Chapter 1
Humanitarian Logistics and Disaster Management: The Role of Different Stakeholders

B.S. Sahay, N. Vinod Chandra Menon, and Sumeet Gupta

1.1 Introduction

The increasing frequency and devastating impact caused by natural and man-made disasters in the last two decades, as witnessed in the loss of lives, disruption of livelihoods, and damage and destruction of property, infrastructure, and assets, has exposed the multi-hazard preparedness and response capacity of governments, business sector enterprises, international humanitarian assistance agencies, civil society organizations, and local communities. The Orissa supercyclone in India in 1999, the Gujarat earthquake in India in 2001, the Bam earthquake in Iran in 2003, Hurricane Ivan in 2004, the Indian Ocean tsunami in 2004, Hurricane Katrina in 2005, the Muzaffarabad earthquake in Pakistan in 2005, Cyclone Sidr in Bangladesh in 2007, Cyclone Nargis in Myanmar in 2008, the Sichuan earthquake in China in 2008, the Haiti earthquake in 2010, the Pakistan floods in 2010, and the triple disaster triggered by the earthquake, followed by a tsunami and ultimately the Fukushima nuclear emergency in Japan in 2011, the Pakistan floods in 2011, the Uttarakhand floods in 2013, Cyclone Phailin in Odisha and Andhra Pradesh in India in 2013, and the Typhoon Haiyan in the Philippines in 2013 were a few of the most devastating disasters in the recent past.

This article is based on the background paper prepared for the International Conference on Humanitarian Logistics 2013, organized by IIM Raipur on 2–3 December 2013 at Raipur, India. A brief report was also published earlier in the Summary of Proceedings of ICHL2013, published by IIM Raipur.

B.S. Sahay (✉) • S. Gupta
Department of Operations and Systems, Indian Institute of Management Raipur, Raipur, Chhattisgarh, India
e-mail: bssahay@iimraipur.ac.in; sumeetgupta@iimraipur.ac.in

N.V.C. Menon
Former Member, National Disaster Management Authority, New Delhi, India
e-mail: nvcmenon@gmail.com

B.S. Sahay et al. (eds.), *Managing Humanitarian Logistics*, Springer Proceedings in Business and Economics, DOI 10.1007/978-81-322-2416-7_1

India itself faced the threat of three cyclones in the year 2013, namely, Phailin, Helen, and Lehar, which shows the unprecedented increase in the frequency of natural disasters. The devastation caused by the increasing number of disasters in India, like the Odisha supercyclone of 1999, the Bhuj earthquake of 2001, the Indian Ocean tsunami in 2004, the Kashmir earthquake in 2005, the Kosi floods in 2008, the floods in Andhra Pradesh and Karnataka in 2009, the Leh cloudburst in 2010, the Sikkim earthquake in 2011, the floods and landslides in Uttarakhand in 2013, Cyclone Phailin in Odisha and Andhra Pradesh in 2013, and the recent floods in Jammu and Kashmir, has repeatedly alerted us to the critical imperative for strengthening the humanitarian logistics and supply chain management of relief supplies in India.

According to UNISDR (2013), "between 2002 and 2011, there were 4,130 disasters recorded, resulting from natural hazards around the world where 1,117,527 people perished and a minimum of US$ 1,195 billion was recorded in losses. In the year 2011 alone, 302 disasters claimed 29,782 lives; affected 206 million people and inflicted damages worth a minimum of estimated US$ 366 billion." UNISDR (2013) further observed that the proportion of world population living in flood-prone river basins has increased by 114 %, while those living on cyclone-exposed coastlines have grown by 192 % over the past 30 years. Over half of the world's large cities, with populations ranging from 2 to 15 million, are currently located in areas highly vulnerable to seismic activity.

Rapid urbanization further increases exposure to disaster risk (UNISDR 2013). Shyam (2013) observed that "the losses from natural disasters to mankind are undoubtedly massive—on average, globally every year over 100,000 people were killed and some 246 million people affected by natural disasters during the period 2002–2011 and the estimated average economic loss was US$ 131 billion per year."

Apart from the loss of lives, livelihoods, and damage and destruction of property, infrastructure, and assets caused by the natural disasters, in the immediate post-disaster phase, the affected countries face the challenges posed by bottlenecks in humanitarian logistics: the identification of sources for the supply of relief materials; the choice of the optimal way in which these relief materials can reach the disaster-affected communities; the transportation, warehousing, and distribution of relief supplies to the disaster-affected households; etc.

In other words, logistics is a major challenge in dealing with disasters, and therefore, there is a need for a comprehensive management of humanitarian logistics in disasters. Several research studies (Nilsson et al. 2010; Granot 1999; Trim 2004; Akhtar et al. 2010) have advocated the need for a well-coordinated effort in dealing with disasters, and therefore, it is imperative that the roles of various stakeholders in a disaster are defined properly and their responsibilities chalked out in advance. This paper looks into the roles that various stakeholders can play in the effective management of a disaster and develops a humanitarian action matrix that summarizes the roles of various stakeholders in humanitarian logistics for improving the effectiveness of disaster management.

1.2 Disaster Statistics and Response Mechanisms

The world has been a witness to various types of disasters since time immemorial. Table 1.1 presents a list of major disasters all over the world. These are representative worst disasters and such disasters have been increasingly common during the recent years.

From the statistics, we can note a few interesting things. First, earthquakes and cyclones have caused severe damages. They arrive for a short period but bestow huge damage. Second, epidemic used to be the cause of major deaths during early years, but its toll on humanity has subsided in recent years. Epidemics used to reign for a long period and sometimes even hundreds of years. Third, hurricanes cause major disasters usually in North America, whereas earthquakes are more common in Asian countries. We can also note that epidemics are more common in European countries and famine/drought are more common in South Africa.

According to UNEP-SBCI (2007) in the reconstruction of damaged houses immediately after the Indian Ocean tsunami which devastated Banda Aceh in Indonesia, the masonry needs for the construction of 120,000 houses in Aceh province were projected to be more than 1 million tons of cement and 3.6 million cubic meters of sand, while the timber requirements for the housing construction were estimated to be between 300,000 and 400,000 m^3. The logistics of sourcing the sand, cement, and timber and getting them across to the house reconstruction sites in Banda Aceh posed very serious challenges, similar to those faced in moving building materials from the mainland to Andaman and Nicobar islands in India for the construction of intermediate shelters and permanent housing reconstruction after the Indian Ocean tsunami.

According to UNISDR (2013), direct disaster losses are at least 50 % higher than internationally reported figures: Total direct losses in 40 low- and middle-income countries amount to USD 305 billion over the last 30 years; of these, more than 30 % were not internationally reported. The Global Assessment Report 2013 observed that disasters directly affect business performance and undermine longer-term competitiveness and sustainability: When business leaves, it may never return. Prior to the 1995 Kobe earthquake in Japan, the port of Kobe was the world's sixth busiest port. Despite a massive investment in reconstruction and efforts to improve competitiveness, by 2010, it had fallen to the 47th place.

Following the 2011 earthquake and tsunami, automobile and electrical component production in Japan declined by 48 and 8 %, respectively. But automobile production also fell by 20 % in Thailand, 18 % in the Philippines, and 6 % in Indonesia. Electrical component production fell by 18 % in the Philippines and 8 % in Malaysia (Ye and Abe 2012).

The Renesas Electronics Corporation, the world's largest custom manufacturer of microchips for the automobile industry, and which serves Japanese automobile manufacturers, suffered estimated losses of USD 615 million. Toyota lost USD 1.2 billion in product revenue owing to parts shortages that caused 150,000 fewer Toyota automobiles to be manufactured in the United States, production stoppages

Table 1.1 Major disasters all over the world

Sl. no.	Year	Disaster	Type	Affect	App. aid[a]
1	Sep 3, 2014	India-Pakistan floods	Flood	557 deaths, 2,500 villages affected, and 80,000 homeless	USD 0.1 billion
2	14–17 Jun 2013	North India floods	Flood	5,748 deaths, 4,200 villages, 110,000 people evacuated	USD 0.17 billion
3	Jul 2011 to Aug 2012	East Africa drought	Drought	12.4 million in need of food, 9.5 million under threat of livelihood, 50,000–260,000 deaths	USD 1.3 billion
4	Jan 12, 2012	Haiti earthquake	Earthquake (7.0 on Richter scale)	0.2 million death, 2 million homeless, and 3 million in need of emergency aid	USD 0.315 billion
5	Mar 11, 2011	Tohoku, Japan, earthquake and tsunami	Earthquake (9.0 on Richter scale)	15 million dead or injured and 2,814 missing, 18 prefectures, and 250,000 buildings damaged/destroyed	USD 235 billion
6	Feb 22, 2011	Christchurch, New Zealand, earthquake	Earthquake (6.3 on Richter scale)	185 deaths, 238 missing, and 164 injured	USD 16 billion
7	Oct 8, 2005	Pakistan earthquake	Earthquake (7.6 on Richter scale)	75,000 death and 106,000 injured	USD 5.400 billion
8	Aug 23, 2005	US Hurricane Katrina	Hurricane (Cat 4)	1,833 killed	USD 108 billion
9	May 2, 2008	Myanmar Cyclone Nargis	Cyclone (Cat 4 on Saffir-Simpson scale)	84,500 people killed with 53,800 missing, devastated 37 townships	USD 10 billion
10	Feb 5, 2008	Afghanistan blizzard	Blizzard	926 deaths, 100,000 sheep and goats and 315,000 cattle dead	
11	Dec 26, 2004	Indian Ocean earthquake and tsunami	Earthquake (9.1–9.3 on Richter scale)	0.23–0.31 million	USD 14 billion

12	Jul–Aug 2003	European heat wave	Heat wave/drought	75 % of wheat crops lost, 70,000 deaths	NA
13	Jan 26, 2001	Gujarat earthquake	Earthquake (7.7 on Richter scale)	20,000 deaths, 167,000 injured, 400,000 homes destroyed, 600,000 homeless	NA
14	Feb–Mar 2000	Mozambique, South Africa, flood	Flood	800 deaths, 44,000 homeless, 1,400 sq. km arable land affected, 20,000 herds of cattle lost	USD 0.015 billion
15	1994–1998	North Korean famine	Famine	240,000–3,500,000 deaths	Aid for 4 years
16	Aug 14, 1992	Africa West Coast Hurricane Andrew	Hurricane (Cat 5)	65 deaths and 175,000 homeless	USD 26 billion
17	Nov 13, 1985	Nevado del Ruiz volcano	Volcano	25,000 deaths	USD 1 billion
18	Nov 12, 1970	Bhola, Bangladesh, cyclone	Cyclone (Cat 3)	500,000 deaths	USD 0.49 billion
19	Jul–Aug 1931	Yangtze River, China floods	Flood	3,700,000 deaths	NA
20	Dec 16, 1920	Haiyuan, China earthquake	Earthquake	240,000 deaths	NA
21	1918	Spanish influenza	Epidemic	40–100 million deaths	NA
22	July 28, 1876	China Tangshan earthquake	Earthquake (7.8 on Richter scale)	240,000 deaths and 164,000 injuries	NA
23	1775–1782	North American smallpox epidemic	Epidemic	11,000 deaths	NA
24	1600s	Europe, the Great White Plaque	Epidemic	Leading cost of death due to tuberculosis	NA

(continued)

Table 1.1 (continued)

Sl. no.	Year	Disaster	Type	Affect	App. aid[a]
25	1348–1351	The Black Death	Epidemic	Killed 25–60% of Europe's population (75–200 million)	NA
26	Oct 11, 1138	Aleppo, Syria earthquake	Earthquake	230,000 deaths	NA
27	526	Antioch, Syria earthquake	Earthquake	250,000–300,000 deaths	NA

[a]The amount in aid is based on the time of occurrence of disaster

at five plants in the United Kingdom, and reductions in production of 70 % in India and 50 % in China (Asano 2012).

The UNISDR's (2013) report also found that the globalized supply chains create new vulnerabilities: Toyota lost $1.2 billion in product revenue from the 2011 Japan earthquake and tsunami due to parts shortages that caused 150,000 fewer Toyota automobiles to be manufactured in the United States and reductions in production of 70 % in India and 50 % in China. The report concluded that disaster risk is a new multitrillion dollar asset class. Global capital flows have transformed the landscape of disaster risk, creating a new pile of toxic assets for businesses and governments that do not currently appear on balance sheets. Globally, USD 71 trillion of assets would be exposed to one-in-250-year earthquakes. In Honduras, already a one-in-33-year disaster would create a significant financing gap for the government with impacts on future GDP.

UNISDR's (2013) report also points out that most disasters that could occur haven't happened yet: Total expected annual global loss from earthquakes and cyclone wind damage alone now amounts to USD 180 billion per year. This figure does not include the significant cost of local disasters from floods, landslides, fires, and storms or the cost of business interruption. Agriculture is also at risk: In Mozambique, a one-in-10-year drought would lower maize yields by 6 % and GDP by 0.3 %.

The low penetration of insurance in disaster-prone areas is another critical issue. Insurance is critical to business resilience. Yet insurance pricing often does not reflect risk levels or provide an adequate incentive for risk-sensitive business investment, particularly in low- and middle-income countries with low penetration rates but rapidly growing markets (UNISDR 2013). In China, for example, only 3 % of properties are insured against earthquake and 5 % against typhoons and floods (McElroy 2013).

With the increasing frequencies of natural disasters, governments in various countries gathered themselves to develop disaster response mechanisms. In all such disasters, logistics play a major role in disaster aid administration. Christopher (1992) defines logistics as "the process of strategically managing the procurement, movement and storage of materials, parts and finished inventory and the related information flows through the organization and its marketing channels in such a way that the current and future profitability are maximized through the cost effective fulfillment of orders." When the same is applied to natural and man-made disasters, it is often referred to as humanitarian logistics.

Governments report significant progress in developing more effective disaster response and preparedness strategies and are investing to address these risks. Yet, the required shift to anticipate risks in public and private investment remains a challenge for most countries. The number of export-oriented special economic zones has expanded from 176 zones in 47 countries in 1986 to 3,500 zones in 130 countries in 2006. Many such zones are located in hazard-exposed areas increasing disaster risks.

A new wave of urbanization is happening in hazard-exposed countries, and with it, new opportunities for resilient investment are emerging. In India alone, the urban

population is expected to grow from 379 million in 2010 to 606 million in 2030 and 875 million in 2050. Private construction company Mori Building has successfully invested in earthquake-resistant housing developments in Japan, where earthquake resistance is the most important criteria for choosing new offices for 92 % of businesses (UNISDR 2013).

Several best practices in humanitarian logistics and concerns like those mentioned above are required to be shared to make the lifesaving drugs, food products, shelter materials, and other necessary relief supplies available to the disaster-affected people. Humanitarian logistics demands a separate treatment in comparison to the commercial logistics operations undertaken by the corporate sector because of the sense of urgency, voluntary nature of the stakeholder groups, and the plethora of problems associated with the lack of effective coordination in the operations, especially in the immediate post-disaster context. The design, development, and implementation of appropriate mechanisms for humanitarian logistics are dictated by the need for understanding "the big picture" related to the complex task of matching demand and supply of post-disaster relief through a series of preparedness measures including pre-positioning of relief supplies in warehouses, identifying potential suppliers of relief materials, working out standardized specifications for relief supplies, entering into long-term agreements with manufacturers and authorized distributors for "just in time" dispatch of relief materials in the event of a sudden onset of disaster, undertaking training and capacity building of humanitarian staff to internalize best practices of humanitarian logistics, working out transportation logistics to collect relief materials from warehouses and reach them to the disaster-affected communities, identifying the most deserving sections of the disaster-affected communities for distribution of relief, etc.

The business case for stronger disaster risk management is threefold. It reduces uncertainty and strengthens confidence: Orion invested USD 6 million in seismic protection in New Zealand that saved the company USD 65 million. It opens the door to cost savings: Preventive investments by fishermen in Mexico saved each individual entrepreneur USD 35,000 during Hurricane Wilma in 2005. It also provides an avenue for value creation: An Economist Intelligence Unit survey records that 63 % of businesses see opportunities to generate value from disaster risk reduction. Businesses that have invested the most in risk management may financially outperform their peers[1].

The best practices in humanitarian logistics and supply chain management by developed countries and international humanitarian assistance agencies emphasize that humanitarian logistics plays a significant role in enhancing preparedness of communities and governments at the provincial and national levels to cope with the challenges posed by increasing frequency of natural and man-made disasters.

[1] http://www.globalnetwork-dr.org/gndr-blog.html

1.3 Coordination for Disaster Management in India

Although logistics mechanisms have been improved, it has been observed that the coordination has become the next big challenge. Disaster response mechanisms now call for effective coordination among various stakeholders. Coordination has been reported as one of the biggest challenges in humanitarian aid administration (Kovacs and Spens 2007).

The Indian Ocean tsunami of 26 December 2004 exposed the weaknesses in institutional mechanisms and techno-legal regimes in most of the tsunami-affected countries. The declaration of the Hyogo Framework of Action in 2005 by the United Nations and its endorsement during the World Conference on Disaster Reduction at Kobe, Japan, by 168 countries prompted many countries to introduce appropriate legislations to improve the disaster management architecture in these countries. A formal architecture of institutional mechanisms for disaster management was a long-articulated demand in India, as early as the deliberations of the high-powered committee established by the Ministry of Agriculture, Government of India in 1999. India finally enacted the Disaster Management Act in the year 2005[2] for the effective management of disasters in the country. A National Disaster Response Force (NDRF) was also established as a specialist first responder agency to respond effectively to disasters. Simultaneously, the National Disaster Management Authority (NDMA) as the apex agency at the central level and State Disaster Management Authorities at the individual state level and District Disaster Management Authorities at the respective district levels were formed to effectively manage disasters. A National Institute for Disaster Management was also established at the national level. The first visible impact of disaster management occurred in the year 2008 with the strategic evacuation of more than 1 lakh people during the Kosi floods in Bihar and later the evacuation of more than 1 million people during Cyclone Phailin in Odisha in 2013 within a very few days. However, post-disaster rehabilitation still continues to be difficult and challenging.

The NDMA envisions building a safer and disaster-resilient India by a holistic, proactive, technology-driven, and sustainable development strategy that involves all stakeholders and fosters a culture of prevention, preparedness, and mitigation[3]. NDMA, as the apex body for disaster management in India, lays down the policies, plans, and guidelines for disaster management to ensure timely and effective response to disasters[4]. One of its major responsibilities is to take measures for preventing the disaster, or the mitigation, or preparedness and capacity building for dealing with threatening disaster situations or disasters, as it may consider necessary.

The National Policy for Disaster Management states that NDMA's vision to build a safer and disaster-resilient India will be achieved through a culture of

[2] http://www.ndma.gov.in/en/disaster.html

[3] http://www.ndma.gov.in/en/about-ndma/vision.html

[4] http://www.ndma.gov.in/en/about-ndma/roles-responsibilities.html

prevention, mitigation, and preparedness to generate a prompt and efficient response during disasters. The entire process will center stage the community and will be provided momentum and sustenance through the collective efforts of all government agencies and nongovernmental organizations. In order to translate this vision into policy and plans, the NDMA has adopted a mission-mode approach involving a number of initiatives with the help of various institutions operating at the national, state, and local levels[5]. Central ministries, states, and other stakeholders have been involved in the participatory and consultative process of evolving policies and guidelines. This policy framework is also in conformity with the International Strategy for Disaster Reduction, the Rio Declaration, the Millennium Development Goals, and the Hyogo Framework 2005–2015. Some of the major themes that underpin the National Policy for Disaster Management are[6]:

- Community-based disaster management, including last mile integration of the policy, plans, and execution
- Capacity development in all related areas
- Consolidation of past initiatives and best practices
- Cooperation with agencies at the national, regional, and international levels
- Compliance and coordination to generate a multi-sectoral synergy

As envisaged in this policy, a well-coordinated effort among various stakeholders will improve disaster response strategies in the country. The most important function in managing disasters is the strengthening of multi-hazard preparedness which involves all stakeholders. The following section presents the essence of deliberations by various practitioners in humanitarian logistics and disaster management during ICHL2013.

1.4 The Role of Different Stakeholders in Disaster Management

Different stakeholders need to play different and specific roles in the management of a disaster. A humanitarian supply chain for both natural and man-made disasters consists of various stakeholders (Kovacs and Spens 2007), namely:

- The academic community
- The government bodies, private sector, and the disaster response organizations
- Other stakeholders (local community, disaster-affected communities and donors)

Technology plays an enabling role for strengthening humanitarian efforts in post-disaster situations.

[5] http://www.ndma.gov.in/en/policy.html

1.4.1 The Academic Community

The academic community plays an important role in teaching and researching on humanitarian logistics. The key roles of academic community are education, research, and developing a knowledge base for sharing of best practices.

1.4.1.1 Education in Humanitarian Logistics

Academia plays a key role in increasing awareness about dealing with disasters among all sections of the society. At the local community level, it is important for everyone to be proactive and understand his/her respective roles during various phases of the disaster management cycle. The academic community can conduct risk assessment and vulnerability analysis of specific disaster-prone areas and suggest appropriate strategies for dealing with the disasters that people of the local area are likely to face. Moreover, some kind of development programs should be carried on regarding natural disasters which may include raising the awareness levels about the disasters and the mechanisms to deal with them. This would include launching a short course or module which can be taught at undergraduate levels. With such modules, a few people could be trained at each district or block level who can work out disaster scenarios, map their vulnerability profiles, develop communication levels and systems, and prepare for the availability of response forces and assets. Then only we will be able to prepare ourselves starting from village panchayat to district, to state, and then to the national level.

Different bodies have undertaken the task for education in the field of humanitarian logistics. UNESCO, for example, has launched its own programs. Still there is a need for disseminating the scientific and technical knowledge in economy of local food systems, agriculture policies, management of supply chain, etc. This can be effectively done by local bodies only, and academic institutions can play a pivotal role in absorbing and disseminating such knowledge.

The death of school children due to fire in schools caused by the lack of trained teachers in handling midday meals raises the question of the need for awareness about dealing with such crisis situations. Disasters happen because the people who are handling the responsibility of midday meals, such as the teachers in local schools, are themselves not trained.

In summary, educational institutes can play an important role in disseminating knowledge of dealing with disasters. Different institutions may participate differently in such efforts. The institutions of national importance can launch advanced courses like “training the trainers” of other local institutions/schools through which such education can be disseminated to the masses.

1.4.1.2 Development and Sharing of Best Practices

A very important role of academic institution is in the development of knowledge base and sharing of best practices. In India, the government bodies such as National Disaster Response Force, Indian Defense Services, and National Disaster Management Authority play an important role in strengthening disaster preparedness, mitigation, disaster risk reduction, and emergency response. There is a serious need to develop and share a well-defined knowledge base of the experiences, strategies, and best practices of these agencies which are involved in humanitarian relief exercises. We need to learn the lessons of organizational management and standard operating procedures (SOPs) from the armed forces in dealing with such disasters. Academic institutions can play a strong role by disseminating education in management of disasters in conjunction with national bodies such as National Disaster Management Authority. Moreover, disaster management in India needs to be more professionalized by institutionalizing the lessons of preparedness, emergency response protocols, and simulation exercises from our armed forces and best practices from developed countries.

Institutions can also learn and develop knowledge base from the initiatives launched by other countries. For example, regarding food security, various governments have launched various initiatives to ensure food for all citizens of the country. The Government of India and state governments have launched different initiatives to strengthen food security to people below poverty line. The Government of Chhattisgarh has established CORE PDS for bringing transparency in the distribution of food. Such initiatives need to be assessed and documented and used as teaching and research materials for education in humanitarian logistics.

1.4.1.3 Research in Logistics Preparedness, Planning, and Optimization

The logistics efforts in humanitarian work absorb around 80 % of the total cost of humanitarian efforts, out of which major chunk of cost is absorbed in procurement. There is a need for serious research in this area for improving the effectiveness of humanitarian logistics in humanitarian efforts.

Humanitarian logistics is a peculiar area of supply chain where all normal parameters of a normal supply chain fail. In fact, disaster management situations can provide worst case scenarios in supply chain management. If somebody can successfully manage a disaster situation, he/she has proved his credentials to manage any other situation. Such situations require just-in-time response without knowledge of who, what, why of disasters. Therefore, different parameters need to be examined and set forth for measuring the effectiveness of humanitarian efforts. In India, none of the management institutions have taken disaster management as a research area. There are several studies whose results are not known to people.

We also need to study the capacity gap in preparedness and response to a disaster. Although we are prepared, but when it comes to response, we find so many hurdles as was demonstrated in the case of Uttarakhand flash flood due to sudden cloud burst caused by unprecedented rainfall.

Risk assessment is very important in managing disasters. Although we cannot stop natural and man-made disasters, still we can reduce the risk considerably by proper planning in advance. This requires substantial amount of research and research institutions to take up this task in the service of the society and the nation. We are also prone to several man-made disasters, such as that of failure of nuclear plant which may cause irreparable damages as in the case of recent tsunami in Japan, which led to failure of Fukushima nuclear plant. We need to examine the acceptable level of risk a technology may bring in so as to not lead to disastrous situations. The probability of occurrence of accidents must be minimized to zero. The ability to pick up precursors as early warning signals is very important at the time of disaster. Serious research can be conducted in this area.

There is also a need for research in the area of schemes such as midday meals. Several models, including both centralized and decentralized, have been developed for midday meal distribution in India, and these models need to be studied for their effectiveness at the grass roots level. There is also a need for research in rehabilitation. The people evacuated from a disaster area need to be rehabilitated. How to rehabilitate them is one of the areas which need to be examined in greater depth.

Another area that needs research is in developing an efficient network of supplies to the disaster-affected area. By establishing relationships with third party agencies which have long-term relationship with suppliers of drug and essentials and transporters, the disaster response could become more effective.

A different model needs to be evolved to strategically manage these networks, and management institutions can take up research projects in this area to identify best practices for management of disaster preparedness and response.

In other words, there is a strong need for research in the area of humanitarian logistics, and academic institutions should take the onus of conducting such research and disseminate its practices in the society. Such research should be need based and should be for the benefit of the entire society.

1.4.2 The Government Bodies and Disaster Response Organizations

Government bodies, such as Integrated Defense Services, INCOIS, NDMA, NDRF, and the national and the state governments, play a key role in the preparedness and response to disasters. They have been playing a key role during all the disasters experienced earlier.

1.4.2.1 Preparedness for Disasters

The need for logistics is different in different terrains, and therefore, proper preparedness will help in management of disasters. There is a need for conducting mock drills and the national and the state governments all have different responsibilities and their responsibilities have to be well coordinated, whereby participation is drawn from people and from the society so that everyone understands the need to be prepared.

Preparedness is also important for different supplies that need to be made available during disasters. Developing countries need to be ready for times when food won't be available to people, thus leading to starvation and which will have a long-term effect on the lives of the people. We also need to see that the middlemen are not taking the chunk of the cost in the food value chain, making it very expensive for the consumer. Government policies must ensure agility and transparency in the system.

Another aspect of preparedness is to train people in values of selflessness and helping each other during the disasters. Disasters bring people together. But if they are together before the disaster strikes, then they can render valuable help to each other.

People need to learn to cooperate with the disaster response organizations in their efforts to quickly evacuate and rehabilitate a disaster-affected area. In India, the Integrated Defense Services is one of the major contributors in disaster preparedness and humanitarian response efforts. The National Disaster Response Force is a dedicated first responder agency which has made significant contributions in responding effectively to several disasters in the past few years. The contributions such organizations make during disaster to save lives are commendable, and we must give them full support in their search and rescue and evacuation operations during disasters.

There is a need to establish formal agreements with the corporate sector entities who are suppliers of relief materials, transporters, or those who own warehouses. The corporate sector may also like to contribute to strengthening disaster risk reduction and disaster preparedness, apart from providing essential relief supplies after the onset of disasters to help the disaster-affected communities. Such partnerships with other stakeholder groups would assist the government in effectively dealing with disasters. NDMA has developed a Corporate Disaster Response Network in collaboration with AidMatrix, and this network helps in providing aid during disasters by leveraging its strong network of civil society partners and corporate donors across the country.

It is also the responsibility of the government to plan the urban critical infrastructure and amenities in such a manner that they do not cause any risk to human lives in case of a disaster. The procedure for quick evacuation must be clearly laid out, and the awareness of the same should be disseminated en masse so that people are always aware and prepared for the same.

1.4.2.2 Responding to Disasters

For an effective response to disasters, there is a need to move from benefit-cost models to the model of agility. In the case of disasters, cost-effective models have limited utility because the opportunity cost of late response is so high. The opportunity cost of quick response has to be seen holistically even if it appears to be expensive otherwise. In the present system, government agencies are ill-suited to respond to such disasters because they are always worried about Comptroller and Auditor General (CAG) and Central Vigilance Commission (CVC). Therefore, there is a need to devise an effective mechanism for disaster response, by considering the total cost of the system, which overcomes the hurdles of CAG and CVC, but still keeping the larger public interest as well as transparency and accountability in the system in the forefront.

The citizens also have a responsibility in responding to disasters, and they should not expect the emergency response to be the responsibility of government or first responder agencies alone. Although disaster preparedness and emergency response planning has been improved after NDMA inception, more effort is required to mobilize community participation in disaster preparedness and emergency response. Sometimes, communities find it difficult to extend their cooperation to armed forces or other first responder organizations when they are asked to evacuate their villages when early warning has been issued about possible threatening disasters. Ultimately, it is the responsibility of the community to assist the NDRF, armed forces, police, and paramilitary forces in their disaster management efforts.

The role of the state government and local administration is most crucial in strengthening disaster preparedness and in responding to disasters, and there are several weak areas that need to be addressed to improve the effectiveness of disaster management in the country.

1.4.3 Other Stakeholders (Disaster-Prone Communities and Donors)

The preparedness and management of disasters is not only the responsibility of the government but also of the local community, the disaster victims, and the donors. They need to cooperate in the efforts for improving the effectiveness of disaster management.

1.4.3.1 Cooperation in Disaster Management Efforts

The community that is affected by disasters also plays a key role in humanitarian efforts. The main principle is cooperation. They need to cooperate with the disasters

management organizations. The local community best understands the local context. There is a need to develop local capacities to improve disaster preparedness and strengthen emergency response capacities at the local level.

The local communities have an equal responsibility for ensuring that the ecosystem does not become fragile due to human interference. The use of nonbiodegradable plastic bags can lead to a major disaster as was witnessed by the clogging of drains that led to the Mumbai floods in July 2005, when the unprecedented rainfall and the high tide choked the expressways and the roads. Therefore, a system for minimizing the damage to the ecosystem needs to be developed and put in place that will help in preventing such disasters. The fact that the frequency and intensity of disasters has been increasing in the recent past means that we are endangering our ecosystem due to our actions like deforestation, encroachment on floodplains and slopes, etc. The constant meddling with the ecosystem will lead to increase in disasters. Therefore, there is a need to study the traditional systems and coping capacities that were useful in dealing with disaster situations.

1.4.3.2 Developing Human Values

The importance of developing psychosocial support in dealing with disasters has to be acknowledged. Most of the people panic when they are suddenly faced by a disaster. There is a need to develop the capacity to stay calm and help others during such disaster situations. During most disasters, people tend to be selfish and therefore try to take advantage of the situation by claiming benefits meant for disaster victims. The value of selflessness needs to be built in our educational system for greater good of the society.

We must also develop a strong concern for our environment. The more we deplete forests and the more we become urban, the more we run the chances of accidents, fatalities, disasters, etc. India has been dealing with almost all varieties of natural and man-made disasters, and even in Chhattisgarh, the fatalities due to disaster in some form or the other are quite high. We must live a life of harmony with nature.

1.4.3.3 Donors Should Be Responsible Citizens

While there are donors who put their sincere efforts in helping to manage disasters, there are many who try to take advantage of disaster situations. They bring items, either advertently or inadvertently, that clog the supply chain as these items are useless for the affected people. Such clogging delays the supply of essential items as well as hamper disaster response efforts. While cash donations help the relief agencies to help disaster victims to purchase essential supplies which they desperately need to repair their house or to help them survive when their livelihoods have been adversely affected due to the disaster.

1.4.4 The Technology for Humanitarian Efforts

The role of technology in humanitarian efforts needs to be clearly understood and applied wherever necessary. The diffusion of technology is very poor in India, and therefore, it is important that such efforts are properly managed and appreciated. Technology can play a key role in strengthening disaster preparedness and in responding to the disaster. This has been demonstrated by the role played by information and communication technology applications in the Uttarakhand floods in 2013. The Google Crisis Mapper, Person Finder, and the use of Unmanned Aerial Vehicles (UAVs) by NDRF to locate marooned people in the remote areas where roads had been washed away due to the floods showed the positive ways by which ICT tools can be used to improve humanitarian response efforts in crisis situations.

1.4.4.1 Role of Technology During Preparedness

Government bodies, such as NDMA, have started using scientific tools such as Decision Support Systems, Geographical Information Systems, etc., for improving disaster preparedness and emergency response. It also uses digital elevation maps depending upon the type of disaster that may strike the local area. These must be in place as these may not be readily available on online sites of public domains. The preparedness for resources needs to be assessed again and again and preparedness to face worst case scenarios evaluated through mock drills so that we are prepared to face any kind of disaster.

1.4.4.2 Role of Technology During Emergency Response

Information and communication technologies (ICTs) and the Internet have been of great use in information management during disaster, and these technologies have come in handy in various disasters all over the world. India needs to leverage IT for effective use because we have a number of security issues as well. The democratization of ICT has empowered stakeholders to effectively use these applications in humanitarian response. The effectiveness of the application of these technologies depends specifically on the individuals and the leaders who participate in the use of that technology. In other words, although India has technology, it needs to be leveraged for improving the effectiveness of both preparedness and in emergency response to disasters.

Many humanitarian organizations have made several innovative efforts to make modular compact kits for disaster response. Examples include the development of collapsible water containers, emergency shelter, and Solar Chill refrigeration

system. We can take advantage of such low-cost and appropriate technology for emergency response.

1.5 Conclusion

The action plan for different stakeholders is summarized in Table 1.2. Different stakeholders play different roles in managing a disaster right from the preparedness stage. These stakeholders must work in unison to ensure an effective response to disasters.

Table 1.2 Humanitarian action matrix

	Academia	Government bodies	Other stakeholders
Preparedness	Initiation of awareness and development programs, training programs at village, block, or district level; institute to take up advanced research courses	3 P's—planning, preparing, and practice; organizing mock drills; training to the people for inculcating the right value system	Communities to be made disaster resilient
Response	Collaboration of government/researchers/local ecosystem for better disaster response	Response effort to quickly evacuate and rehabilitate	Coordinate with govt. bodies for efficient logistics
Technology	Effectiveness of ICTs for coordination during disaster management and response. Examining the effectiveness of DSS and GIS in disaster preparedness and response	Agility and transparency in government policies and systems; efficient networks of supplies to disaster-affected areas; use of digital elevation maps/communication technologies/Internet	Build network of suppliers for emergency response and prepare long-term agreements
Coordination	Minimizing the damage to ecosystem; need to build the value of selflessness; development of a shared knowledge base	Participation from people and society; maintain relationship with third parties or the agencies involved; the request for resources to be properly routed and coordinated	Coordination between the demand from the disaster-affected community and matching supply by the donors
Procurement	Proactive, emergency, and accelerated procurement; effectiveness of procurement policies for disaster response; examination of agile vs benefit-cost-based models of disaster response	Disaster procurement rules are clear, but agencies are not always prepared, so there is need for an effective mechanism	

References

Akhtar P, Fischer C, Marr N (2010) Improving the effectiveness of food chain coordinators: a conceptual model. In: Paper presented at the third international symposium: improving the performance of supply chains in the transitional economies, Kuala Lumpur, 4–8 July

Asano K (2012) Rethinking a Business Continuity plan (BCP): what should companies learn from the Great East Japan Earthquake? Nomura Research Institute paper No. 173, May 1, 2012. Nomura Research Institute, Ltd., Japan

Christopher M (1992) Logistics and supply chain management: strategies for reducing costs and improving services. Pitman, London

Granot H (1999) Emergency inter-organizational relationships. Disaster Prev Manag 8(1):21–26

Kovacs G, Spens KM (2007) Humanitarian logistics in disaster relief operations. Int J Phys Distrib Logist Manag 37(2):99–114

McElroy (2013) Traditional approaches 'increasingly fail' insurance industry in time of climate change. Available at: http://www.unisdr.org/archive/33781. Accessed 10 Sep 2013

Nilsson S, Sjoberg M, Larsson G (2010) A civil contingencies agency management system for disaster aid: a theoretical model. Int J Organ Anal 18(4):412–429

Shyam KC (2013) Cost benefit studies on disaster risk reduction in developing countries. World Bank's Working paper. Available at: http://documents.worldbank.org/curated/en/2013/08/18136412/cost-benefit-studies-disaster-risk-reduction-developing-countries. Accessed 10 Sep 2013

Trim PRJ (2004) An integrative approach to disaster management and planning. Disaster Prev Manag 13(3):218–225

UNEP (2007) After the Tsunami: sustainable building guidelines for South-East Asia. UNEP SBCI (Sustainable Buildings and Construction Initiative). Published by Swiss Resource Centre for Consultancies for Development, Vadianstrasse

UNISDR (2013) Global assessment report on disaster risk reduction 2013. Published by The United Nations Office for Disaster Risk Reduction. Available online at: http://www.unisdr.org/we/inform/publications/33013. Accessed 10 Sep 2013

Ye L, Abe M (2012) The impacts of natural disasters on global supply chains. Asia-Pacific Research and Training Network on Trade. ARTNeT Working Paper Series N°. 115/June 2012. ESCAP, Bangkok