unsolicited donations, often involving items near or past their expiration dates" (Wassenhove and Martinez, 2012, p. 312, our translation).

An alternative and more sustainable approach, as proposed by Wassenhove and Martinez (2012, p. 313, our translation), involves "maintaining standardized emergency kits in warehouses and distributing them immediately after the disaster, with small adjustments according to the victims' needs, local conditions, and the specific characteristics of the event." This method ensures a more organized, transparent, and equitable distribution of aid, minimizes waste, facilitates traceability, and strengthens public trust in humanitarian institutions.

Ultimately, the implementation of a comprehensive Contingency Plan that integrates strategic logistics, intersectoral coordination, and evidence-based management constitutes not only an operational instrument for disaster response but also a structural policy for long-term resilience. By focusing on prevention, preparedness, and continuous improvement, such a plan transforms logistics into a proactive and adaptive system of social protection, ensuring that when crises arise, all communities—regardless of location or resources—retain timely access to food, water, and essential services necessary to rebuild their livelihoods with dignity and security.

6. CONCLUSION

It can be observed that by fostering a systematic and coordinated interaction between Strategic Logistics in its humanitarian dimension and Food and Nutritional Security, with the primary goal of providing timely, effective, and organized assistance to victims of

natural disasters, it becomes possible to overcome many of the limitations, physical barriers, and operational challenges imposed by the widespread destruction caused by such catastrophic events. The development and implementation of a comprehensive Contingency Plan allows for the creation of a fully integrated logistical framework that ensures a smoother and more efficient flow throughout the entire food supply chain, encompassing all stages from storage, inventory management, and quality assurance, to transportation, safety measures, monitoring, and finally the delivery of safe, nutritious, and culturally appropriate food to individuals and communities directly affected by disasters. By guaranteeing Food and Nutritional Security for those impacted, the Brazilian State actively contributes to reducing human suffering, supporting the recovery process, and promoting the resilience, autonomy, and well-being of disaster-affected populations.

Furthermore, it is evident that during the tragedy that affected seven municipalities in the Serrana Region of Rio de Janeiro in 2011, the absence of a structured and regionally tailored Contingency Plan severely limited the ability to provide immediate and sustained food and nutritional support, as well as to ensure the long-term resilience of survivors. One of the limitations encountered during this study was the scarcity of detailed information regarding the food and nutritional conditions of the affected population during the first days of the disaster and in the following weeks, months, and years. This lack of longitudinal data hindered a comprehensive assessment of the population's capacity for recovery and adaptation, highlighting the critical importance of continuous monitoring, systematic data collection, and evaluation of resilience outcomes in disaster-affected regions.

Therefore, this study recommends that the Federal Government, through the National Secretariat for Protection and Civil Defense, immediately establish a dedicated task force or national commission composed of strategic-level professionals from the logistics, nutrition, defense, health, and other relevant sectors. This body should be responsible for designing, implementing, and regularly updating a Contingency Plan for natural disaster response that accounts for the specific geographic, demographic, and socio-economic characteristics of each region in Brazil. Given that extreme climate events are projected to become increasingly frequent and severe, resulting in escalating destruction and affecting thousands of people, proactive and well-coordinated government action is essential. As a comparative example, the European Union developed a comprehensive Contingency Plan with a strong focus on Food and Nutritional Security in the post-COVID-19 period, illustrating the benefits of structured planning, intersectoral coordination, and preemptive resource allocation.

For future academic research, it is recommended to further investigate the post-disaster resilience of affected populations, with particular attention to food and nutritional security outcomes, adaptive capacities, and long-term recovery trajectories. Such studies would provide critical insights for refining policy design, strengthening logistical preparedness, and enhancing the effectiveness of interventions in future disaster scenarios, ensuring that vulnerable populations receive timely, equitable, and sustainable assistance. By integrating strategic humanitarian logistics with targeted Food and Nutritional Security measures, governments can transform disaster response into a proactive, adaptive, and resilient system that not only mitigates immediate suffering but also supports long-term community recovery and well-being. Ultimately, strengthening contingency logistics for food security represents not only a technical requirement but a moral imperative for sustainable national resilience.

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