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Issues in disaster relief logistics

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5

Issues in disaster relief logistics

Nezih Altay

[T]he most deadly killer in any humanitarian emergency is not dehydration, measles, malnutrition or the weather, it is bad management . . .

*(John Telford, former senior emergency preparedness and response officer,
United Nations High Commissioner for Refugees)*

This book covers scientific approaches and issues thereof to predicting, preparing, and responding to large-scale disasters. Even though scientific models may help tremendously in capturing most of the facets of each of these three stages, softer and hard-to-model issues surface at their interface. This chapter primarily looks at the soft issues at the interface of preparation and response which is logistics. Logistical problems in the private sector have been widely researched in the field of operations research and management science. This chapter reviews some of these modeling approaches that relate to disaster relief. However, the logistics of disaster relief present certain complex challenges that cannot be easily incorporated into mathematical models, yet directly affect the outcome of relief operations. Such challenges are the main interest of this chapter.

5.1 Introduction

In 2003, 700 natural events caused 75,000 deaths (almost seven times the number in 2002) and more than \$65 billion in estimated economic losses, and affected 213 million people (United Nations Economic and Social Council [ECOSOC], 2004). In 2004, an estimated 244,577 people were killed in disasters globally. In 2005, natural disasters caused estimated economic losses in excess of \$150 billion, with hurricanes Katrina and Rita, which ravaged the Gulf Coast of the United States, responsible for 88% of this amount. Within the first 5 months of 2006, natural disasters have already caused 12,718 deaths and \$2.3 billion in economic damages.¹ This increasing trend in the occurrence of natural disasters is clearly presented in Figure 5.1.

Unlike our common inclination to believe that disasters are low-frequency high-consequence events, some disasters such as floods, cyclones, and droughts tend to affect the same regions repeatedly. For example, Vietnam and the Philippines have suffered serious floods every year between 1999 and 2005. Central America and the Caribbean are frequent targets for hurricanes with more than thirty hits in 2005. More than 1,000 tornados hit the United States every year, most occurring in the central plains states, also called “tornado alley.”

¹ Data compiled from EM-DAT, an international emergency disasters database (www.em-dat.net).

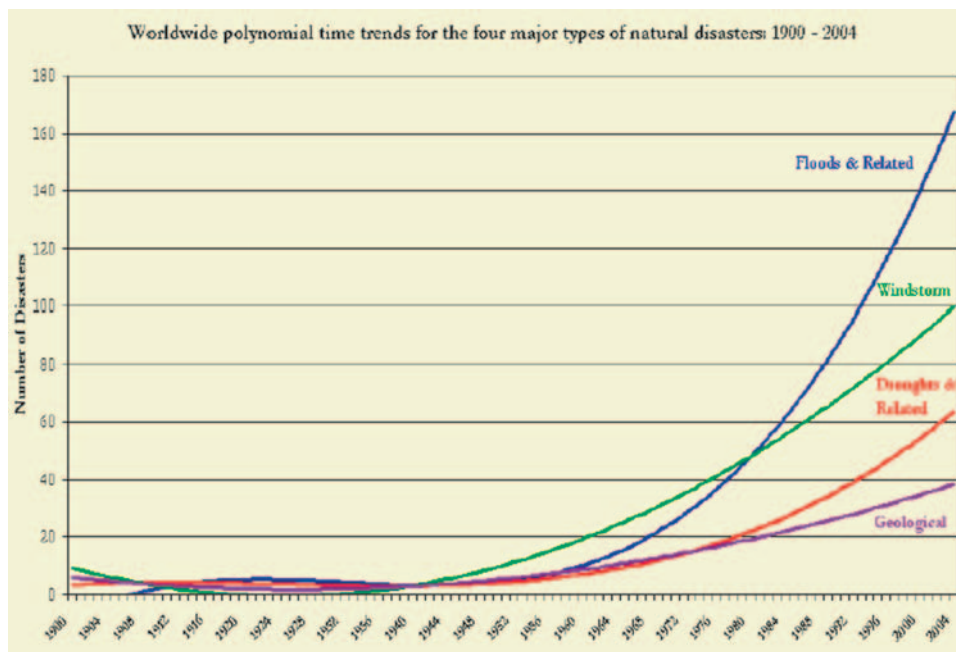


Figure 5.1 Natural disasters are occurring more frequently. *Source:* EM-DAT (2005).

The previous data suggests that as populations shift and their densities increase, and as supply networks grow and their interdependencies widen, concern about disasters becoming increasingly severe is very real, thus making better management of relief efforts critical. Disaster relief operations will need to increase in size and value, reinforcing the need to develop better preparedness programs. Preparedness is the key to a successful response to disasters, and logistics serves as a bridge between preparedness and response.

The Fritz Institute defines humanitarian relief logistics as “the process of planning, implementing and controlling the efficient, cost-effective flow and storage of goods and materials, as well as related information, from the point of origin to the point of consumption for the purpose of alleviating the suffering of vulnerable people” (Thomas and Kopczak, 2005, p. 2). This definition is parallel to the supply chain management concept in the private sector. Therefore, similar to the case with their corporate counterparts, success in humanitarian supply chains will depend on effective communication, coordination, and collaboration among supply chain partners.

Coordinating and collaborating during an emergency is not a trivial task. The mere size of the problem requires the involvement of international agencies, military forces, local authorities, and nongovernmental organizations (NGOs), creating bureaucratic and communication and collaboration difficulties. The response of the International Federation of Red Cross and Red Crescent Societies (IFRC) to the Gujarat Earthquake gives a good indication for the scale of the problem. Within 30 days of the incident, the Logistics and Resource Mobilization Department organized the delivery of forty-five charter planes full of 255,000 blankets, 34,000 tents, and 120,000 plastic sheets along with various other relief items for 300,000 people (Samii et al., 2002). Controlling the procurement and flow of goods into the region is only one side of that equation (Trunick, 2005). In most disasters,

information is scarce, and coordination rarely exists (Long and Wood, 1995). Furthermore, disasters often occur in developing countries with poor transportation and communication infrastructures (Nollet, Leenders, and Diorio, 1994). Efforts are duplicated and agencies compete with each other for supplies, driving up prices. In addition, political constraints and domestic or international conflicts routinely make the situation more complicated. Often, corruption and bribery increase operational costs even during times of normalcy (Hecht and Morici, 1993).

Hence, coordination and collaboration between aid agencies is critical and requires investing in building strong supply chains. For many aid agencies, however, the design of high-performance logistics and supply chain operations is not a priority. This lack of investment into logistics, along with the unpredictable nature of emergency incidents and the intermittent nature of funding leads to high employee turnover, lack of institutional learning, and operations based on poorly defined processes and disjointed technologies (Thomas and Kopczak, 2005).

The situation is not as bad as it seems though. The humanitarian sector seems to have come to realize of the criticality of logistics. The United Nations (UN) and other large humanitarian actors are taking the lead in bettering coordination and logistical operations. In addition, academics are now also interested in making contributions to this field. For example, the fields of operations research and management science are applying advanced analytical methods to help make better decisions. Optimization models have been developed for routing vehicles, allocating resources, and locating collection centers, and many more interesting problems in disaster relief logistics are being uncovered.

In this chapter, we first summarize some of the previously mentioned logistical challenges in the disaster relief sector. Then we attempt to provide a review of the important issues in this context keeping an eye on developments in operations research and management science. Finally, we identify key issues that will have the greatest impact if resolved.

5.2 Disaster relief issues identified in literature

In February 1995, the IFRC, in collaboration with the Danish Red Cross, Danish International Development Agency, and European Community Humanitarian Office, identified key factors to incorporate into the federation's disaster response methodology. The report took the lead in identifying some important issues still current for many aid agencies, such as standardization of services, transparency and accountability, building capacity, capabilities for preparedness, and decentralization (IFRC, 1996).

Later, the director of the Logistics and Resource Mobilization Department of IFRC, together with researchers from INSEAD in France, reiterated that obtaining funds dedicated to support preparedness and capacity building, identifying optimal structures for coordination, and clearly defining roles of involved agencies remain as supply chain challenges for most relief organizations (Chomilier et al., 2003). Lars Gustavsson, the director of Emergency Response and Disaster Mitigation at World Vision International, agreed with the funding problem. Chomilier et al. (2003) pointed out and added to this list the lack of depth in knowledge and lack of investment in technology and communication as factors hindering the ability of NGOs to incorporate best practices emerging in the private sector (Gustavsson, 2003).

Recently, based on several excellent case studies he authored or coauthored and his interaction with major humanitarian agencies, Van Wassenhove (2006) identified significant issues facing humanitarian logistics teams as complex operating conditions, safety and security, high staff turnover, uncertainty of demand and supply, time pressure, a need for

robust equipment that can be set up and dismantled quickly, large number of stake holders, and the role of media.

Other research focused on observations of humanitarian activity in specific events. For example, after observing the response to Hurricane Georges in the Dominican Republic, McEntire (1999) listed inadequate preparedness, absence or unreliability of disaster-related information, difficulty of needs assessment, unjust distribution of aid, centralization of decision making, insufficient amount of aid, and distrust in emergency managers as perpetual problems of relief logistics. A Fritz Institute survey of humanitarian agencies after the Indian Ocean Tsunami revealed that assessments of needs and planning were inadequate, collaboration and coordination were limited, and supply chain processes were largely manual (Fritz Institute, 2005). Further research by the Fritz Institute identified lack of recognition of the importance of logistics, lack of professional staff, inadequate use of technology, and limited collaboration as some of the common challenges in humanitarian aid logistics (Thomas and Kopczak, 2005).

Logistical challenges in disaster relief highlighted in the literature are summarized as follows:

- Need for capacity building for preparedness
- Lack of funds dedicated to preparedness
- Centralized decision making slowing down response
- Lack of standardization of services
- Need for better coordination
- Tough operating conditions
- Safety and security problems
- High personnel turnover
- Uncertainty of demand and supply
- Need for affordable and robust equipment and technology
- Large number of stakeholders
- Need for more transparency and accountability
- Unreliable or incomplete influx of information
- Lack of recognition of the importance of logistics

Some of these issues are inherent to the very nature of the disasters. For example, disaster relief agencies will always be under time pressure with sudden-onset events such as earthquakes. The operating conditions will always be complex due to the chaotic nature of damage. Other issues mentioned previously, however, could be resolved or at least relaxed if we have a better understanding of the disaster relief business and its logistics function.

In this chapter, we divide logistical issues in disaster relief as supply chain issues and operational issues. With that said, the political and humanitarian nature of disaster relief cannot be ignored because these two areas provide unique challenges that indirectly and sometimes directly interact with relief operations and aid distribution. This chapter also reviews some of the critical political and ethical issues affecting disaster relief logistics.

5.3 Supply chain issues

The definition of disaster relief logistics mentioned in the first section of this chapter is reminiscent of corporate supply chains. However, the flow of physical goods, information, and cash in humanitarian supply chains differs from corporate as depicted in Figure 5.2. For example, shareholders invest in a company expecting financial returns. If returns are not realized, investments cease. Similarly, donors provide money to aid organizations and want

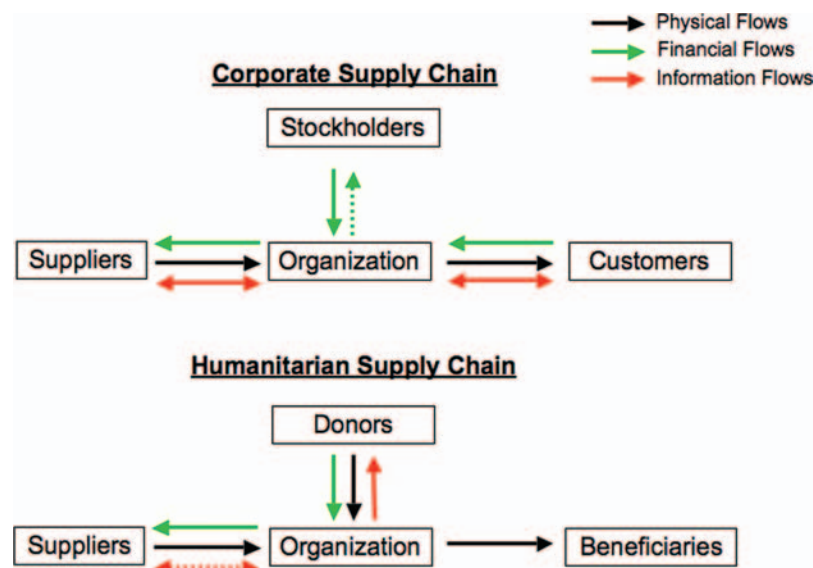


Figure 5.2 Physical, financial, and information flows in corporate versus humanitarian supply chains. *Source:* Blanco and Goentzel (2006).

to be well informed about the results of their philanthropy. If timely and clear feedback regarding the use of their donations is not available, donations may disappear or move to other agencies. With donors being the only significant income source for aid agencies, the quality of feedback becomes crucial for the future of operations.

Donors are not the only stakeholders of humanitarian supply chains. Media, governments, militaries, NGOs, suppliers, third-party logistics firms, and, of course, beneficiaries are all in some form involved in disaster aid operations. Similar to their corporate counterparts, humanitarian supply chains are essentially networks of organizations working for the same objective. Problems are usually strategic and involve all partners in the chain. A well-designed supply chain would thrive through its capabilities like physical and communications infrastructure, and coordination and collaboration among supply chain partners. IFRC's Logistics and Resource Mobilization Department (LRMD) is a good example of this. Recognizing that they cannot operate as an island, LRMD worked to expand the focus of their supply chain from merely purchasing of relief goods to include all activities such as planning, warehousing, training, and reporting (Chomilier et al., 2003).

The World Food Program (WFP) is another excellent example of a humanitarian organization investing in supply chain design. The WFP often establishes its own physical and communications infrastructure during relief operations by using prefabricated, prewired facilities, a logistical preparedness team called the Augmented Logistics Intervention Team for Emergencies, and an information and communications technology support team named the Fast Information Technology and Telecommunications Emergency Support Team. These teams build partnerships with other aid organizations so they can deploy them as standby partners. The main goal of WFP since 2000 has been to improve rapid response capability (Scott-Bowden, 2003). WFP is establishing warehouses in strategic locations to provide storage capacity and act as staging areas for response. Furthermore, WFP's efforts in building rapid local procurement capability allows them to reduce inventory levels significantly.

Supply Characteristics	Long-lead times	<i>Lean</i> Plan and optimize	<i>Hybrid</i> Decouple through postponement
	Short-lead times	<i>Just-in-Time</i> Continuous replenishment	<i>Agile</i> Quick response
		Predictable	Unpredictable
	Demand Characteristics		

Figure 5.3 Generic supply chain strategies in the private sector. *Source:* Christopher (2005).

Supply chains are usually designed to minimize cost, maximize throughput, or minimize response time. The private sector recognized long ago that different product lines require different supply chain designs. Figure 5.3 summarizes generic supply chain strategies based on one characteristic of supply and demand. Humanitarian aid supply chains face the challenge of minimizing response time and minimizing costs (McGuire, 2001). Hence, at first glance, disaster aid seems to fall to the lower right quadrant of Figure 5.3 because demand is usually considered unpredictable and short response times require short lead-times. However, similar to the private sector supply chains, different product families should be handled differently. For example, prepackaged food aid for emergencies is mostly standardized using staples, and could be procured and stocked well before the occurrence of a disaster, suggesting a lean supply chain that can be planned and optimized ahead of time. Portable decompression chambers, in contrast, are used to treat crush syndrome victims after earthquakes for which the demand is unpredictable and delivery lead-times must be short.

The previous example suggests that corporate and humanitarian supply chains have a lot to learn from each other. According to Hau Lee, the codirector of the Global Supply Chain Management Forum at Stanford University, supply chains need to possess three very different qualities to have sustainable competitive advantage: they need to be agile, adaptable, and align the interests of the firms in the supply network so that companies actually optimize the chain's performance when they maximize their interests (Lee, 2004). Agility and adaptability are natural skills that relief agencies have to use every day. However, the corporate world started paying attention to these skills only within the past two decades. For example, WFP's portable operations should be treated as a benchmark for agility and adaptability. In contrast, the humanitarian sector may learn alignment strategies from the

corporate world because it does seem that many NGOs operate independently, causing the overall system to underperform.

Alignment requires standardization of tasks and products and a well-designed infrastructure that consequently will promote coordination through assessment, management, and dissemination of information. However, all this starts with money, and unfortunately, funding for building capacity and capabilities is not always available. These issues are discussed in the following sections.

5.3.1 Funding issues

Many people in this field believe that the main issue holding back many relief organizations from better preparing for disasters is the difficulty of finding funds for building capacity and capabilities for effective logistical operations (Van Wassenhove, 2006). Donors tag their donations with specific spending targets and want to see that their donation has been spent accordingly. Rarely are funds designated for infrastructure or system development. Furthermore, the public approaches the issue of spending with suspicion. In an interview in 2001, the president of World Vision Canada said, "I would say our biggest challenge in Canada has remained pretty much the same. The challenge, as shown by survey work we have done, is an estimated 80% of the Canadian public is still in a position where it questions whether the money and aid they give to the poor actually gets to them" (Moody, 2001, p. 1). Clearer reporting and demonstrable accountability are needed to keep donors satisfied. Therefore, keeping tabs of expenditures is critical for reporting purposes (ECOSOC, 2005).

During the response to the Indian Ocean Tsunami however, one thing that was abundant was donations. Some organizations received far more than they could spend in the response phase. For example, Doctors Without Borders, the American arm of the medical charity Medecins Sans Frontieres (MSM), announced that they received as much money as they can spend and what was needed was "supply managers without borders: people to sort goods, identify priorities, track deliveries and direct traffic of a relief effort in full gear" (Economist, 2005). When MSM asked if they could use some of the money they had raised for the tsunami disaster to address other crises, the government of Sri Lanka complained to the French government (Strom, 2006).

Although this availability of money allowed humanitarian aid agencies to operate without focusing on fundraising, it also put pressure on them to spend funds quickly. Driven by donor pressure for fast results, many of them used it inefficiently by launching simultaneous projects and executing them with large numbers of personnel (ECOSOC, 2005). Sometimes relief items were dumped in order to artificially raise the number of beneficiaries. Unfortunately, such behavior was not exclusive to the tsunami disaster. At the end of 2005, the health minister of Niger charged that some international aid groups had overstated the extent of the hunger crisis in his country as part of a strategy to raise money for their own purposes (Strom, 2006).

Not every disaster draws as much money as the tsunami. There is a close relationship between the influx of donations and the extent of media coverage of and interest in a disaster (Kim, 2005). During the response to the tsunami the media focus was on Indonesia, India, Thailand, and Sri Lanka. However, 4 months after the tsunami, the Indian Ocean state, Seychelles, received only \$4.4 million in response to their appeal, despite their announcement that the estimated cost of repairing damages was \$30 million. Similarly, only 3 % of the funding requested in the UN's 2005 Consolidated Appeal for Somalia had been pledged at the beginning of April of that year (Nyanduga, 2005). Not only is money not usually as

plentiful as it was for the tsunami response, but donors frequently make financial pledges that are later not fulfilled. Ensuring that the promised funds are actually delivered may be a challenge. For example, only one-third of pledged funds for Darfur (Sudan) and Hurricane Mitch were actually delivered (Oloruntoba, 2005).

5.3.2 Needs assessment and procurement

The goal of logistics is to deliver the right product to the right location at the right time and at the right cost. Therefore, the correct assessment of need immediately after a disaster is crucial for sending the right products. The quality of assessment depends on the involvement of the local authorities in the process. For example, in 2002, Malawi, Lesotho, and Zimbabwe declared a state of emergency after the worst crop failure in recent history. The WFP started distributing food mostly donated by the U.S. government, but many African countries refused the food because it was genetically modified. They claimed that their economy depended on nongenetically modified produce, and they did not want to risk contamination. In another case, during the response to the Indian Ocean Tsunami, there were cases where food aid did not match the needs of the survivors. For example, wheat flower was distributed to rice-eating communities in Indonesia and Thailand, and the nutritional biscuits given as part of emergency food aid packages were not chewable by the elderly (Carballo and Heal, 2005).

Identification of the right products needed is important. Then these products need to be acquired, making procurement one of the key initial steps in a successful response to a disaster. A Fritz Institute (2005) report indicates that the NGOs responding to the Indian Ocean Tsunami had preestablished procurement processes, but nevertheless half of them experienced procurement delays because all organizations were simultaneously trying to purchase the same items.

Procurement is one of the areas where relief organizations may learn from the private sector. Some initial response items are common in every situation and could be secured or even purchased and prepositioned ahead of the time. For such items, continuous or periodic review inventory policies have already been developed (Wright, 1969; Whittmore and Saunders, 1977; Moinszadeh and Nahmias, 1988; Chiang and Gutierrez, 1996). These models assume two modes of demand, one for ordinary demand and one for emergency orders. Recently, Beamon and Kotleba (2006) developed such a model with two options for replenishment for humanitarian relief operations. An order size of Q_1 is placed every time the inventory level reached R_1 , the regular reorder point. An emergency reorder option is an expedited order of size Q_2 placed when the inventory reaches a position R_2 (where $R_1 > R_2$). The lead times of emergency orders are assumed to be shorter than the regular orders. The emergency order items are also assumed to have higher ordering and purchasing costs than regular orders.

Not all relief items need to be purchased. Some are donated by the public. However, these donations, called gifts-in-kind (GIK), do not always match the assessed needs of the survivors. Management of the flow of incoming supplies and sorting out the essential items from the inappropriate donations becomes a resource draining challenge to the local humanitarian actors. We refer to GIK that are not sensitive to the local culture and norms and to unsolicited aid that is not useful as “donation pollution.” Although the former undermines a successful aid operation, the latter takes up valuable time and resources. Disaster survivors need help, not pity. In Banda Aceh, a bundle of torn and stained clothes were dumped at the entrance of a camp. Camp residents found this degrading saying, “although we are in this situation we still have our pride” (Solvang, 2005, p. 29).



Figure 5.4 Tons of inappropriate drugs in Southeast Asia. *Source:* www.drugdonations.org.

Unless a relief organization already has a process in place for identifying and preventing unsolicited and inappropriate donations from entering their system, the extra effort of separating, prioritizing, transporting, and storing these items results in delays and increased logistics costs (Fritz Institute, 2005). During the response to the 1993 Bangladesh Earthquake, unwanted goods constituted 95% of all goods received (Chomilier et al., 2003). Diet pills and winter coats were sent to the Dominican Republic after Hurricane Georges (McEntire, 1999). After Hurricane Katrina, tons of donated clothing from all over the United States were sent to New Orleans. The donations exceeded warehouse capacities, and piles and piles of clothing were left to rot away. In the case of the tsunami relief, such gifts included high-heeled shoes and female swimsuits (Fraser, 2005). Wagonloads of quilts arrived from northern India but were of no use in hot and humid coastal regions (Banarjee and Chaudhury, 2005). Tons of inappropriate drugs were donated (Figure 5.4). The October 2005 newsletter of the *Pharmaciens Sans Frontières (PSF) Comité International* (www.psfci.org), on its assessment of medicine donations to Banda Aceh province in Indonesia after the tsunami, reported that 4,000 tons of medicine were received for a population

of less than 2 million people. Nearly 60% were not on the National List of Essential Drugs. Ten percent had expired before they reached Banda Aceh, and another 30% were due to expire in less than 6 months or had missing expiration dates. About 345 tons of donated drugs have been identified for destruction, which was estimated to cost 1.4 million Euro. PSF-Germany has noted that the same problems have also been experienced in Pakistan.

5.3.3 Management of information

In disaster situations, there is a paucity of information. One does not really know how many survivors are present; what their immediate needs are; and how much food, medicine, and water is still good at their homes. This uncertainty reverberates along the supply chain and becomes exaggerated as we move upstream. It becomes very difficult to ship the correct type and quantity of supplies when the information at all levels within the supply chain is imprecise.

During the response to the tsunami, the problem was not absence of information but rather an absence of comprehensive, cross-functional information on the situation across the affected area (Hudspeth, 2005). During the tsunami response, with an unprecedented number of national and international NGOs (UNICEF alone had around 400 partners) the UN Humanitarian Information Center became critical for information consolidation, analysis, and dissemination (Hudspeth, 2005). However, the center did not become fully operational until several weeks after the tsunami (Volz, 2005).

Even though information may be readily available, most relief agencies do not necessarily have the capability to process that information. A 1997 World Disasters Report of IFRC points out that identification of the necessary information in providing effective relief, how it should be used, and the facilitating effect of technological tools on data collection and transfer has not been given much emphasis. As evidenced by Hurricane Katrina in August 2005, disaster response efforts are hindered by a lack of coordination, poor information flows, and the inability of disaster response managers to validate and process relevant information and make decisions in a timely fashion (Thompson et al., 2007). Even if we assume that information is readily and correctly available, the quantity of variables and parameters makes optimal decision making still difficult. As a point of reference, the IFRC catalog of relief items includes 6,000 stock-keeping units. The UNICEF warehouse in Copenhagen carries \$22 million worth of relief supplies acquired from more than 1,000 vendors worldwide. Add to this the problem of donation pollution, and tracking and tracing of inventories becomes a taxing task without the use of information management technology. Outside the large international organizations, most humanitarian agencies use spreadsheets to accomplish this task, and reporting is still done manually (Thomas and Kopczak, 2005). Even if they wanted to develop such technology, they would not have the monetary resources to spend on such a project because donors mainly fund relief efforts rather than preparedness efforts. On average, of funds requested by the World Health Organization in 2002, the supplies component was 37%. Medical and other supplies (excluding vehicles) comprised 35%, and information technology approximately 2% (de Ville de Goyet, 2002). For this reason, the Fritz Institute recently developed the Humanitarian Logistics Software (HLS), which is free of charge. HLS is intended to assist with mobilization, procurement, transportation, and tracking decisions, and produce quick reports. It also connects to financial systems to provide real-time visibility of costs and to allow tracking of budgets (Lee and Zbinden, 2003).

Aid organizations with more resources developed their own technology. One such example is Pan American Health Organization's (PAHO's) Supply Management Software

System (SUMA). SUMA, also available free of charge, is mainly used to sort and identify relief supplies, rapidly identify and prioritize the distribution of supplies to affected population, maintain inventory and distribution control in warehouses, keep authorities and donors informed about items received, and keep managers informed about the availability of items (PAHO, 1999).

Other systems developed in-house include the United Nations' Internet-based operational alert system for earthquakes and sudden-onset emergencies called "virtual on-site operations coordination centers," WFP's International Food Aid Information System, which tracks movements of food aid; and IFRC's Disaster Management Information System to retain existing knowledge within its network (ECOSOC, 2004). Also, in 1991 the U.S. Army's Civil Affairs developed the Disaster Assistance Logistics Information System, a database used for tracking inventories (Long and Wood, 1995).

There have been information systems developed in academia and the private sector to assist emergency managers and relief agencies. For example, Science Applications International Corporation developed the Consequences Assessment Tool Set, which provides decision support with casualty and damage estimation and estimates the amount of resources required to mitigate the destruction and its aftermath. In the academic world, there have been many decision support systems developed, but these are mainly for specific disaster types or scenarios. Two of these systems are the Distributed Environmental Disaster Information and Control Systems developed to help during wildfires (Wybo and Kowalski, 1998) and the Information Management System for Hurricane Disasters, which offers support for preparedness and during and posthurricane response (Iakovou and Douligeris, 2001).

The development of such information systems by and for aid agencies is very encouraging. However, one potential future problem will be coordination using these individual systems, which at this point do not have the capability of communicating with each other. Businesses have already experienced this problem when they tried to coordinate decision making in their supply chains. One greedy solution was to create middleware. Middleware is a software application designed to enable effective information exchange between two systems that are otherwise incompatible. Whether it is middleware or some other solution, these individual decision support systems will need to be able to communicate with each other for effective coordination. This and other coordination challenges in disaster relief are discussed in the next section.

5.3.4 Coordination issues

The relief logistics business is a dynamic one. The actors are not always the same in every disaster. Nor do they have the same task assigned to them every time. Their capacities vary from nation to nation and even year to year within countries. Such uncertainties may easily hinder success of relief operations. Benini (1997) studied uncertainty management and information processing in WFP and UNICEF during their work with victims of the conflict in southern Sudan in 1995, and concluded that cooperation among agencies and public confidence in their work provide functional equivalents for certainty. This means effective coordination may help cope with uncertainties. An excellent review of coordination within social networks in the context of the interactions among public, private, and nonprofit organizations in response to the September 11 terrorist attacks is provided by Kapucu (2005). He showed that dynamic network theory and complex adaptive systems theory are good approaches to understanding social networks and coordination among their nodes.

In a nutshell, coordination is a big challenge given the very different origins, history, geographic, cultural, and political nature of humanitarian actors (Van Wassenhove, 2006).

5.3 Supply chain issues

131

A report to the UN's ECOSOC states that coordination was not always smooth during the response to the Indian Ocean Tsunami. Some communities were flooded with relief items that did not always match the needs. Miscommunication among aid agencies led to duplication of efforts, delays, and ad hoc plans (ECOSOC, 2005).

There are volumes of research regarding coordination and information sharing in the private sector. Chen (2003) reviewed information sharing and coordination in supply chains. When independent entities in a supply chain are sharing information and one entity has superior information, two things may occur. Information may be withheld to gain strategic advantage, or revealed to gain cooperation from others. If the former, the other (less informed) firms may try to provide incentives for the well-informed firm to reveal this private information; this is called *screening*. If the latter, *signaling may occur* (i.e., revealing information in a credible way). Sometimes it may not be possible to identify who has more or less information. In that case, a firm's willingness to share its information depends on if the others are going to share their information and how the revealed information will be used. Whether we look at information screening or signaling, the common assumption is that the firms in the supply chain are independent entities and information is decentralized. This seems to fit the nature of humanitarian supply chains. Although indeed NGOs, military, governments, and so on are independent units with decentralized information, they are not necessarily competing for beneficiaries' interests. This point of view is a better fit for the case with decentralized information but shared incentives. This seems to fit the team model introduced by Marschak and Radner (1972). Organizations only have access to partial information, but they share a common goal—to optimize the supply chain-wide costs or benefits. An organization acting as an information clearing-house can simply remove the assumption of decentralized information in this scenario helping reach other organizations' goals. The following paragraph highlights one such organization.

The United Nations Joint Logistics Center (UNJLC) is taking on the challenge of coordinating large relief efforts by collaborating with various aid agencies, governments, and local authorities around the world. UNJLC was established during the humanitarian response to the 1996 Eastern Zaire crisis to deal specifically with logistics issues such as interagency coordination and asset management during a complex emergency. UNJLC views the disaster relief effort as a "modular" system and seeks to strengthen logistics of individual agencies. It accomplishes that by gathering, analyzing, and disseminating relevant information from and among humanitarian and nonhumanitarian actors (Kaatrud, Samii, and Van Wassenhove, 2003).

For effective coordination, it is important to understand the impediments to coordination in humanitarian settings. Oppenheim, Richardson, and Stendevad (2001) list the barriers to effective coordination within the relief aid supply chains as (1) involvement of large number of parties (in Rwanda, 200, and in Kosovo, 300 aid agencies were present), (2) locating and deploying appropriate skills and expertise, and (3) donor-induced constraints for allocating resources. Further research also found competition for donations, competition for media coverage, and cost of coordinating as legitimate issues hindering effective coordination (Stephenson, 2005).

Clearly, effective coordination is essential for successful relief operations. However, coordination overkill may have an adverse effect. For example, in Banda Aceh alone, UN agencies were holding seventy-two coordination meetings per week, but "most NGOs did not have the resources to attend even a small fraction of these meetings" (Volz, 2005, p. 26). Meetings were held in English without translation into the language of the host country. As a result, many local NGOs stopped attending the meetings.

5.3.5 Transportation infrastructure and network design

Network design is a critical element in building successful supply chains. For example, in the business world, a conventional rule of thumb for minimizing cost is for manufacturers to be located closer to suppliers and for retailers to be located closer to end-customers. However, Dell computers worked around this rule by selling directly to the end-customers. This required a different supply chain network design and gave them competitive advantage. Relief agencies have to think about two supply chains, one before a disaster occurs (preparedness stage) and one thereafter (response stage). The latter needs to be portable, agile, and adaptable, and depends on the local infrastructure much more than the former.

In most disaster scenarios, however, the local transportation infrastructure is often heavily damaged. Alternative transportation mediums and shipping routes need to be explored. For example, the Indian Ocean Tsunami destroyed 200 km of coastline in Banda Aceh, making it completely inaccessible. It washed away roads and bridges, and transformed the coastline with new sandbars and debris restricting the landing of large sea vessels (Figure 5.5). Consequently, access was only possible by helicopters and small boats (Hudspeth, 2005). One airport north of Banda Aceh had no lighting and no fuel available, so it could only operate during the day. Krueng Raya seaport had no handling equipment such as forklifts or cranes in place (Oloruntoba, 2005). In the case of the Maldives, its geography was the main challenge in distribution of aid. With 199 inhabited islands dispersed in a strip running 850 km north to south and with much of the transport infrastructure lost to the tsunami, delivery of water, food, and medical supplies was not a simple task (Brown, 2005). In the United States, Hurricane Katrina destroyed major highways and bridges that connect New Orleans to the rest of the country (Figure 5.6).

5.3.6 Standardization of relief

Coordination and collaboration among the providers of disaster relief would benefit from common standards for assessing emergencies and carrying out relief tasks (Oppenheim et al., 2001). In 1997, a group of humanitarian NGOs and IFRC launched the Sphere Project Initiative to identify minimum standards for relief in five key sectors: water supply and sanitation, nutrition, food aid, shelter, and health services (www.sphereproject.org). The Sphere Project aims to enhance the quality and accountability of humanitarian agencies to help them assist people more effectively. It is a very comprehensive undertaking and resulted in a 340-page handbook. IFRC also introduced standardization to procurement, transportation, and tracking of relief goods along with codes of conduct and frame agreements to improve collaboration and coordination with other agencies. This allowed them to keep donation pollution from diluting the essential relief operations.

5.4 Operational issues

Roughly speaking, operations could be explained as the execution side of a business. It is how strategies are implemented while keeping costs and use of resources as low as possible. Disaster relief agencies frequently find themselves helping the unfortunate while constrained with limited resources. Operations research and management science tools are good fits in solving constrained optimization problems. Altay and Green (2006) provided a review of operations research and management science approaches in disaster operations. Because most of the issues discussed in this chapter are soft issues (i.e., they are difficult to formulate mathematically), operations research approaches on relief logistics focus on



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Figure 5.5 Devastated transportation infrastructure in Banda Aceh. *Source:* BBC News.



Figure 5.6 Interstate 90 was completely destroyed during Hurricane Katrina.

resource allocation, transportation planning, scheduling, and routing. Kaplan (1973) formulated deployment of resources from one location to another as a transportation problem. Knott (1987) modeled the transportation of bulk food as a minimum-cost, single-commodity network flow problem with a single mode of transportation to minimize transportation costs. He used the same model to maximize the amount of food delivered. In a later article, Knott (1988) used linear programming along with expert knowledge to schedule delivery vehicles to distribute bulk relief of food. Similar to Knott's knowledge-based approach, Brown and Vasiliou (1993) developed a real-time decision support system that incorporates linear and integer programming models and simulation along with the judgment of the decision maker to assign resources to tasks after a disaster.

Haghani and Oh (1996) pointed out that the basic underlying problem in relief logistics is to move a number of different commodities using a number of different transportation modes from a number of origins to one or more destinations efficiently in a timely manner. Hence, they formulated a multicommodity, multimodal network flow problem with time windows for deliveries. The physical transportation network is converted to a time-space network and solved using a heuristic algorithm. Later modeling approaches to the transportation of relief were all modeled as realistic multicommodity, multimodal problems, while considering multiple conflicting objectives (Barbarosoglu et al., 2002), stochastic demands (Barbarosoglu and Arda, 2004), and dynamic time-dependent problem setups (Ozdamar et al., 2004).

Although the previously mentioned models are targeting to improve relief logistics by optimal allocation and movement of resources, it should not be forgotten that the most important resource in disaster relief logistics is people. Planning makes sense, and technology helps, but it is the people who execute. Therefore, it is crucial for any aid organization to retain their people, hence, retaining know-how and experience. The following subsection discusses personnel issues in disaster relief logistics. The availability and use of technology is another resource issue that is worth discussing. The last part of this section looks into the use of local resources during response to disasters.

5.4.1 Personnel issues

Locating and transporting experienced staff quickly every time a disaster hits is difficult. During the response to the Indian Ocean Tsunami, the humanitarian community was not able to quickly deploy and maintain enough experienced staff specialized in information management, communications, and civil-military liaisons (ECOSOC, 2005). For this reason, one NGO, World Vision, created a full-time division dedicated to predicting, preparing for, and responding to large-scale emergencies (Matthews, 2005). An advantage of having the same people tackling relief challenges is that they are building their own networks with other relief professionals and agencies facilitating effective coordination.

Responding to disasters is a high-pressure job with long hours under hazardous conditions. As if working in harsh environmental conditions were not stressful enough, lately threats from local militia and terrorist groups against foreign humanitarian workers have become very real, adding more stress to the lives of humanitarian actors. Such working conditions present real operational challenges to humanitarian agencies. In this section, we consider four personnel management challenges: employee turnover, safety and security of employees, management of volunteers, and logistics training of personnel.

Employee turnover is a common problem for all disaster relief agencies. High employee turnover impairs institutional knowledge, which is a valuable asset for organizations dealing

Table 5.1. *Disaster stressors*

Lack of warning	Sudden-onset events reduce reaction time
Event type	Psychological impact of natural disasters is relatively less than manmade disasters
Nature of destructive agent	Unseen or highly toxic threats trigger more intense reactions
Degree of uncertainty	Not knowing the duration of threat or possibility of recurrence
Time of occurrence	Responding at night tends to be more stressful
Presence of traumatic stimuli	Sights, sounds, and smells associated with a disaster
Lack of opportunity for effective action	Factors beyond the person's control
Knowing the victims or their families	A sense of shared fate associated with high levels of identification with the deceased
Intense media interest or public scrutiny	Media portraying aid workers in inappropriate ways or generating rumors
Higher than usual or expected responsibility	Making life or death decisions, often with incomplete or inaccurate information
Higher than usual physical, time, and emotional demands	Relief workers often believe that the success of the relief effort hinges on their personal involvement
Contact with victims	Increases traumatic stimuli and reduces workers' willingness to use support resources
Resource availability and adequacy	Insufficient equipment to perform particular tasks increases the sense of inadequacy
Coordination problems	Repetition of tasks and poor communication fuels frustration
Conflict between agencies	Causes additional stress and unrest
Inadequate and changing role definition	Relief workers frequently find themselves in different roles
Inappropriate leadership practices	An automatic management style is not appropriate for disaster work
Single versus multiple threats	Aftershocks, unstable buildings, water contamination, and fires are all threats during response to earthquakes

Adapted from Paton (1996).

with nonroutine problems. Staff members working in harsh conditions tend to get stressed and burned out rather quickly. Table 5.1 provides a comprehensive inventory of disaster stressors (Paton, 1996). Such an inventory may help identify high-risk situations, alert the organization to likely support requirements, and facilitate effective training programs and realistic simulations.

Lack of security is a major obstacle to the delivery of aid where the security of humanitarian personnel is threatened. Northern Uganda, Burundi, Somalia, Iraq, and Afghanistan are some of these locations. In Angola, despite the end of the war, landmine infestation and unexploded ordnance have hindered the delivery of disaster aid along key delivery routes. Separatist rebels in Banda Aceh, "Tamil Tigers" in Sri Lanka and Jemaa Islamiye, a militant Islamic group that warned the aid organizations that they will not tolerate long-term deployment of foreign aid workers, create very real security threats to humanitarian aid personnel (CNN, 2005). After the European Union added the group to its list of banned terrorists in May 2006, Liberation Tigers of Tamil Eelam demanded that European Union citizens leave the mission.

It is argued that aid workers everywhere in the world have become a chosen, deliberate, and direct target of terrorist groups. Between January 1992 and September 2002, 216 UN

civilian staff lost their lives. An additional 265 were kidnapped or taken hostage.² Bombing of the UN headquarters in Iraq in August 2003 and the attack on the International Committee of the Red Cross the following October suggest that the emblematic protection traditionally afforded aid organizations is no longer recognized. Attacks on humanitarian workers in Afghanistan demonstrated that some belligerents perceive humanitarian organizations as taking sides (ECOSOC, 2004). In August 2006, UN observers were accidentally hit by Israeli bombs in Lebanon, and seventeen staff members of the French branch of the international aid agency, Action Against Hunger, were found killed execution style in Sri Lanka. Clearly, humanitarian agencies need to reorganize their security arrangements. Since the end of 2003, more than \$100 million is estimated to have been spent on revamping the security arrangements of the UN and other aid agencies (Gassmann, 2005).

Work conditions may be harsh for humanitarian workers, but after each disaster volunteers offering help are aplenty. When it comes to extra hands, one might think the more the merrier. Indeed, individuals volunteering to help are great, but this may also create a management nightmare. Similar to the “donation pollution” issue discussed earlier in this chapter, volunteers in inappropriate clothing and gear simply cause delays in operations. After the 1999 Turkey Earthquake, many people showed up at the disaster site wearing open-toed shoes, shorts, and tank tops, and were angry and confused when their help offer was denied. Despite warnings, some still went ahead and started working in the rubble, causing medical personnel to use precious time to treat them when they got hurt. Which organizations need help, where will these volunteers be sent, what will they do, and who will supervise them and how, are important questions that will take time and resources to answer (Oloruntoba, 2005). Relief organizations should recognize that conduct and behavior of their staff must be sensitive to the local norms and practices of their duty stations (ECOSOC, 2004). Careless behavior of some volunteers may cause incidents that diminish hard-earned trust and reputation of relief organizations in a host country.

The last personnel issue we discuss is logistics training. Most people working for humanitarian aid agencies are social activists who are not professional logisticians. Donald Chaikin, the head of logistics at Oxfam, says that humanitarian agencies need logisticians with management experience and calls for “professionalism” in the sector (Chaikin, 2003). This shortage of logistics know-how affects the efficiency of distribution efforts (Long, 1997). Recently, in the United States, the humanitarian community started collaborating with professional organizations such as the Council of Supply Chain Management and the Association for Operations Management to provide logistics and operations training. In addition, the Fritz Institute now offers a Certification in Humanitarian Logistics. Several universities in Europe are also providing supply chain management training to humanitarian groups. Part of logistics training should include introduction of technology to the humanitarian sector. The following section focuses on new technology and discusses the importance of having low-tech backup systems.

5.4.2 Availability of technology

Stephenson and Anderson (1997) reviewed the developments in information technology likely to shape disaster planning, management, and research within the last decade. They focused on ultrabroadband networks, digital libraries, high-capacity data storage, cheap microprocessors, “smart cards,” mobile wireless PDAs, high-performance computing, and remote surveillance technology. Most of these technologies are yet to be found in use in

² Data from the September 2002 issue of WHO newsletter *Health in Emergencies*.

managing disasters. They foresaw that videoconferencing between field operations and coordination centers, real-time access to beneficiary information, wider use of electronic cash, and use of commercial satellite technology would redefine relief distribution.

International accessibility of satellite technology made remote sensing and use of geospatial technology (geographic information systems, global positioning systems, and related form of earth mapping) in disaster management a reality. Verjee (2005) provided an excellent review to geospatial technology and its use in complex humanitarian crises, and argued that most of the humanitarian community's use of this technology is simple and cartographic in nature, such as updating land use maps and creating transportation maps. According to Verjee, few relief agencies are exploiting geospatial technology to optimize the efficiency of relief distribution.

Even though technology increases the speed and quality of decision making, one thing to remember is that the more easily available the technology, the more dependent on it we become. The disaster management community knows that one should always have low-tech backup systems in place. For example, cell phones can become useless within hours due to their limited battery life. Cell phone towers also receive their power from large batteries or a generator, and after a catastrophic incident, they may not be accessible for replenishment. A robust communications infrastructure is a prerequisite for most of the upcoming information technology. However, in many poor or developing countries, such infrastructure does not exist. For example, doctors from Virginia Commonwealth University's Medical School had to develop a database to monitor hospital bed availability among nine hospitals in Ecuador, and nurses had to enter data by using the land phone line because using the Internet was not a viable solution.

5.4.3 Local resources

All disasters are essentially local. Therefore, a successful response depends heavily on local capabilities and on collaboration with the host government (van Wassehove, 2006). During the critical initial hours, the speed and effectiveness of the response very much depends on the speed and effectiveness of the local response. In Iran, national authorities and the Iranian Red Crescent Society (IRCS) responded to the earthquake quickly and effectively. The IRCS managed to rapidly mobilize 8,500 relief workers for a massive rescue operation. The response to both, the Bam Earthquake and the earthquake in Morocco, demonstrated that investing in local capacities leads to a speedy response and a solid logistical network (ECOSOC, 2004). Furthermore, use of local groups in decision making and logistics of relief operations also eases the effects of sociocultural differences (Oloruntoba, 2005). In addition to local manpower, relief agencies also acquire part of their relief supplies locally.

EuronAID, an association of European NGOs concerned with food security, lists the benefits of supplying disaster aid locally as follows: first, it helps the damaged local economy. Procurement of food aid from the local farming community would have a positive development effect by improving rural livelihoods and would also catalyze food production for future seasons. A second advantage of using local suppliers is that the risk of delivering inappropriate relief supplies is minimized, and delivery lead-times are relatively shorter. Local procurement also improves the local food quality because international food aid agencies in control of the local procurement process can enforce more appropriate quality standards. Finally, local procurement of relief goods promotes regional trade and employment. Table 5.2 shows EuronAID purchases from local markets from 2000 to 2002 and gives an indication of the monetary impact on local markets. In 3 years, about 69 million Euros were spent locally.

Table 5.2. Local purchases by EuronAID 2000–2002

Year	Product	Quantity	Origin	Recipient	Purchase value (Euros)
2000	Cereals	47,091 tons	Ethiopia	Ethiopia	10,294,344
	Vegetable oil	1,077 tons	Sudan	Sudan	1,683,615
	Pulses	4,018 tons	Madagascar	Madagascar	10,687,225
	Other food products	6,320 tons	Ethiopia	Ethiopia	5,510,368
	Seeds & plants	549 tons	Nicaragua	Nicaragua	474,108
	Seeds & plants	1 lot	Sudan	Sudan	51,300
	Tools & inputs	4,000,000 pieces	Nicaragua	Nicaragua	18,390
	Tools & inputs	1,364 Euros	EU	Albania	16,913
	Tools & inputs	3,135 lt.	Honduras	Honduras	15,178
	Tools & inputs	127,172 pieces	Spain	Nicaragua	916,508
	Tools & inputs	1,376 tons	Nicaragua	Nicaragua	318,060
	Tools & inputs	15 lots	Ethiopia	Ethiopia	928,379
Total: 30,914,388					
2001	Cereals	93,031 tons	Sudan	Sudan	14,423,292
	Milk powder	220 tons	India	India	579,360
	Sugar	82 tons	Madagascar	Madagascar	72,721
	Vegetable oil	634 tons	Sudan	Sudan	663,054
	Pulses	1,533 tons	Sudan	Sudan	923,140
	Other food products	178,000 pieces	Rwanda	Rwanda	16,224
	Other food products	848 tons	Sudan	Sudan	630,717
	Seeds & plants	911,700 pieces	Nicaragua	Nicaragua	68,064
	Seeds & plants	2,444 tons	Sudan	Sudan	1,778,611
	Seeds & plants	1 lot	Sudan	Sudan	37,670
	Tools & inputs	11,176 meters	Ethiopia	Ethiopia	133
	Tools & inputs	4,500 lt.	El Salvador	El Salvador	46,507
	Tools & inputs	145 rolls	Ethiopia	Ethiopia	3,464
	Tools & inputs	165,379 pieces	Sudan	Sudan	493,848
	Tools & inputs	3,648 tons	China	N. Korea	768,057
	Tools & inputs	16 lots	Nicaragua	Nicaragua	372,878
Total: 20,877,740					
2002	Cereals	68,944 tons	Ethiopia	Ethiopia	11,906,211
	Milk powder	189 tons	India	India	262,485
	Sugar	204 tons	India	India	74,916
	Vegetable oil	776 tons	Sudan	Sudan	473,218
	Pulses	3,156 tons	Nicaragua	Nicaragua	1,387,710
	Other food products	1,225 tons	Ethiopia	Ethiopia	736,869
	Seeds & plants	2,848 tons	Eritrea	Eritrea	1,412,394
	Tools & inputs	2,745 Euros	Ethiopia	Ethiopia	2,057
	Tools & inputs	4,500 sets	S. Africa	Angola	48,825
	Tools & inputs	1,354 lt.	Nicaragua	Nicaragua	13,782
	Tools & inputs	324,049 pieces	Burkina Faso	Burkina Faso	792,185
	Tools & inputs	1,770 tons	Pakistan	Afghanistan	406,455
	Tools & inputs	1 lot	Sudan	Sudan	2,249
Total: 17,519,356					

Source: www.euronaid.net.

One negative issue with the local resources is the cost of merchandise and housing in the disaster area. The influx of hundreds and even thousands of international aid workers usually causes local housing prices to rise rapidly, sometimes as much as tenfold (Gustavsson, 2003). This artificial increase in prices also applies to food and sanitation supplies, and drains valuable funds that could be spent elsewhere in the relief process.

5.5 Ethical issues

Although the physical and psychological toll of disasters brings out the good in some people, it brings out the bad in others. There are many ethical issues in disasters; however, we only focus our attention on the issues of discrimination among aid recipients and the effects of corruption within local and state governments on relief logistics.

5.5.1 Discrimination

Internally displaced persons (IDPs) are those who have been forced to leave their home due to a natural disaster, political conflict, or war. IDPs bring about various human rights challenges to humanitarian aid operations. In complex emergencies such as wars, IDPs cause special security challenges because women and children can be used as negotiation weapons and for trafficking (Kalin, 2005). In other cases, IDPs are discriminated against and not given access to assistance by controlling governments based on their ethnic background. Some are discriminated against by other survivors based on class differences. After the Indian Ocean Tsunami, in a caste-based hierarchical social structure such as India, some survivors (dalits or “untouchables”) were either reluctantly accepted to shelters or were driven away (Hedman, 2005).

According to the Refugee Studies Centre of University of Oxford, “there is evidence of de facto discrimination by local government authorities and Thai citizens against Burmese tsunami survivors” in the affected southern province of Thailand (Hedman, 2005, p. 4). Burmese migrant workers have been excluded in the distribution of emergency relief. Similar to this scenario was the discrimination against Haitian workers in the Dominican Republic during the response to Hurricane Georges (McEntire, 1999).

IDPs may also be difficult to track due to the loss of documentation and the difficulty of obtaining replacement documentation. After the tsunami, Hudspeth (2005) mentioned that “simply finding many of the IDPs in Aceh was difficult.” Consequently, some IDPs staying with accepting families, instead of in the survivor camps, did not get aid.

5.5.2 Corruption

Corruption, or our perception of its existence, may affect relief logistics internally and externally. Internally, it affects the protection and distribution of relief supplies. In 1999, after the Kocaeli Earthquake in Turkey, cases were reported where warehouse personnel were sifting through donations to pick newer items for themselves or simply to sell. In such a scenario, fair distribution of aid becomes an issue. For example, after Hurricane Georges, it was reported that the public did not trust the government regarding even distribution of aid (McEntire, 1999).

External corruption, or the perception of it, affects the willingness of donors to contribute to the relief effort. Once again, after the 1999 earthquake in Turkey, monetary donations stalled immediately after the news that donation money may be being channeled from the Turkish Red Crescent Society accounts to the president of the society. Consequently,

donors who perceived the Red Crescent Society as a government institution lost their trust in all other government organizations and scrambled to find small trustworthy local NGOs to whom to give their donations.

Unfortunately, the influx of aid in a chaotic environment encourages corruption. Aid agencies need to take every precaution to make sure that distribution of relief is fair. Coordination with the local authorities and the public would help if aid agencies truly understand the power dynamics in the social fabric of the host country. Disregarding these dynamics will only reinforce inequitable social structures (Walker, 2005).

A report for Transparency International identifies transparency, and strong logistics and administrative systems within humanitarian organizations, as being among a set of variables affecting risk of corruption. The report shows establishing bogus NGOs or inflating budgets as examples of ways of moving funds for personal gain. It also identifies logistical risks under procurement and distribution as securing substandard, out-of-date, or below specification goods, giving undue preference to some suppliers, diversion of stock and equipment for private gain, and “taxation” of relief goods by local elites or authorities (Ewins et al., 2006).

5.6 Political issues

Ideally, the existence of developed national institutions and committed governments contributes greatly to the success of relief efforts (Couldrey and Morris, 2005). This does not always work out the way it should, however. The relief effort after the North Korean train explosion in April 2004 was severely hindered due to political reasons. Direct routing of relief by land from South Korea was not allowed by the North Korean government, forcing the diversion of aid materials to take longer, multimodal routes (Pettit and Beresford, 2005).

Aid to North Korea has been a highly politicized process. In the autumn of 2005, North Korean government stopped accepting humanitarian assistance in the form of food. Aid officials in North Korea were not given access even to basic data such as population and employment statistics. The government also refused to supply a complete list of institutions that received food from WFP. The WFP was banned from food markets and was required to provide prior notice of inspection visits (Fairclough, 2006).

The role or significance of political dynamics on humanitarian relief became more obvious during the response to the tsunami. In Indonesia, Sri Lanka, and Somalia, the tsunami occurred in areas with complex and protracted conflicts, which hindered the organization and delivery of relief. In Banda Aceh, for example, the identity of survivors who have been internally displaced before the tsunami due to an internal conflict has become politically sensitive. Sri Lanka asked the U.S. government to scale down its military deployment, India rejected international assistance to Tamil Nadu and Nicobar islands, and Indonesia allowed all foreign military groups only 3 months to operate in the Banda Aceh region (Olorunfoba, 2005). These examples show the critical role of military in disaster relief. We focus on this issue next.

5.6.1 Military use in disaster relief

It is almost impossible in large-scale disasters to provide aid without some kind of relationship with the military. Increasingly, some countries are including humanitarian activities in the mission mandates of their armed forces. In recent years, the United Nations has applied a multidimensional approach to peacekeeping operations, bringing together the

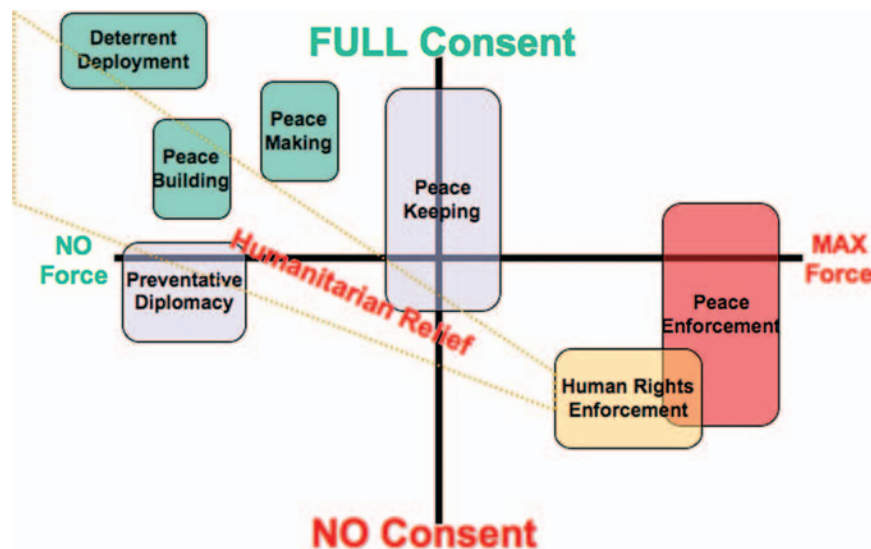


Figure 5.7 Humanitarian space. Source: Wolfson and Wright (1995).

peacekeeping humanitarian and development areas of the UN system (ECOSOC, 2004). Figure 5.7 presents the role of military in the humanitarian space as defined by the United Nations High Commissioner on Refugees (UNHCR). So, the question is not whether there should be a relationship with the military, but rather how to establish what the appropriate relationship should be and where the boundaries should lie.

In July 2000, a joint multiagency disaster relief exercise called “Strong Angel” (www.medibolt.com/strongangel) was carried out in the Asia-Pacific region. Military, United Nations, several NGOs, and civilians participated. The objective of the exercise was to establish a forum to exchange relevant information between relief organizations and the military. Military involvement in major natural disasters is not only acceptable, but also vital, because no other institution has the same means in terms of equipment and available personnel (Bredholt, 2005). However, for many NGOs, information sharing with military units to ensure fulfillment of needs through the use of available military assets such as aircraft, boats, vehicles, and personnel is poor at best (ECOSOC, 2005). The Civil–Military Operations Center (CMOC) formed during the Strong Angel exercise was intended to close this gap and coordinated relief operations between the military and civilian NGOs (Figure 5.8).

Not all humanitarian agencies have an adequate understanding of military command structures. For example, NGOs and military units have different organizational structures. Most NGOs are organized geographically, whereas military units are functionally organized. Despite the technical and organizational strength of the military, their main objective is to fight wars not provide disaster assistance. In addition, militaries are mission oriented, meaning that they identify the objective of a mission and carry out the necessary actions. The primary purpose of some humanitarian agencies such as Oxfam, in contrast, is rebuilding and development (Long, 1997).

Humanitarian organizations live by their principles of humanity, neutrality, and impartiality (Van Wassenhove, 2006). The involvement of the military in disaster relief operations is seen by some NGOs as being likely to compromise their neutrality. Neutrality is especially important to NGOs because they see it as their best defense (Pettit and Beresford,

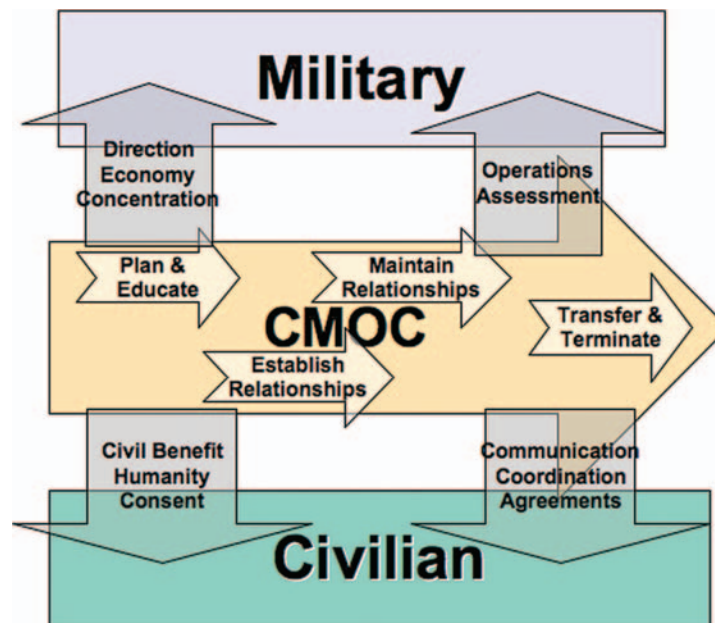


Figure 5.8 The civil–military operations center (CMOC). *Source:* www.medibolt.com/strongangel.

2005). However, a military presence is needed for security when the disaster area suffers from war, internal conflict, or looting.

5.7 Conclusions and future research directions

Disaster relief logistics is a complex task. Too many actors are working under uncertain and difficult conditions toward satisfying their objectives. Investing in relief logistics would make humanitarian organizations better prepared for responding to disasters and alleviate the pressure on field operations. Unlike the private sector, which enjoys the luxury of having flexibility of spending their cash, the humanitarian sector is constrained by the scarcity and tagging of funds. In contrast, in the private sector, money is invested into research and development, organizational design, and building of infrastructures that provide unique capabilities to their supply chains.

In this author's opinion, the one change that would have the largest impact on the success of relief operations would be the tagging of funds. The inflexibility of money is the main bottleneck in the humanitarian aid sector. If donors could be convinced to make their donations for the best use rather than for a self-defined specific purpose, relief organizations could build agility into their supply chains, retain more of their personnel, and afford investing in information and communications technology for better coordination.

The logistical issues discussed in this chapter may appear to be insurmountable. However, the private sector has been running global supply chains that are lean and agile over the past two decades and reacting to uncertainties posed by changing customer demands. Private sector supply chains adjust to environments with less uncertainty but with more variety of products, while optimizing cost, quality, and lead-times. There is much to learn from the private sector supply chain design for the relief industry. Lars Gustavsson, director

of Emergency Response and Disaster Mitigation at World Vision International, agrees that “it is critical for NGOs to learn from the corporate and for-profit sector and incorporate emerging best practice” (Gustavsson, 2003, p. 7).

Surely, relief supply chains need to be agile and adaptable, but they also need to be efficient due to scarcity of funds. The interaction and boundary conditions between efficiency, agility, and adaptability need to be investigated to design well-balanced relief supply chains. Thus, more research is needed on disaster relief logistics. *Beamon (2004)* focused specifically on logistical issues in disaster relief and called for more research on appropriate supply chain structures and distribution network configurations, procurement and inventory control models specifically developed for humanitarian scenarios, and appropriate performance measures for disaster relief.

Many of the issues discussed in this chapter could also be interpreted as future research directions. In 1995, IFRC identified some specific research directions. They reported that new and practical methods were needed for analyzing capacity and vulnerability in specific disaster situations, and for evaluating the quality of the relief process. The IFRC called for the development of more holistic accountability systems and methodologies to evaluate the impact of international relief on local organizations. A point was also made regarding the importance of disseminating research results to the correct audience (IFRC, 1996).

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145

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