Chapter 3
Strategies that Improve the Performance of the Humanitarian Supply Chain

Patricia Cano-Olivos, Diana Sánchez-Partida, Santiago-Omar Caballero-Morales, and José-Luis Martínez-Flores

Abstract Disasters are not a novel phenomenon; however, they have demonstrated the need to implement coordinated action by international organizations, governments, and humanitarian actors to meet the different challenges they pose in recent decades. In this sense, there are numerous plans and protocols for steps in prevention and response. However, beyond the socio-economic consequences of disasters, the same humanitarian supply chains are affected, so those responsible must prepare a rapid and effective response to possible future events. Logistics planning allows the flow of humanitarian products and services, demolition, and reconstruction of physical infrastructure, but should be incorporated as a strategic activity to prepare a National Emergency Plan which depends on the government. The strategies proposed in this research can develop the ability to respond more quickly to the disaster so that its effect decreases, and assistance operations are facilitated. It should be noted that, before the disaster, a reconstruction strategy must be carefully formulated so that post-disaster implementation is implemented with minimal change if required. Hence, reconstruction is longer than the previous ones and requires more economic resources. In general, all strategies (planning, information flow, evaluation, coordination supplying, warehousing, transportation, distribution, and reconstruction) necessary for the deployment of logistics flows during an emergency must prepare, known, tested, and validated in advance by all government offices. It is vital to arrive in the exact place, at the required opportunity, in the necessary quantities and with a high level of service. Logistics strategies must be structured and agreed upon by all parties involved; otherwise, the implementation may not function properly. Therefore, logistics strategies take on extreme relevance in processes for future preventive operations.

Keywords Humanitarian logistic · Supply chain · Earthquake 2017 · Mexico · Strategies

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3.1 Introduction

Logistics in the humanitarian supply chain is defined as effective and efficient planning, implementation, and control of the flows of products, materials, and information from donors to affected people to meet survival needs. According to Wassenhove (2006), the planning strategy includes five critical elements: (a) human resources deployment; selection and training of people coordinating and in intervention in the event of a disaster, (b) knowledge management; store, code, and use information about previous events to improve prevention and support strategies, (c) operations management; location of collection centers and shelters, distribution routes for support resources and evacuation routes under various scenarios, (d) financial resources; allocation of monetary resources to deploy aid operations, and (e) collaboration; identify the various actors (government, private institutions, NGOs and the community) in the event of a disaster and coordinate the humanitarian logistics effort among the participants.

However, humanitarian (HL) and commercial logistics are radically different, but so far, most analytical formulations fail to capture the full complexity of HL (Holguin-Veras et al. 2007). In Mexico, the earthquakes of September 7th and 19th, 2017, left a latent pre-occupation due to the mismanagement and disorganization of humanitarian aid; these events evidenced the unlearned lessons of September 19th, 1985. The contingency and evacuation plans always have variations and eventualities typical of each disaster that was not predicted, so HL must be flexible enough to adapt quickly to needs. On the other hand, corruption in government increases property damage and the death of people, derived from the diversion of resources and the poor application of laws for the construction of real estate, roads, bridges, among others. Thus, HL is an integrated process associated with the management of different flows (capital, goods, and services, people) and whose development impacts the performance of the humanitarian supply chain, favoring both response times and early recovery.

Preparing for a disaster is complex, but there are more likely areas to achieve better results when implementing strategies. A comprehensive humanitarian supply chain requires ideal strategies to improve its performance, i.e., reducing the impact of disasters. This research has identified nine strategies, which are: (1) planning, (2) information flow, (3) evaluation, (4) coordination, (5) supplying, (6) warehousing, (7) transportation, (8) distribution, y (9) reconstruction. These strategies should be directly correlated and continually reviewed before and after the disaster for updating.

3.2 Literature Review

Humanitarian logistics provides emergency supplies quickly to reduce deaths and human suffering. (Balcik and Beamon 2008; Hasanzadeh and Bashiri 2016; Krishnamurthy et al. 2013). However, coordination in humanitarian logistics is one of

the most important aspects for both the preparation phase and the response phase (Nikbakhsh and Farahani 2011). Therefore, it is necessary to recognize that disaster response should not be an impromptu outcome; on the contrary, the successful response depends on the response and collaboration capabilities demonstrated by the local government (Van-Wassenhove 2006). According to Yadav and Barve (2015), strategic planning of humanitarian logistics should include resource provision, development of response plans, and analysis of requirements, and define coordination strategies among humanitarian agencies.

Various research mention that humanitarian logistics management implements commercial logistics strategies, such as inventory management (Balcik and Beamon 2008; Chakravarty 2014; Kunz et al. 2014), location of logistics and emergency centers (Najafi et al. 2015; Salman and Yücel 2015; Tuzkaya et al. 2015), and routing to distribute humanitarian aid and evacuate people (Vargas-Florez et al. 2015; Zhen et al. 2015). However, implementing commercial logistics strategies is not fully transferable due to the inherent characteristics of humanitarian logistics (Pettit and Beresford 2009). Complexity increases because disaster preparedness and response operations are related to the diversity and number of involved actors (Kumar and Havey 2013; Ergun et al. 2014), such as local, regional, and international organizations (Yadav and Barve 2015), which do not always work together, and many do not have sufficient experience to carry out their operations (Van-Wassenhove 2006; Kovács and Spens 2007). Table 3.1 shows the main differences between commercial and humanitarian logistics.

Table 3.1 Differences between commercial and humanitarian logistics (Holguín-Veras et al. 2012)

Characteristics	Commercial logistics	Humanitarian logistics
Objective	Minimizing logistical costs	Minimizing social costs (human suffering due to lack of goods or services + logistics costs)
Source of supply flow	Autonomous	Impacted by the arrival of large quantities of supplies in the disaster zone
Demand	Known with some certainty	Unknown and dynamic, lack of information and access to the site
Structure for decision-making	Structured and controlled interactions by few decision-makers	Unstructured interactions with thousands of decision-makers
Periodicity/volume of logistics activities	Repetitive, relatively stable flows, large volumes	Once in a lifetime, great unexpected impulse, small volumes
Communication, social media, etc	Normal, as usual	Severely impacted, in continuous change
Support systems (e.g., transport)	Stable and functional	Impacted and dynamically changed

On the other hand, a disaster is mainly characterized by the level of uncertainty, the variability of demand, and the scarcity of resources and supplies (Day et al. 2012), making the planning process of the humanitarian supply chain more complex (Tofighi et al. 2016). Humanitarian supply chain actors can minimize logistical complexity through the systematic organization, allocation and understanding of specific functions, and identification of barriers (Heaslip et al. 2012; Kabra et al. 2015). Thus, the generation and consolidation of inter-organizational coordination of logistics operations (Tatham and Spens 2011) facilitate the division and organization of responsibilities, competencies, and resources; Actors need to know that their roles can change according to the stages of the disaster, capacities, and access to resources (Jensen and Hertz 2016).

Whereas logistics processes represent 80% of the total costs in disaster care (Van-Wassenhove 2006; Rodríguez-Espíndola and Gaytán 2015), logistics coordination becomes a critical factor in the performance of humanitarian logistics (Balcik et al. 2010). It is important to note that coordination enhances efficiency and effectiveness indicators in operational costs, delivery times, coverage levels, and beneficiaries' satisfaction (Balcik et al. 2010; Jahre and Jensen 2010; Akhtar et al. 2012). Supply chain management requires coordinated execution of operations for satisfactory results when chain members are focused on achieving global optimal (Nikbakhsh and Farahani 2011). Thus, effective relationships between organizations improve process management and overall chain performance in agility and adaptability (Cozzolino 2012; Makepeace et al. 2017). The humanitarian supply chain must integrate all actors to react and coordinate their different links (Ganguly and Rai 2016). Figure 3.1 shows the various actors involved in the humanitarian distribution network.

As the number of actors involved in disasters grows, the complexity of the network becomes difficult (Balcik et al. 2010; Bharosa et al. 2010), and at the same time, donor pressure for transparency in the use of resources grows (Cozzolino et al. 2012). It should be noted that, in the disaster zone, there are also exogenous situational

Fig. 3.1 Actors in the humanitarian aid distribution network

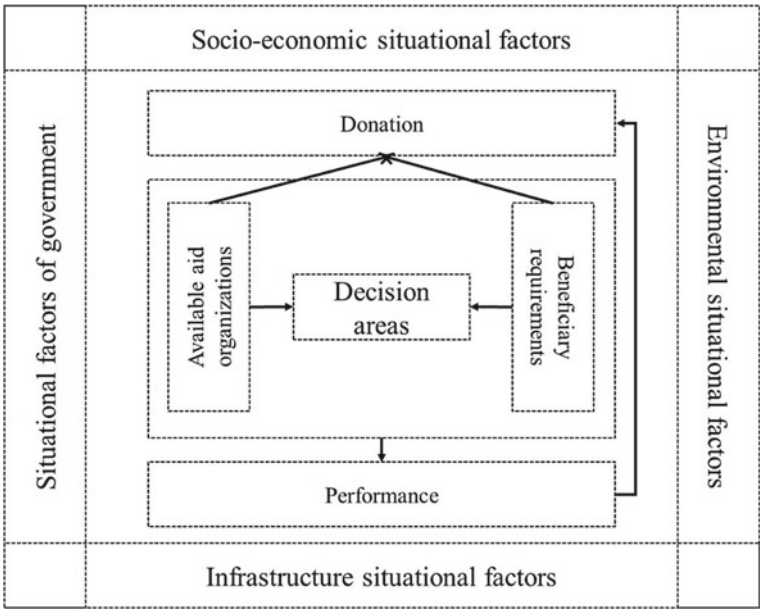

Fig. 3.2 Situational factors in the disaster zone

factors or contextual variables (Fig. 3.2), which have a direct impact on the performance of humanitarian logistics (Kunz and Reiner 2012). Aid organizations do not control these factors or variables, but the effect can be reduced based on the skills organizations have in managing them.

Some of the challenges in humanitarian supply chains after a disaster are (Day et al. 2012):

1. *Management and control problems.* Recognition of government's role at all levels, as international agencies, cannot take any action if local government does not request it.
2. *Life or death.* The effectiveness of humanitarian supply chains is represented by the number of victims alive or killed in the disaster.
3. *Supply chain formation.* The specific group of organizations assembled by a disaster depends on the location, nature, and severity of the disaster, availability of potential units for a response, expected needs, and official procedures.
4. *The independence of donors.* The effort to help after a disaster often depends on donor organizations to provide the necessary goods and services.
5. *High levels of uncertainty.* After a disaster, humanitarian supply chains operate with high levels of uncertainty about the location and distribution of the disaster, victims' needs, donor contributions, the composition of infrastructure, and aid groups.
6. *Dynamic general priorities.* Although speed can significantly reduce the loss of human life and suffering, it is difficult to achieve it at a time of high demand

uncertainty. As a result, aid organizations frequently "push" available supplies into the disaster area as quickly as possible. Simultaneously, response efforts focus on demand, using the information on damage and needs to "pull" supplies to victims.

7. *Dynamic operational needs.* Local conditions are highly dynamic, requiring different responses, resources, and capabilities.
8. *Participants with their initiative.* It is common for individuals, groups, or organizations to want to help. It is essential to recognize that participants with their initiative have social capital and relationships, increasing aid capacity when required and not. They can also smooth out potential conflicts between organizations resulting from differences in culture, religion, gender, and race or ethnicity. However, good intentions become problems as (a) they demand logistical capacity, coordination, communication, and livelihood like everyone else, and (b) generally disrupt or complicate the efforts of others. Sometimes, the donation of materials or other goods creates turbulence that complicates the supply chain's management.
9. *A large number of actors.* It increases the problems related to coordination activities and the information-sharing process.
10. *Advertising and press.* The press always accompanies a disaster, but it generates costs and benefits. For example, the press can direct attention to problems in supply chain performance. On the other hand, publicity derived from the coverage of a charitable organization at the disaster site can help generate donations.
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3.3 Case Study: Earthquake in Mexico September 19th, 2017

On September 19th, 2017, the National Seismological Service (SSN) reported an earthquake with magnitude 7.1 located on the state boundary between Puebla and Morelos, 12 km southeast of Axochiapan, Morelos, and 120 km from Mexico City. The quake, which occurred at 1:14:40 p.m., was strongly felt in the center of the country. The epicenter coordinates are 18.40 latitude N and −98.72 longitude W, and the depth is 57 km (Fig. 3.3).

The earthquakes in Mexico in September 2017 showed the fragility and vulnerability of the cities and towns of the country (Fig. 3.4). These events exacerbated the current fragile situation that the government did not attend to in the past. However, government deficiencies in infrastructure and education were discovered, and the scarcity of supply chain professionals reduces the efficiency and effectiveness of

Fig. 3.3 The epicenter of the earthquake

Fig. 3.4 Damages in Juchitan, Oaxaca

humanitarian aid in the most affected places. Therefore, humanitarian logistics is essential to improve response procedures in Mexico in recurrent catastrophic events.

The National Coordination of Civil Protection of the Ministry of the Interior, through its four General Directorates: Civil Protection (DGPC); Linking, Innovation and Normativity (DGVIN); Risk Management (DGGR); and the National Center for Disaster Prevention (CENAPRED), implement the following actions: (a) the MX

Plan was activated and through the DGPC the National Emergency Committee was installed, this was responsible for coordinating support for the federation entities concerned, (b) the DGPC established permanent communication with the authorities of the federal entities where theism was perceived, as well as the Federal Units to integrate a preliminary damage assessment, through the National Communication and Operations Centre (Cenacom), (c) national search and rescue teams, (d) were activated and convened, (d) a link was established in the Crisis Room and the CDMX C5 Emergency Operations Centre, (e) a Command Post (CNAR) was established, where the operational base was installed to coordinate the actions of national and international search and rescue teams.

On the other hand, the Ministry of Foreign Affairs and the Governments of the Federal Entities will carry out the channeling and logistics of supplies of international aid to reach each affected population. The tremendous damage to the earthquake was in Chiapas, Oaxaca, Morelos, Puebla, and Mexico City. The houses suffered a partial or total injury, which has historically been one of the most neglected areas of public policy (Puebla 2002; Schteingart 2018), being more critical municipalities and localities with less population than in the big cities as interference of the housing policy is minimal. Under the assumption that the effect of the earthquake in Juchitán is linked to social and housing vulnerability. It is known that in Mexico City, 60 buildings collapsed, 22 thousand 182 buildings suffered less severe affectations, Fig. 3.5 is enormous, and there was undoubtedly no capacity to verify it immediately.

Although CENAPRED had designed a protocol and network to review real estate security after theism, the formats neither the criteria nor the expertise were standardized in transparent processes. Databases were not approved or concentrated. To date, they are a cause for uncertainty, as the lack of official opinions that many people lack is a problem in the reconstruction process. Currently, a final death toll of 369 people is confirmed: 228 death in Mexico City, 74 in Morelos, 45 in Puebla, 15 in the State of Mexico, 6 in Guerrero, and 1 in Oaxaca; and more than 14,000 families affected in Mexico City alone. However, the lack of transparency of government

Fig. 3.5 Damage in Mexico City, Mexico

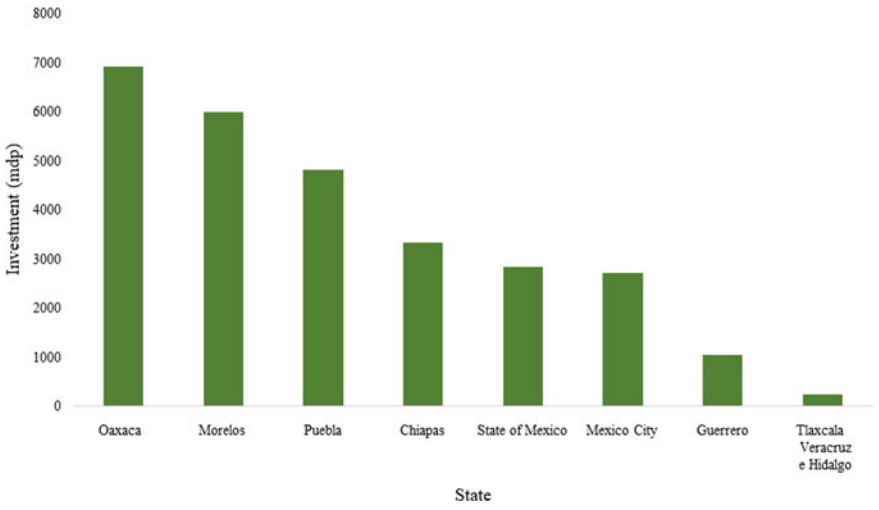


Fig. 3.6 Investment to rebuild the entity

programs and donations has limited the reconstruction of the damage. However, at the morning presidential conference (March 2021), it was mentioned that 9% of the actions to rebuilding homes, hospitals, schools, and real estate of cultural heritage are still pending, i.e., the progress to date is 91%.

Oaxaca is the entity with the highest investment (millions of Mexican pesos) with $6,916; followed by Morelos with $5,985; Puebla with $4,821; Chiapas with $3,335; the State of Mexico with $2,842; Mexico City with $2,717, and Guerrero with $1,029; in Tlaxcala, Veracruz and Hidalgo approximately $225 have been allocated (Fig. 3.6). Of the total resources, 15.2% of the National Natural Disaster Fund (FONDEN), one of the funds disappeared on the initiative of the current federal administration. In contrast, from the Multi-Contribution Fund (FAM), 12%, 32.4%, were raised from the Federation's Egress Budget, and 19% through insurance.

The Committee on Reconstruction has not achieved coordination between units; there is no single file for victim or property; it is the neighbors who seek the different secretariats to deliver the same documents for similar procedures. The dispersion of the budget and formalities between the units have also resulted in a weak commission that cannot impact public spending or sanction officials who do not provide information. The earthquakes of September 2017 showed the country's lack of disaster prevention and preparedness. Despite updating technical standards and regulations, the government does not have an inventory, measures, or funds to strengthen or renovate buildings.

On the other hand, we do not know whether we live in areas of greater risk, nor the precise recommendations for maintaining our workspaces, housing, or study centers. The earthquake also made clear the lack of qualified professionals to assess damages and recommend measures. Finally, the authorities cannot coordinate professionals and trade unions, which has led to a lack of accurate and timely diagnoses. The

Fig. 3.7 DN-III-E Plan and health brigades in Chiapas and Oaxaca

absence of professionalization of civil protection at the different levels of government and the C5 operations center did not coordinate institutional efforts. The DNIII Plan (Fig. 3.7) was actually (if not ignored) by the social solidarity used by current technology and social capital networks, including hundreds of chats, data, collaborative maps, and volunteer chains mobilizing resources.

3.4 Humanitarian Supply Chain Strategies

Efficient and effective supply chain management allows humanitarian organizations to make the best use of resources to address high-priority needs in the shortest possible time, under the restriction of limited funds. However, humanitarian logistics are highly dynamic, often informal or improvised, and far from unification. Under these conditions, it is essential to identify the main strategies that will improve the performance of the humanitarian supply chain (Fig. 3.8).

3.4.1 Planning

Planning is a crucial strategy at any stage of humanitarian logistics; that is, the government must prepare and continuously revise the National Emergency Plan and constantly update it before the disaster, which is essential for its proper post-disaster functioning. Planning before the tragedy demands a significant investment of efforts but helps to improve knowledge of possible areas of operation, identify both weaknesses and needs, as well as solutions and alternatives. Planning should be based on the geographical, social, political, and physical context of the areas where managers will carry out logistical activities. Government and society should dismiss

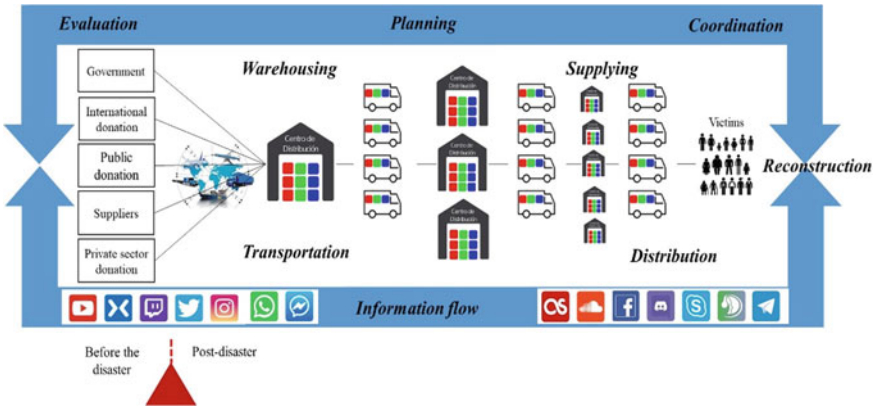


Fig. 3.8 Humanitarian supply chain strategies

the misconception that logistics is improvised at the time of disaster since the catastrophes to which society is exposed as the needs they generate are predictable. The National Emergency Plan should be directly related to infrastructure vulnerability and resource analysis and the particular plans of organizations involved in disasters (Fig. 3.9).

Infrastructure vulnerability analysis should identify the strengths and weaknesses of the country or region's strategic real estate works and resources under study and provide alternative actions in the event of a collapse of the infrastructure available. To do this, government and humanitarian associations must:

- Systematically map and review critical elements of the national transport infrastructure, such as strategic route capabilities and difficulties, potential bottlenecks,

Fig. 3.9 National Emergency Strategic Plan

availability of communications resources, risks, and blockages due to the impact of an event.
- Analyze annual climate records to determine the impact of the weather on the capacity of the transportation system at different times of the year.
- Regularly monitor major modifications or constructions that could lead to bottlenecks or different temporary routes.
- The availability of strategic resources for logistics support is dynamic, so periodic reviews must be up-to-date. This resource review includes both the private sector, the public sector, and the non-governmental sector, both domestic and international. This way, it will have:
- Inventory of sources and location of different types of supplies, including delivery times to provide critical resources that victims might need in an emergency, such as medical and rescue equipment, food, clothing, fuel, among others.
- Inventory of transport modes for the mobilization of persons and provisions, with specific information of transport capacity, such as fleet size, type, and capacity, location, rates, availability, etc.
- List of places for the logistics operation, depot and fuel supply centers, including public and private facilities, ample storage complexes, factories, and other facilities to adapt it.
- Identified the locations and capabilities of ports and airports to handle emergency supplies under different scenarios.
- List of feasible routes in emergencies.

Review government policies, plans, and preparations; the government is primarily responsible for assistance and coordination between the different actors in the humanitarian supply chain. Actors should reach mutual collaboration agreements to facilitating emergency activities, such as tax exemption for humanitarian supplies, priority treatment in customs formalities, etc. Effective planning can significantly prevent loss of life.

3.4.2 Information Flow

It is essential to maintain the information flow with all potential identified actors in the humanitarian supply chain for creating an effective response and recovery plans from lessons learned from other disasters. The information flow integrates technology, actors in the humanitarian supply chain and affected community; however, to improve the quality of information, there are three basic principles (ONU-OCHA 2012):

- Information is a basic need.
- Everyone can generate valuable information (disaster victims, society, and supply chain actors).
- Information creates more value when it is widely and freely shared.

The community can contribute helpful information even when the Internet is not available. Free applications developed on mobile devices allow it to send messages between mobile devices without an Internet connection or the cellular network. Therefore, people are the sensors: people collecting and sharing information to help in the recovery process (Laituri and Kodrich 2008). So, a person is considered a mobile smart sensor if who has interpretation and integration skills, which vary according to the experiences. Users can improve skills through mobile phones with integrated GPS, digital cameras, and tracking devices (Manfré et al. 2012).

Strengthen information systems to provide real-time, up-to-date, and integrated information to expeditiously develop and execute reality-adjusted recovery plans and needs in each territory. The standardization of collaborative technology platforms allows verification and systematizing large amounts of data in real-time. So, citizens locate family members and neighbors and alert rescuers to disaster points by supporting the changing needs in a coordinated way. In addition, the availability of a logistics information system in a disaster situation helps in the efficient management of assistance.

3.4.3 Evaluation

The evaluation will identify an approximation of the logistical and supply needs of the inhabitants, the capacities available locally, and the restrictions and facilitation in the disaster zone (Fig. 3.10). This assessment should be comprehensive in determining the type and extent of damage and the most urgent areas of intervention. The speed and quality of this assessment are crucial, as requests for supplies will be made based

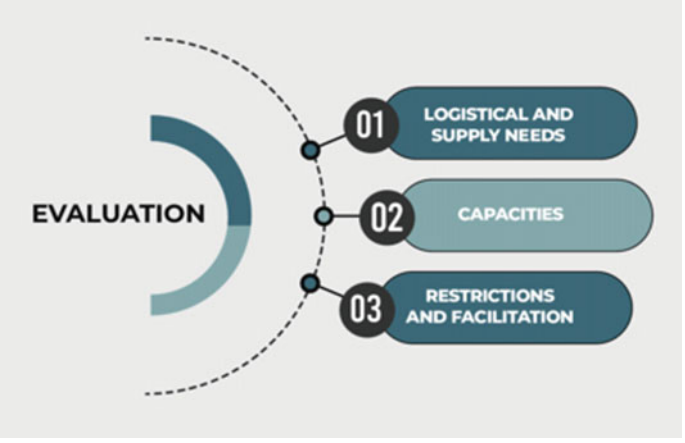


Fig. 3.10 Actions evaluation

on the identified situation. However, evaluation should not be a paralyzing activity; evaluators can initiate the most urgent actions even if the rescue is not complete.

It is essential to know the logistical needs to perform the functions correctly in the emergency context. When planning is effective, the determination of available and missing resources is simplified. On the other hand, supply needs are often dynamic and changing, so the assessment should identify the needs of the current situation and anticipate future needs. Disasters should not be typified; the generated requirements depend on the type of event, socio-economic characteristics, and other specific aspects (socio-environmental and cultural) of the affected region or country. As evaluations continue, preliminarily, it is possible to determine what type of assistance will likely be needed and initiate response activities. As evaluations continue in the short term, they will reveal more specific aspects of the required care. Generally, the possible basic survival needs are:

- Health
- Water
- Food
- Shelter
- Sanitation

Assessing capacities involves knowing the resources available in operations and the local aspects that could facilitate or complicate supply management. For example, disasters often affect lifelines, including communication routes and infrastructure in general, so rapid verification of the availability or operationality of sites and means for the mobilization and arrival of supplies, such as:

- Ways and means of communication for the delivery of supplies
- Sites for storage of supplies
- Availability of means of transport

Restriction or facilitation measures for the entry of foreign organizations, in addition to the regulation for mobilization in the affected areas, religious, political, or health reasons sometimes restrict the access into the country of any product or material. On the other hand, some Governments take exceptional measures to facilitate the tasks of organizations involved in the aid of victims and allow for more flexible procedures for the entry of humanitarian assistance. The evaluation must mention restrictions and/or facilities in the displacement of work equipment and supplies.

3.4.4 Coordination

The coordination of logistics systems must be transparent; humanitarian supplies must be beneficial to populations in crisis. The various actors that assist the affected people are of different origins, mandates, and working methods. Although all have the same will for help, lack of coordination, poor information flow, and minor teamwork cause delays in victim care, duplication of effort, and waste of resources. Assistance

tasks require a coordination effort to minimize difficulties and maximize resources. Coordination should be initiated with a cross-sectoral, inter-agency, and interdisciplinary vision before emergencies occur and strengthened immediately after the disaster.

There are permanent and temporary structures for humanitarian aid in each country; Civil Protection for Mexico, which is responsible for coordinating aspects related to national emergencies, is generally a permanent structure. Minor emergencies are addressed by national agencies and sometimes by some international organization, and when they are significant events, they are addressed by various actors, both national and international such as:

- Local population
- Neighboring communities or regions
- National or local government
- Foreign governments
- Multilateral agencies
- National and international non-governmental organizations
- The private and commercial sector
- Specialized institutions
- Military forces

Agreements must be concrete and feasible, not generate expectations of non-compliance; the effort must be geared toward cooperation and mutual support that allow for rapid and diversified assistance. On the other hand, when the effects of the disaster exceed the country's available capacity to respond adequately, the federal government will request humanitarian aid to the international community, usually channeled through the United Nations and diplomatic representations abroad. Similarly, the national subsidiaries of some international organizations will make applications to their respective headquarters or other counterparties in the region.

3.4.5 Supplying

Once the requisitions of the affected area are known, it is also necessary to identify sources and forms of acquisition, indicate the conditions of preparation and shipment, and the shipping procedures (Fig. 3.11).

Requisitions need to be clear and concrete so that supplies are available as quickly and accurately as possible. Order forms can avoid requisition errors, which must specify the details of the articles, priority, volume, frequency. Emergency supplies come from various sources, whether organizations purchase them directly, are donated by the national and international community, or provided by collaborators. In a disaster, all these modalities are combined. However, it is not always able to choose among them the most appropriate. Managers must decide based on technical criteria to minimize response times.

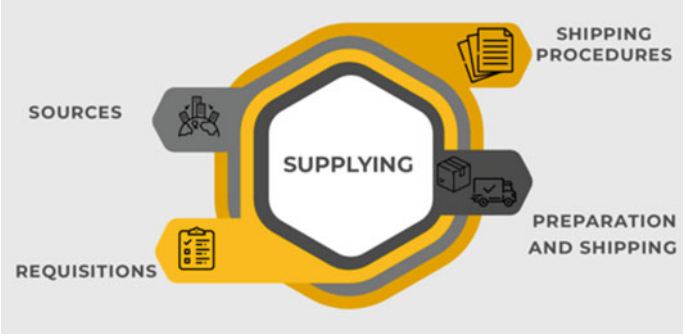


Fig. 3.11 Supply functions

The preparation of shipments plays a vital role in humanitarian logistics. Ideally, the shipped supplies are separated and classified because it would facilitate the delivery of humanitarian aid in the affected area. Do not ship products whose quality or condition is not safe. Avoid the shipment of products whose expiration date is very close except in early use or distribution cases. Many international organizations use symbols and colors to identify content. For example:

- Green for medicines and medical equipment;
- Red for food;
- Blue for clothing and household goods; and
- Yellow for equipment and tools, among others

The shipment of supplies must follow a procedure to ensure that everything is correct and transparent, as inquiries are not suitable in an emergency operation.

3.4.6 Warehousing

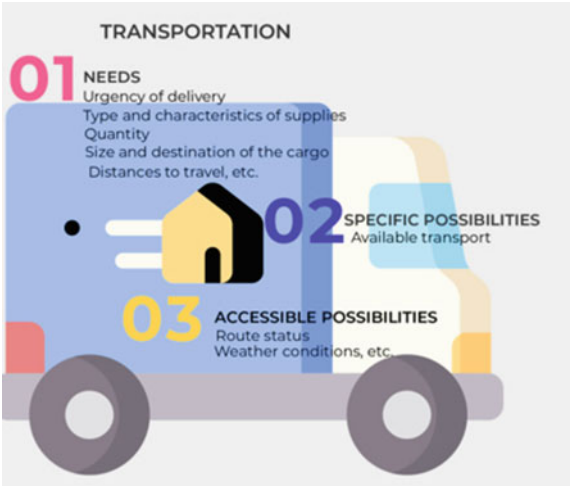
During emergencies, collection centers (courtyards, offices, garages, among others) are often set up to receive donations. However, it is complicated to organize a storage system in these sites, mainly because of the lack of space. However, collection centers can separate and classify donations and send only those considered helpful products to warehouses. On the other hand, warehouses must safeguard supplies until distribution or use. Still, it is a matter of having a space to store and an organized system that allows knowing the type, quantity, and location of the existing provisions. The organization of a warehouse must have the necessary standards for the optimal care of supplies. However, in the reality of emergencies, most of the time, it is necessary to improvise the available spaces (schools, communal centers, gyms, etc.), which have not been designed for storage. Nevertheless, even under these circumstances, warehouses should consider effective and efficient operations (Fig. 3.12).

Fig. 3.12 Important aspects of warehouses

3.4.7 Transportation

The various routes and means of transport have different characteristics and requirements that reflect advantages and disadvantages according to the particular situation of the operation and ranging from its costs to its capabilities. Nevertheless, in deciding the transport type, other variables are involved in the identified needs and the specific and accessible possibilities (Fig. 3.13). Managers will not always have the necessary resources to pay for the ideal transport, i.e., perfect transportation will not always be available. Furthermore, the conditions of access to the area will not allow the use of a specific type of transport even if it is available. For this reason, the challenge is not only to determine needs but also to real possibilities and alternatives. For each planned means of transport, there should be an alternative plan for the case where circumstances make it impossible to use.

Fig. 3.13 Considerations for transporting supplies



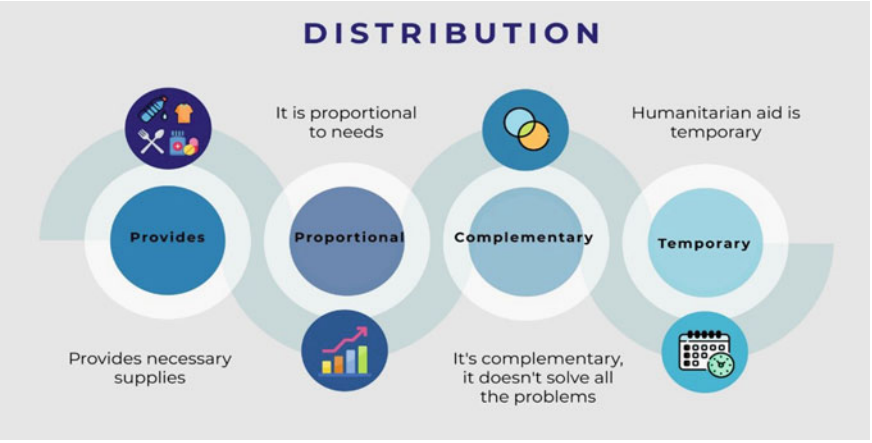


Fig. 3.14 Scopes of distribution

3.4.8 Distribution

Distribution cannot be a generalized and indiscriminate action but must instead be proportional and controlled (Fig. 3.14). While each organization has policies and motivations regarding disaster assistance, some criteria must transcend the individuality of organizations and be applied as basic principles for more equitable and effective distribution. On the other hand, it is necessary to control and monitor the revenues, the dispatches, and outputs of products of the warehouses, and the proof of distribution to have continuously updated inventories. The revision of documents is not sufficient and should therefore be supplemented by physical verification at distribution sites, not only for accounting reasons but also for observing and determining the adequacy of the procedures used, identifying needs, correcting problems, etc.

3.4.9 Reconstruction

It is focused on restoring the normality of life, so it is essential to reactivate services to the community and its sanitation. Activities should focus on rehabilitation, demolition, enablement, repair, reconstruction, construction, etc. Reconstruction is often conceptualized and designed to return to normal development conditions, which were enjoyed before the disaster. Often leads to the reconstruction of existing risk conditions before the disaster, preparing for future disasters, and possibly contributing to the country's debt levels increase thanks to loans for reconstruction.

Similarly, people begin to recover spontaneously, rebuilding and reproducing even conditions riskier than those that existed before the disaster occurred. Thus, when providing appropriate technical support for recovery efforts early, it is possible to

consider risk management and reduction considerations within initiatives from the outset, avoiding risk reconstruction and addressing underlying causes.

3.5 Discussion

Logistics operations in the humanitarian supply chain are much more complex than those in business logistics, not only because there is a need to respond immediately to unpredictable situations in terms of demand (how much) and because there is uncertainty when, where, and how will provide aid. For example, even in places prone to natural disasters, where contingency and evacuation plans are available, there are always variations and eventualities which were not foreseen. In addition to uncertainty, donations that are not needed add complexity, causing saturation in humanitarian organizations' warehouses. Not to mention the problem of local policies (e.g., customs) that cause bottlenecks and minimize the flow of resources required to satisfy the basic needs for the survival of the affected people.

While it is challenging to prepare for a disaster, more disaster-prone areas can achieve better results by implementing a planning strategy than distributing aid once the disaster has occurred. Planning allows the anticipation and preparation of national, regional, and local institutions and citizens. Unfortunately, humanitarian supply chain operations are highly complex, as there is a need to respond immediately to unpredictable situations, implying high flexibility. Therefore, strategies must provide the essential components from planning as a crucial and determining element. In general terms, the guiding principles of action are:

- Speed, coordination, and coherence
- Recovering the destroyed by improving the quality of services
- Rebuild with respect and protection of the characteristics of the natural environment and local customs

All information and activities carried out in the planning should be accessible and timely for all national, local, and international actors involved in a disaster. Providing for early policies, mechanisms, and instruments and formulating guidance allows for an adequate articulation between emergency care and recovery and for it to be sustainable and not to reproduce risk. Needs assessment is the basis of disaster impact decision-making to provide a solid foundation for a recovery process. On the other hand, it is necessary to improve coordination between governmental, intergovernmental, and non-governmental risk management actors to create institutional and operational capacities and better prepare strategic areas subject to hazards and vulnerabilities. Finally, the recovery tends to be the longest lasting and the most economically resource-efficient.

3.6 Concluding Remarks

LH should optimize financial resources (considering there are no demand planning processes) and certify suppliers who produce and market products suitable for survival. It cannot buy everything at any price, although the costs are not definitive at the time of purchase.

Each disaster situation is unique, and the inherent difficulties determine the level of challenge to face to bring provisions and resources to the affected regions. Therefore, the application of knowledge and skills, plus the mobilization of people and materials, is essential for the rapid and effective care of the affected population.

Frequently, disaster sites are flooded with tons of supplies, many of which do not satisfy the needs of the affected population, which is a significant problem for relief workers. However, disasters offer unique (albeit transitional) opportunities for change.

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