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Logistics Support and Its Management during Disaster Relief Operations

Shahzadi Amna

Department of Environmental Sciences, International Islamic University,
H-10 Islamabad, Pakistan

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Correspondence:
Shahzadi Amna, Department of Environmental Sciences, International Islamic University,
H-10 Islamabad, Pakistan
E-mail: Shahzadi.bses169@iiu.edu.pk

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Abstract

The rate of occurrence of disasters has amplified during the last two decades and effects the hundreds of millions of people each year. The impact of disasters and the large scale recent global relief efforts has drawn the attention towards the dire need for effective and efficient disaster response operations. Reviewing the various reports on the logistics support during the disaster, especially the 2005 earthquake in northern areas of Pakistan, we could conclude that rapid response to the urgent relief needs at the right time at the right place in an efficient way is necessary for alleviation of disaster impact in the affected areas. The major and complex component of relief operations is the logistics. Enhancement in the emergency logistics is critical as it optimizes the humanitarian relief by better preparation. Planning prior to the disaster onset could play an important role in reducing the impact of the disaster and serve as the basis for the development of the logistics plan. The logistic management during the disaster must keep the balance between balance speed, security, storage and transport and number of other factors. However, the use of the geospatial technologies could help in the improved management logistics during disaster.

Introduction

Natural disasters have become a constant feature of the global landscape that has reached to unpredictable intensity around the world. Damages from the disaster have increased from approximately $20 billion per annum in the 1990s to $100 billion annually during 2000- 2010. This ascending movement of the damage is predicted to continue because of various factors that may include; large population living in a disaster prone area and most importantly climate change (IPCC, 2012; Meister Consultants Group, 2013). The increasing frequency of disasters, together with a number of evolving threats making people more vulnerable to the impacts of disaster imposing greater damage and loss to vulnerable people, worldwide (UNDRO, 1991).

Natural disasters are occurring with increase intensity in the developed countries. The recent example includes the Katrina hurricanes 2005; sandy hurricanes 2012; Indian Ocean tsunami 2004. However, due to better disaster preparedness and prevention programs the impacts are less in the developed countries. Unsurprisingly, the consequences tumble most on poor communities in the developing world that has the fewest resources for coping with disaster. We may have once thought of disasters as occasional setbacks in the development process. It is now obvious that vulnerability to disaster is a key element of underdevelopment (IPCC, 2012; Elizabeth et al., 2013).

Focusing on the occurrence of natural disaster in less developed countries, the south Asia is the most vulnerable region which is facing the rage of natural disaster. During the recent years countries in this region have undergone various catastrophic disasters resulting increase in the regional poverty and a major barrier to achieving the United Nations Millennium Development Goals. South Asia has witnessed a rush in natural disasters in recent years mainly triggered by heavy rains and floods (CSIRO, 2006; Simpson et al., 2008). Pakistan has also suffered its share of natural disasters in the region. In 2005 country faced disastrous earthquake that resulted in the death toll reaching to 73,000 people. During the last decade, overwhelming cyclones and floods has been witnessed by

Pakistan. A cyclone struck in the southern province of Sindh in 1999 wiping off 73 settlements and loss of 168 lives. Rate of Floods in South Asia has been increased as a result of climate change. In India, the area affected by floods has increased twice from 1953 and 2003 (Nasir, 2012; World Bank 2007). The floods of 2010 and 2011 in Punjab, Sindh and Khyber pakhtoonkha are the examples of increasing and devastating disaster in the south Asian region (Haq and Zaidi, 2012).

Natural disasters lead to lower economic growth posing a significant impact on poverty and social welfare of the region. The fact is natural disasters cannot be prevented; however the impact can be reduced in term of life loss and economic costs (Alexander, 1993). These losses occur in three different ways; (i) Loss of buildings, highways and other infrastructure, (ii) Loss in output and reductions in employment and tax receipts, (iii) Losses due to the increase in the price of consumable and construction materials. Here, Logistics plays a critical role to prevent or at least to lessen these losses. Delivering the right commodity, to the right place, within time takes becomes difficult when the route of transportation and other logistics infrastructure are impaired or devastated by an episode of a disaster. The disaster relief is a distinctive and focused type of supply chain and logistics problem. Militaries equipped with trainings and specialized tools to deal with large-scale logistics, play a vital role in disaster relief (Ardekani and Hobeika, 1988; Beamon, 2004; UNDP, 2006). But the role of the private sector cannot be neglected as in case of 2005 earthquake in Pakistan as well as in disasters like Hurricane Katrina and the Indian Ocean Tsunami.

For the logistic industries preparing for the disasters and humanizing the relief process should be a continuous initiative. The logistics during the disaster relief operation must aim to (i) Provide the victims with their needs quickly, (ii) Assist in the provision of services, materiel, transport and competence to the responders, (iii) Participate into the Federal logistics system, (iv) Sustain the logistics willingness during disaster and non-disaster times (Brown and Vassiliou, 1993; UNDP, 2006).

The central interrogations intended to be reconnoitered in this paper includes (i) focus on the importance of the logistics support in case of a disaster event (ii) management of logistics during a disaster episode (iii) logistics support during earthquake of 2005 Pakistan (iv) benefits for logistic support during an event that can be gained from the technological option available (v) Future research and directions are assumed through recommendations.

Methodological Approach

To analyze the role of logistics in the management of disasters in line with rapid occurrence of these events a descriptive study was carried out. The importance was given on fundamental aspects of logistics. The loopholes and synergies are focused between logistics supply and its management .Potential solutions and the role of government using technological options are discussed briefly.

Disaster Management

Disaster management is an immense task that aims to reduce and mitigate the effects of a disaster. It is the process of evading and dealing with risks. Entire earth is vulnerable to disasters as these are not limited to a particular area or a region and once occurs create widespread impacts (Haddow et al., 2007). To limit the destructions to a certain point, an authoritative management to optimize competency of planning and response for disaster situation is obligatory. It is a continuous or cyclic process. As one stage ends, the other starts. Most of the time, several stages are occurring simultaneously (Karen et al., 2009). A complete Disaster management plan, with timely decisions at each phase of the plan, is necessary to have better management of the disaster. Hence, a cooperative effort at the governmental, private and public levels are essential that requires a synchronized and organized effort to militate against, prepare for, respond to, and recover from disasters (Balick et al., 2007). The phases of disaster management can be given as;

Fig.1 Disaster management phase

Figure 1 illustrates a simple picture of phases of management of a disaster. In between these phases the logistics support is required in each phase in more or less similar way (Haghani, and Afshar, 2009).

Logistics Support

Logistics is a critical element of emergency response plans to make sure the accessibility of the required goods and services in the right place at the right time and in the required quantities. In simple;

Logistics = Supply + Materials management + Distribution

However, Logistics planning entails information and data regarding topography, social, governmental, and physical characteristics of the area. Logistics system is defined by UNDP in 1993, as; "To deliver the appropriate supplies, in good condition, in the quantities required and at the places and time they are needed" (UNDP, 2006). Logistics is most important and complex component of the disaster relief operations. Therefore, it must be both agile and flexible. 80 % of disaster relief is about logistics, consequently it would follow then that the only way to achieve this is through slick, efficient and effective logistics operations and more precisely, supply chain management. In spite of logistics importance during relief operations it is considered only as a series of local, incoherent activities (Van Wassenhove, 2006). In actual logistics is a complete system exercise that involves combined and harmonized presentation from various groups of expert (UNDP, 2006; IFRC, 2011). The key components of logistics includes (i) Communication, (ii) Medical supply, (iii) Security, (iv) Basic Facilities.

Customarily, the transfer of the goods and equipment that includes the above given components is included in the relief logistics but overall it incorporates the movement of disaster-affected people, transfer of casualties, and the movement of relief workers (IFRC, 2 011). Due to the severity and frequently occurring disaster the national government requires outside assistance to manage with the impacts of the events and supply the logistics in time. Thus, internationally managed logistics operations have been started in the disaster affected areas in order to rearrange large numbers of people and provide them with the basic needs (Iqbal et al., 2007).

When a calamity occurs, timely delivery of provisions to the victims is important. This must be organized in such a way as to react according to the prerequisites of the community. The most affected regions should be given priorities and synchronization between different agencies must be there. All of the logistics operations (locating, transporting, distribution, warehousing) are closely interconnected to one another (Thomas and kopczak, 2005; Iqbal et al., 2007). Mismanagement in one area may consequently results in the letdown of the whole logistics operation. Whether the logistics are supplied by the national, private organization or international organization, quite a few logistics choices should be prepared. However, timely arrangement of disaster relief goods should be provided to meet the needs of the victims. During disaster relief timely decision matters much. Any delay may result in the complexity of the operation and more causality (UNDP, 2006). The basic principle of logistics includes (i) Responsiveness, (ii) Simplicity, (iii) Flexibility, (iv) Economy, (v) Attainability, (vi) Sustainability, (vii) Survivability. The logistics, following these principles, isn't a simple process but requiring number of different distribution points, suppliers, manufactures, institutes, organizations and various other players (UNDRO, 1991).

Figure 2 clearly defines the Logistics support is the process of development, formulation, implementation, and assessment of all logistics functions that support an operation or activity. To reduce the costs and delivery time effective logistics management in an integrated manner is required (Benita, 2007; Tabbara, 2008).

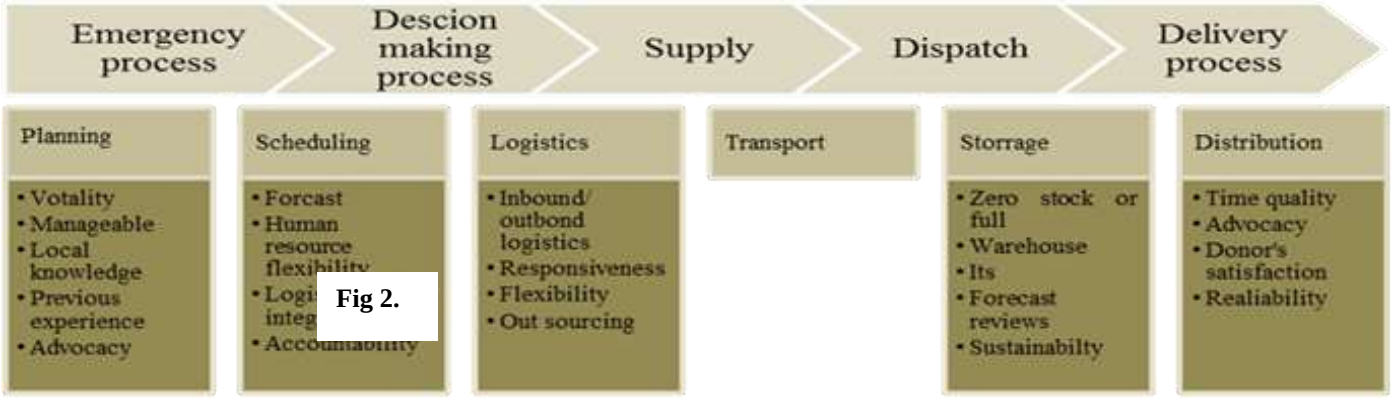

Fig 2.

Fig 3. Simplified logistics system for relief operations

Individual logistics functions and related sub utilities comprise two major components;

(a) Production Planning and Inventory Control

As a component of Materials Management, Production planning and inventory control is the Inventory Management that is directly associated with material Necessities Planning, Purchasing. It includes both physical stocks and planned movements i.e., requirements and receipts. It is accountable for providing a platform for the components required for production order. The delivery of the commodities into the warehouse is dispatched in Inventory Management. The Warehouse Management system manages storage holders in complex warehouses which are usually extended by the Inventory Management system. While Inventory Management manages the stocks by quantity and value, the Warehouse Management component reflects the special structure of a warehouse, and monitors the allocation of the storage bins and any transfer transactions in the warehouse.

(B) Distribution and Logistics

Distribution of products to victims at the disaster location is distinct from transport and handling bulk package of commodities. The assignment of distribution is commonly decentralized to a distinct agency. It includes the physical and non-physical transfer or distribution from their point of production to the point at which they made available to the victims. The effectiveness of distribution systems depends largely on how recipients are selected and identified in the first place. Often this is a complex and highly political activity, over which external implementing agencies has only limited influence (UNDP, 2006).

Transport infrastructure is the major factor that plays an important role in the Provision of supplies to the anticipated location that includes the movement of materials, products and persons between production facilities, warehouses, distribution centers, ports and effected location. Transport structure must be resilient enough that if disaster hits an area, it is able to ensure the supplies be delivered to the affected peoples in time. However, time is the most important factor to provide the people with the needs. To attain timely conveyance of disaster relief supplies, it is awfully significant to determine the warehousing sites and to manage which items should be put in storage. The storage sites should have a planned and organized delivery system (Iqbal et al., 2007; FEMA, 2013).

Logistics in Disaster Management

Now, understanding the basics of what disaster is and the part played by the logistics in the relief operation, we can divide the disaster management process on the basis of logistics support.

During pre-disaster phase, measures are taken to reduce the results from a disaster through structural and non-structural mitigation processes. In total these measures comprise engineering keys including dams and levees; land-use planning to avoid development in disaster prone areas, Covert transmission lines, building codes, training and insurance termed as strategic planning. The pre-disaster phase of the cycle is considered to be preparedness involving coordination and collaboration among the concerned departments to be prepared for the logistics support in case of any emergency. It includes the activities that help to quickly respond after the immediate occurrence of a disaster episode.

Fig. 3. Relief Operation during Disaster Management

Development of response measures, design and setting up of warning systems, evacuation planning, exercises and the training of emergency personnel to handle transport and distribute the logistics are all done during this phase of the disaster management.

The second phase of the management cycle is the repose phase in which the immediate needs of the disaster victims are fulfilled. It aims to deliver instant support to maintain life, improve health, and the building of confidence of the affected population through demand management of logistics. It is short term process and may range from mobilizing and locating emergency supplies, tools and personnel to time-sensitive operations such as search and rescue, evacuation, medicinal care, food and lodging, and repairing damaged services and systems.

As the emergency condition is taken under control, the

affected inhabitants are able to take up various tasks to restore their lives and infrastructure. These actions help to set the community back as it was before the disaster and sometimes the management teams get chance to manage the infrastructure and are better than it was before the occurrence of the event. Maintenances to roads, bridges, and other public facilities, reinstatement of power, water supplies and various municipal services to restore to the normal operations of life within the community system (Tabbara, 2008).

Hence, in each phase of the disaster cycle the assistance and collaboration of all individuals, groups, and communities is required to make the process successful. When a disaster occurs in any part of the world, emergency management agencies work with government and non-government organizations with the emphasis on logistics and supply chain that involves the logisticians. All these together create humanitarian logistics stream to reduce the impact of the disaster to provide the sufferers with the urgent needs (Thomas, 2001).

Logistic Management during Disaster

It is a tough task to manage and execute the logistic supports during disaster event. The opportunity to utilize the local resources that are usually available to support is most of the times prevented by the disaster and it may severely hamper the competence of the local government to react as many of the local government's staff members may also be adversely affected. The reasons may include; (i) The facilities may no longer be available, (ii) In most of the cases the Communication system and other important infrastructures are severely disrupted, (iii) Assistance required by the victims is beyond the capabilities of the government, (v) A disaster event may result in a generation of debris, increased water levels, obstructed roads, etc. that may hinder the movement; equipment loss and similar other aspects may damage functional capabilities (Tomasini, R. and Van Wassenhove, 2009). Therefore, logistics supports during the disaster often need to be organized as soon as possible under severe constrictions. In the affected area various constrain involves; (i) Damage to already present logistics infrastructure, (ii) Administrative factors, (iv) Degree of damage done by the disaster, (v) security within the operating areas (UNDP, 2006). Often, it is Prior investment on which the degree of effectiveness of logistics support depends on that incorporates both. In addition, efficiency of the support also depends on the level of consideration and compensation given to the vulnerability of transport and communications infrastructure towards a hazard (Kovacs and Spens, 2007; Kaatrud, et al.,).

For the successful management of the disaster impacts and to ensure the timely and accurate delivery of the needs a proper Logistics planning is required. It is important to determine; (i) Possible locations for logistic centers and supply centers, (ii)The capacity of the transport setup to carrying the supplies, (iii) Government policies, procedures and research for logistic support, (iv) The ability of the ports and airports to deal with the emergency operation. For the management of disaster response and recovery the logistical support of assets and resources is tremendously a critical aspect. Thus needs to be built properly; systematic arrangement and distribution of responsibilities among the staff members and its functioning and operations should be maintained (UNDP, 2006; CSIRO, 2006).

Key Elements in Logistics Management

The competent placement of logistics expertise in the first phase of an emergency can be crucial in providing medicine, food and shelter to minimize human suffering. During the disaster relief operations the proper and systematic management of logistic support should be the priority of the logistics agencies and organizations. It must follow functional or operational objectives the major aspects of logistic management for the system design and administration (FLIS, 2010).

i. Rapid Response

A quick response towards a disaster is the most important aspects of logistic support management. With the enhancement in Information technology the capability to carry logistical operations timely and deliver the required inventory to the victims has been efficient. Land, air, and water transport operations are among the most immediate requirement before and after the episode of disasters Depending on the level of emergency, the management of following tasks must be carefully and properly done. (i) The relocation of important equipment and critical needs as the warning is issued, (ii) Evacuation plans, (iii) Assessment, (iv) Road clearance for the movement of commodities. (rubbles, vehicles and mudslides) (v) Movement of casualties, (vi) Moving rescue and repair teams and their equipment (vii) Rescue of the effectives (UNDP, 2006; FLIS, 2010).

ii. Sustenance Support

For the effective functioning of any element of lifeline

systems, detailed resupply is immediate requirements. For an instant after an event of disaster a hospital may get short of first aid equipment or water supply system may need supplementary tools for its repair teams. Mostly the local logistics and communications resources play a vital part in ensuring that the needs of especially critical facilities are identified, and equipment and materials moved to them. So the local logistics support must be given preference (WHO, 2001).

iii. Transport

In the shortest time the accessibility of resources to the affected areas by type of transport that can help be mobilize must be made available. Thus, survey of transport service providers must be done prior to the event. Mostly the relief operation use road and air transport. However, the evaluation of other modes should also be considered to efficiently support distribution activities. During the relief operation the Cooperative freight systems for the transportation of resources must be done. This system incorporates the resources of the cooperating agencies and organization working for the relief operation to provide the needs of the victims within in time increasing economic benefit too. In addition it reduces the unnecessary delivery trip loads leading to less pollution and cost. Ultimately the quality of the operation gets enhanced (Atikens et al., 2002;UNDP, 2006; Iqbal et al., 2007)

iv. Coordination and Collaborations

In the operational phase the decentralized model for the provision of commodities through collation among adjacent cities or countries should be focused. The logistic support Process standardization assists to facilitate regional cooperation. Economies of opportunity in recognized emergency response systems support joint operations; and corporations with multi-location and international corporations bring flexibility, robustness and agility to the logistic support. Governments should play authoritative role in determining the critical resources victim needs and attaining the coordination among the NGOs and organizations working for the logistic support in the affected area. Other strategies to expedite collaboration may include (i) Information sharing, (ii) Organization specialization (Iqbal et al., 2007; FEMA 2013).

v. Understanding Environments

For the successful logistic support operation the awareness of the local conditions is vital. It is therefore, important to involve the community in all the three phases of disaster management and to understand their coping mechanisms prior to implement the overall logistic plan.

The capacities of the locals must be identified. Local capacities and assets utilization provides the benefit of preserving the residents' dignity and opportunities to participate in the response and recovery operations (UNDP, 2006; FEMA, 2013).

vi. Constant Communication

Information from and communication with the effected people is critical. Information and communication emergency systems should be built prior to the event. However, with little flexibility, it must be observed accurately. The use of mobile phones, when possible, has obvious advantages; moreover, telecommunications companies may see an agile disaster response as a marketing opportunity. Satellite phones might be purchased in advance in case terrestrial cellular service becomes unavailable. Various technologies such as GIS (Geographic Information System) and GPS (Global Positioning System) are available as part of robust current information systems (UNDP, 2006; Bennent, 1997).

vii. Packaging

The aspect of the logistic support that must be given the importance is the Packaging of commodities. Handling equipment, determine the bulk of the unit package should be done accurately as to protect it from damaging. However, Storage and transport circumstances determine the strength of the package unit. For example medicines in plastic bottles survive rough road transport. Other related aspect that should be kept in mind is Shelf-life Climate, Spoilage, Pest resistance (FEMA, 2013, NDMA, 2010).

viii. Protecting Important Provisions

After the episode of disaster large-scale, relief logistics require consistent and sustained supplies of critical and fast-moving products such as fuel, oil, lubricants, tires, and essential spare parts. In addition, expansion of an operation requires shipments of high value specialist equipment. The time of disaster condition is critical any need may rise therefore before during and after the disaster the protection, handling and provision of the related supplies must be done carefully, such as; Fuel import, refining, and storage, Materials handling and storage at ports , Unloading and bagging equipment, container handling, and secure Storage, Handling and storage at Airport , Storage at developing regional

airfields, Local assembly and secure packing of tires and spares parts (UNDP, 2006; NDMA, 2010).

ix. Security

Security arrangements should be reviewed as soon as the disaster hits. Access to some routes and airfields may be destructed to reach the location or clearance and permits may be needed by the logistic supply teams, especially in emergencies. Hence, Arrangements should be made to obtain the relevant documents before, rather than after, the onset of a disaster (Iqbal et al., 2007; UNDP, 2006).

x. Protecting Backup Stocks

Once a disaster hits an area, such as earthquake the aftershocks occurs frequently, therefore, the protection of the supplies should be done in such a way that logistic are not damaged. In some cases after the major event the climatic condition get worse i.e., heavy rainfall. There may raise serious risk of contamination of the supplies. Therefore, proper management to store the supplies in the disaster area must be done to achieve the goal of providing aid to the victims (Özdamar et al., 2004; NDMA 2010).

Monitoring and Evaluation of Logistic Support

The plan for the logistic support during the disaster needs a monitoring and evaluation for its proper implementation. At local level Field staffs have to manage and monitor receipt and distribution process. Various measures to monitor the process involves; (i) The date and time of consignment, shipment and delivery must be informed to the staff, (ii) For in time reporting at checkpoint, the equipment such as radios, satellite radios, transistors and other communication means at the field end must be properly structured, (iii) For the purpose of keeping the record of delivery and dispatch of goods and services from each warehouse of separate staff must be made responsible, (iv) A proper verification system for eligibility and suitability of recipients must be observed, (v) Most importantly administration and supervision of the dispersal and delivery to final beneficiaries (UNDP, 2006; FEMA, 2013).

The second aspect is evaluation for logistics. Assessment teams must work in coordination to support the administrative authorities. The collection of related information regarding the relief logistic must be carried out as soon after the disaster. Road situations and operating limitations must be mapped out immediately. Communication of the important details and information with the local emergency operations center, logistic support organizations should be done properly. The information for the assessment of the system may require; (i) Limitations imposed by the destruction of roads, bridges (ii) Forecast of weather conditions (iii) Accessibility of fuel on route, (iv) Security conditions, (v) Estimation of trip times. However, for the assessment and monitoring the selection of local senior management staff must be done trained in accordance to achieve the goal of "build back better" (UNDP, 2006).

Technological Options to Manage the Logistics during Disaster

For the assemblage, scrutiny and visualization of topographical information, a technique is widely used termed as Geospatial technology. In an emergency, up-to-date information is vital for the efficient decision making effective management and communication. Influential capabilities for disaster planning, monitoring and mitigation are developed through this technology. Geospatial technology can provide time critical information to responders and decision makers, and provide powerful visualization in coordinating disaster preparedness, response and recovery efforts. This technology includes, Remote sensing, Geographical information system, Geographical navigation Satellite System, Sensing Node Network System (Karen et al., 2009). The first two techniques for risk and natural disaster management require data and information for the utilization. The administration must have a proper technical staff to handle and analyze the required information. For the purpose the scientific community has anticipated A Spatial Data Infrastructure that is executed as an alternate to address data sharing problems (Rao et al, 2007).

These technologies can be used all the three phases of disaster management. In conventional use of GIS and RS, the evaluation of locations and sites that are susceptible to landslides, hurricanes, floods, tropical cyclones tsunami etc. was carried out. This analyzes the land cover maps established by the use of satellite images with other map information, such as topography, geology, hydrological maps, flood scenario and geomorphology. GPS technology has been frequently applied in natural disasters and in the monitoring of geophysical phenomena, mainly landslides, which require the application of a different type of GPS techniques. For the detection of slow movement of geological structures, Sensing Node Network System is also used in developed countries (Bennent, 1997).

Therefore, the integration data from various geospatial technologies also assists the comprehension of climate-related disasters, the identification of slope instabilities, geological and geomorphological causes of seismicity and ground structure and infrastructure effected by the earthquakes as well. All of this information facilitates the compilation of databases on natural disasters and supports humanitarian relief and disaster management activities. The data from the geospatial technologies are in time as well as realistic. The first information that can be obtained is the disaster type, its location and rough magnitude. Afterwards accurate magnitude and the level of damage are usually derived (Karen et al., 2009). An initial aerial survey, commonly made by the police or media or local community, is combined by the aerial photography survey is composed which is then compared with pre-disaster data. By the use of pre disaster data from these technologies help the logistic support agencies and organizations to store with the prerequisites of the community prone to the disaster. However, if the disaster hit an area, the maps provided by RS, GIS helps to measure the extent to which the logistic support is required. In addition these maps highlight the routes available to reach the victims in the shortest time along with the relief goods (Zeger and smith, 2003; Manfre et al., 2012).

Geospatial information on airport facilities helps to recognize hindrances adjoining the airspace for the safety of airport landings. It helps to identify the air route to the disaster location to provide and the site which can be used as heliports.Geospatial technologies during large-scale disasters in distant locations around the world are used for the logistics. Hence, for the use of geospatial analysis, the challenge is to collect the required data and precisely fuse it together to use the information for the logistics support and its management during the relief operation (Manfre et al., 2012).

Illustrative Example- Logistic Supply during 2005 Earthquake Pakistan

The promptness and efficiency of relief programs is determined by the capacity of logisticians to acquire, transport, receive, and dispense supplies to relief efforts location. Example of such a logistic program is the one done during the relief operation of 2005 earthquake by National Disaster Management Agency (NDMA). When the 2005 earthquake hit Pakistan, the country did not have any administrative setup for disaster management. The Federal Relief Commission (FRC) was established on 10 October 2005 to manage and coordinate the entire relief operation. It consisted of a Relief Planning Cell, Relief Operations Cell, Information Management Cell, Air Liaison Cell and Foreign Collaboration Cell. The tasks allocated to these were to: administer, organize and deal with all administrative and other features of the rescue and relief operations to provide well informed situation reports; coordinate all air operations. This acted as the point of contact with foreign military deputations and aid organizations, monitoring and evaluate their relief efforts. The Army Logistics Control HQ at Chaklala was the main logistics cell where the relief goods were received, handled and dispatched relief goods to effort sites. Hence, the combined efforts of these entire units make the

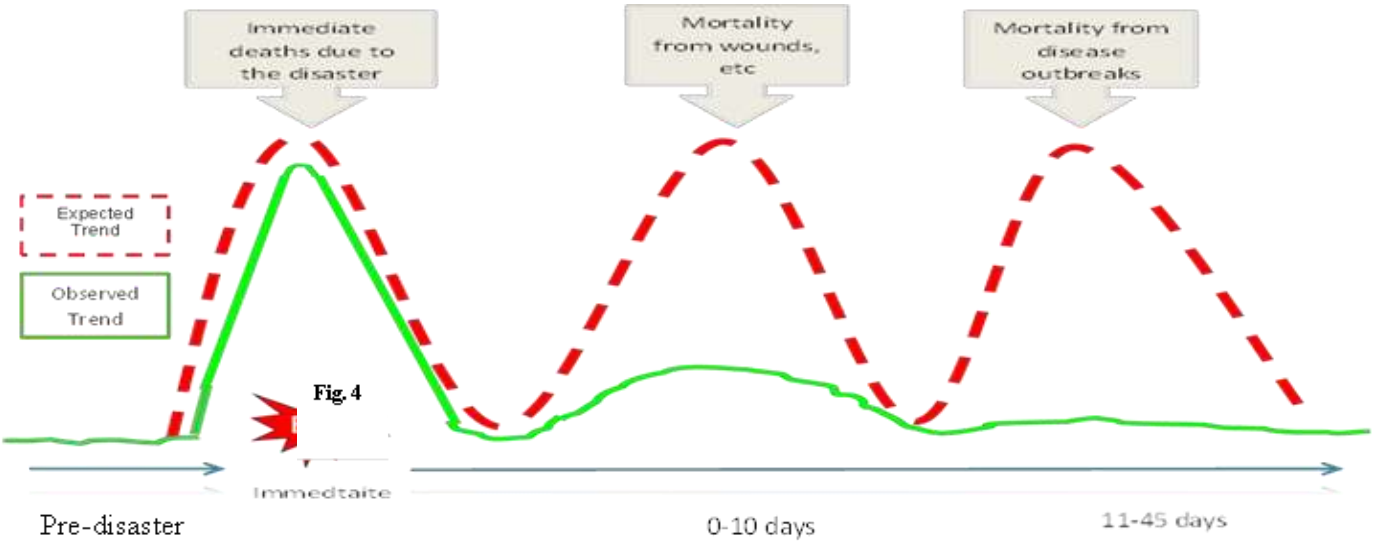

Figure 5. Result of better management of logistics support during 2005 Earthquake of Pakistan

operation to be one of the best operations around the world done for the disaster management in terms of logistic support. The efforts carried during the logistic support in 2005 earthquake resulted in the better management of the disaster event which has been shown in the figure 6. NATO Air Bridge was used for the timely and quick logistic support during the disaster which was one of the world largest heli operations after World War II By the timely and well accomplished logistics efforts the disastrous event was managed effectively that there was a wide difference between the expected and actual impact of the episode (ERRA, 2006; NDMA 2010).

Recommendations

One of the major aspects of logistics during disaster relief operation must be to make sure master operations plan is understandable by the staff and the required training is provided to them to understand the plan and implementation. Complexity of logistic support must be lessening at every stage. A check on the communications among fundamental elements should be developed. In addition, the personnel involved in the logistic support operation must be well informed. The long-term result of logistics support programs needs to be considered from the start. When required the task forces must be involved to deal with major problems, but keep the normal charter of accountabilities. In Planning location and design of emergency facilities and staff development methods must be considered. Long-term emergency logistics programs have widespread social and economic impacts and provide various development opportunities at different level of operation. These create capital investment opportunities as well if the operation is carried out in best possible way. The private logistics support sector in the disaster site helps in the development of the areas as they increase the number of trained staff; present new types of equipment and practices. For the better management of the logistic the new technologies must also be utilized. Certain recommendations that could help in the management of the logistics during the disaster management operation are here;

i. Planning and Organization: The management of logistics of rescue and relief operations is the part of contingency planning that requires especial attention and focus. It is evident that there is a dire need of an organized and well planned disaster management Programme to face the emergency situations and their implications. Therefore, it is mandatory upon the Governments to strengthen their policies of disaster management.

ii. General Assessment of Logistics: A comprehensive detailed assessment of relief logistics must be done before and after the disaster. After the onset of a disaster the urban areas may face the problem of tire and suspension damage resulting from debris. Therefore, there will be a need of vehicles with heavy tires and strong suspension as in case of floods high wheel base; light trucks; diesel engines are required. Hence the assessments and identification of the logistics to be used during the relief operations must be done before during the preparedness phase. After the onset of disaster, immediate efforts should be made immediately to map the road conditions and operating constraints. An ongoing evaluation and monitoring must be done throughout the process.

iii. Assessment Capacity: The physical and economic infrastructures are the major obstacle towards effective relief logistics. Limitations in port and airfield capacity, shortages of secure warehousing space, and difficulties with commodity handling and packaging are the major barriers in the management of logistics. The lack of capacity to manage is the major threat when need arise, especially if a country is economically reliant on agriculture. Assessment for the capacity to provide the logistics must be done in all the phases of the disaster management as a continuous process.

iv. Cataloguing the Tools: In order to enhance the process of documentation and research, recording, and organizing the items for the logistics information the cataloging of the certain tools must be done. These tools provide the information regarding the items such as; names, definitions, federal Supply Class structure, federal Item Identification Guides (FIIGs). Tool development is done by existing principles such as directives, manual methods, and automated information systems and the Federal Logistics Information. Cataloguing the Operational users; decision-makers, donors and national authorities concerned with planning, budgeting and execution of assistance programs in emergency situations must be the top priority in the management task. The other tools that must be catalogued may also include;

Commodities Likely To Be Needed: Medical supply, food, shelter, clean drinking water and communications facilities are the critical components of logistics.

Sources of Supply: As part of the disaster preparedness phase the sources for emergency supplies should be recognized. National inventory of resource establishment is the ideal to be used in the event of a disaster.

Storage: Storage doesn’t mean just to find place to keep

the supplies. A system with proper flow of information regarding type, amount and location of the existing supplies along with reserves for later needs must be established. This process is termed as Warehousing that assists in the secure supplies. The size of the warehouse depends on the quantity of supplies required or will be stored. However, in emergency operations it is difficult to estimate the number of packages that will be stored in the ware houses. Hence, largest possible space should be devoted for logistics storage.

Handling: The foremost aim of logistics is to provide assistance to the victims of disaster. To achieve the desired goal the handling of needs should be in a way to avoid abuse and wastage of resources. Certain criteria must be followed to manage the logistics. A proper maintenance and organization of the staff to handle the logistics should be managed in order to minimize the ad hoc a condition at the time of onset of disaster.

Source of Transportation: Critical transport routes involve numerous modes such as road, rail, waterways transport, and occasionally air routes. Measures to building up the transport capacity should be the priority of the logistics. Longer-term economic vulnerability analysis toward the disaster must be done. Reconstruction might need a consideration. Structured investment on the transport network will aid logistics in both sudden and longer term response and recovery. Air route helps to manage the sudden influx of relief goods. It will be tremendously worthwhile if port and airport staff is well trained with the procedures to be used in case of emergency. There should be a planning to simplify the records needed for clearance and onward carriage (UNDP, 2006; Haghani and Ali, 2009; FLIS, 2010; FEMA, 2013, NDMA, 2010).

Conclusion

The importance of disaster risk reduction for sustainable development cannot be ignored. For the purpose establishment of appropriate policy, legal and institutional arrangements, and implementing strategies and programs to minimize risks and vulnerabilities are indispensable. Lack of proper plan for facing up an emergency situation result in chaos as the disaster hits an area. To improve disaster relief, better logistics planning through better forecasting methods, is desirable. In response to a disaster, a logistic chain, consisting of basic links is critical. However, they must not be considered as separate activities but integrally, due to their complex interrelationships. Furthermore, to upsurge cooperation at all levels, it is also necessary to equipped with reliable communication technologies and a better information technology structure between different agencies must be ensured. Utilizing technologies like GIS and real-time tracking systems will help to make the disaster relief stocks be distributed fairly.

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