

# ENHANCING SUPPLY CHAIN OF HUMANITARIAN SUPPLY CHAIN MANAGEMENT - A Case study

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## Abstract

Supply chain management (SCM) is the management of the flow of goods and services which includes the movement and storage of Raw material. It also includes the finished of goods from point of origin to point of consumption, interconnect or interlinked Network & channels. Humanitarian supply chain is the humanitarian supply chain relief operation during disaster, works under the blend of communication, collaboration and coordination of humanitarian relief and aid organization all over the world implement efforts aimed to focus on the assurance of safety of the victims with work effectively and efficiently. It's providing better coordination between the agencies involved and methods to overcome the lack of technology and power in disaster situations. In today's society, disaster seem to be striking all corners of globe. The importance of HSCM is undeniable, much human loss and & destruction of infrastructure can be avoided with specific planning and implementation. During disaster, various organization often face problems of transporting large number of different commodities including food, clothing, medicine, medical supplies, machinery from different points of origin to destination in disaster area. The transportation of supplies & relief operations must be done quickly and efficiently to maximize the survival rate of affected population and minimize the cost of such operation. The Need for Research on humanitarian supply chain (HSC) is due to raise of number of humanitarian disaster and the gap between appeals and funding. In this review paper, an attempt is made to review the status of leading published literature in HSCM. The reviewed journals are classified according to research publication, objective, author and methods/Techniques & arranged review of various research and its conclusion on HSCM in table form. These reviews paper are also described the methods & techniques used by various authors are elaborated on their context and its advantage & disadvantage. Now at last a case study is taken of Uttarakhand (INDIA) tragedy in which, challenges during disaster and relief done by Indian government different NGO's and other organization are tried to describe. Due to importance of HSCM, it has attracted research attention for future.

**Keywords:** Case study; Disaster; HSCM; SCM

## Introduction

Due to climate change and increasing man made resources the number of natural and man-made disasters increased significantly. United Nations in 2006 also confirmed that the natural disasters over the next years become more severe, destructive and often. 332 natural disasters were registered in the Annual Disaster Statistical Review 2011. Natural disasters killed 30.773 people and caused 244.7 million victims worldwide in 2011. Economic damages from natural disasters were estimated US\$ 366.1 billion. In Japan the tsunami and earthquake disaster was the most ever recorded expensive natural disaster, with estimated economic damages of US\$ 210 billion. China was affected by flood in June 2011 and this had affected 67.9 million victims. In Ethiopia (4.8 million), Kenya (4.3 million) and Somalia (4.0 million) droughts and consecutive famines caused many victims.

The increasing number of disasters urging help from Humanitarian Aid Agencies (in following HAA) to deliver humanitarian aid in an appropriate and cost effective way. The successful functioning and development of the road transport enterprises within a market economy requires a sound approach to the formation of the innovation policy.

### 1.1 Supply Chain Management

Supply chain management is the art of management of providing of right product, at the right time, right place and at the right cost to the customer. Supply chain management represents an effort by suppliers to develop and implement supply chain that are as efficient and economical as possible. Supply chain cover everything from production, to product development, to the information system needed to direct these undertakings.

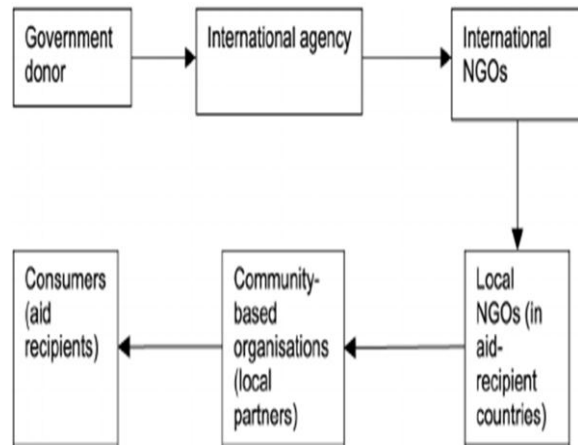
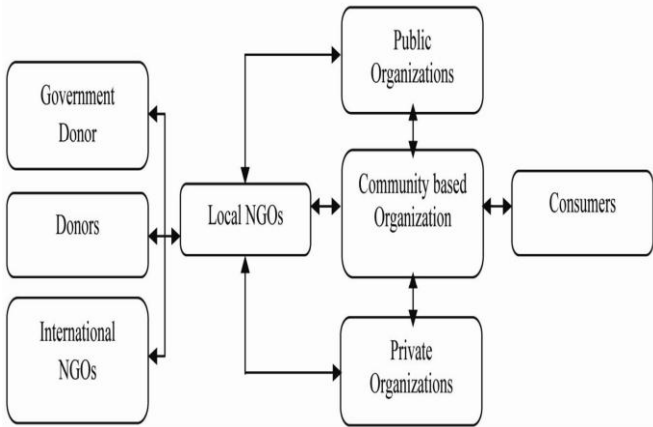


Fig. 1.2(b). A typical HSCM model

Fig. 1.1 Flow Diagram of Supply Chain Management

**1.2 Humanitarian Supply Chain**

The humanitarian supply chain as the network created through the flow of services, supplies, information and finances between donors, beneficiaries, suppliers and different unit of humanitarian organizations, in order to provide physical aid to beneficiaries.

HSCM is referred to as the process of effective and cost-efficient plans, implementation and controls for aid flows i.e. materials, goods, services, financials resources, information, medicines, clothes, foods etc. from the point of origin to the point of consumption with the intention of meeting the help requirements.

“Apply the supply chain management for the humanity is called Humanitarian Supply Chain Management.”

Business engineering look at HSCM as a whole to keep track of all included process and at the same time attempts to align them appropriately according to each other.

Operations research decompose HSC into separate problems (like facility, location, inventory management, transportation etc.) and use modeling and simulation approaches to optimize their output.

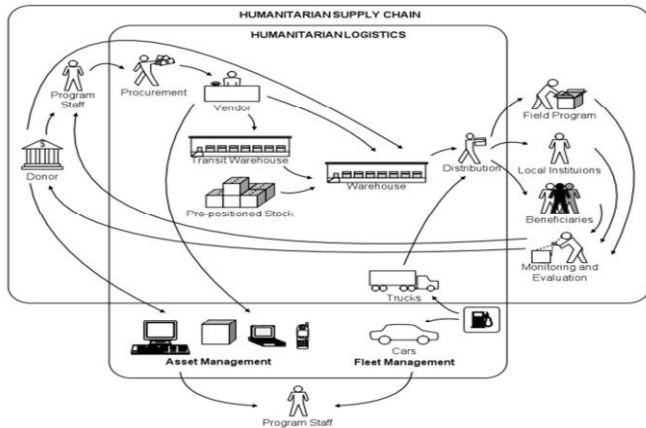


Fig. 1.2(a) Working Flow Diagram of Humanitarian Supply Chain

**1.3 Disaster Relief Supply Chains:**

In a typical HSC, governments and NGOs are the primary parties involved. Main power is hold by Government with the control they have over political and economic conditions and directly affect supply chain processes with their decisions. The Indian government did not invite international aid agencies to participate at all in the first 60 days of the relief effort, and functioned during that period with the local sources of supplies after the 2004 tsunami, for instance. Military, donors and the media are the other significant players in the humanitarian supply chains. Management and coordination between the members of disaster supply chains has challenging problems. The supply network are huge and complicated with numerous peoples (donors, NGOs, government, military, and suppliers), and this is hard to coordinate all of them along with all the items that need to be delivered. Despite the different cultural, political, geographical and historical differences among them, collaboration and specialization of the tasks between NGOs, military, government and private business is increasingly needed in the HSCM.

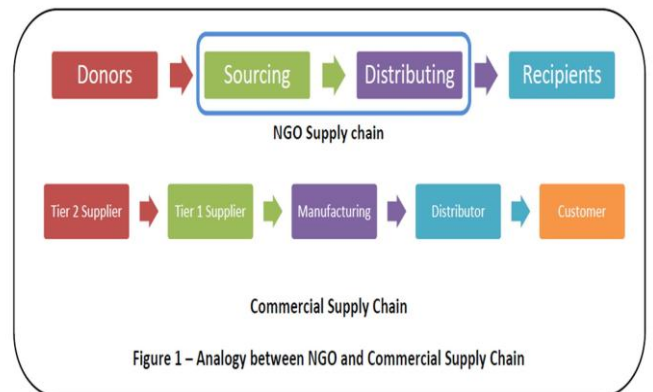


Fig. 1.3 Analogy between NGO and Commercial or disaster relief supply chain

### 1.7.1 How Business SCM Is Different From HSCM?-

**TABLE 1.7** Differences between Business SCM and HSCM

Topic	Business SCM	Humanitarian SCM
Main objective	Maximize Profit	Save Lives And Help Beneficiaries
Demand pattern	Fairly Stable	Irregular
Supply pattern	Mostly Predictable	Unsolicited Donations And In Kind Donation
Flow type	Commercial Product	Resources Like Vehicles, Shelters, Food, Medicines
Lead time	Mostly Predetermined	Approximately Zero Lead Time
Inventory control	Safety Stocks	Challenging Inventory Control
Delivery network structure technology	Location Of Warehouses	As Hoc Distribution Facilities
Performance measurement methods	Highly Developed Technology Based On Standard Supply Metric	Less Technology Is Used. Time To Respond The Disaster, Meeting Donor Expectation, And Percentage Of Demand Supplied.

### 1.4 Importance of HSCM

- It deals efficient and effective delivery; the challenge is to deliver the appropriate at emergency supplies in sufficient quantities exactly when and where they are needed.
- HSCM are fore to make quick vital decisions in a highly dynamic and uncertain environment time pressure is high and resources are scarce due to strict budget limitation.
- Challenges like network design, facility layout, fleet planning etc.
- Humanitarian relief organization a more focused on getting the job done and have forget about performances measurement.
- There is need for information communication & technology (ICT) solution that support relief operations

### 1.5 Advantages of HSCM

- Safety of human lives and infrastructures.
- Control the losses of money due to tragedy.
- Good data management of information system.
- Provide better transportation system.
- Improve the alarm time and networking system.
- Improve the communication skills.

### 1.6 Disadvantage OF HSCM

- Lack of recognition.
- Lack of professional staff.
- Lack of scientific methods.
- Lack of performance measurement.
- Inadequate technologies.
- Ineffective co-ordinations.

### 1.7 How Business SCM Is Different From HSCM?-

The HSC is often unstable, coordination and management of disaster supply chains are increasingly needed and must be put in place in the HSC. Goals, revenue sources, and performance metrics of HSC and regular SC differ notably. Unlike the HSC, which do not have any profit targets and rely heavily on donors and volunteers, in regular SC, stakeholders are the “owners” of the chain. Revenue for humanitarian supply chain is funded by government, charitable donations from individuals and corporation, and in-kind donations.

### 1.8 DISASTER RELEIF PHASES: -

Our whole project suggests a four-stage process model of disaster relief that include preparedness, response, recovery and Mitigation as the details below.

#### 1.8.1 MITIGATION

Activities that either prevent the occurrence of an emergency or reduce the community's vulnerability in ways that minimize the adverse impact of a disaster or other emergency are examples of mitigation.

#### 1.8.2 PREPAREDNESS

During the preparedness phase, governments, organizations, and individuals develop plans to save lives, minimize disaster damage, and enhance disaster response operations.

#### 1.8.3 RESPONSE

The focus in the response phase is on meeting the basic needs of the People until more permanent and sustainable solutions can be found.

#### 1.8.4 RECOVERY

Recovery activities aim at restoring the affected people lives and the infrastructure that supports them.

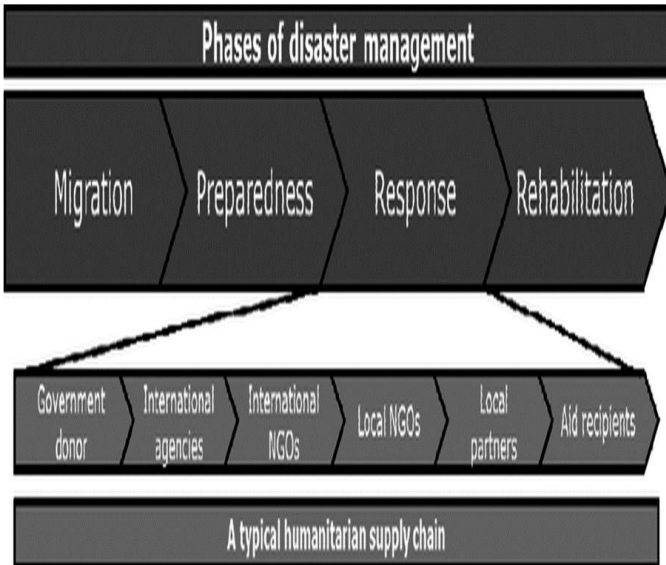


Fig. 1.9 Phases of Disaster Management

- High challenges and uncertain behavior of supply
- Lack of information sharing because of weaker communication.
- Long-term impact of the numerous actions carried out throughout humanitarian procedures.

TABLE 03 Literature survey

TITLE OF PAPER	OBJECTIVE	AUTHOR	METHODS/TECHNIQUES
1. Great Lakes and East Africa Inter-agency Research project	A Documented supply chain populated with information and material flow across the East Africa Inter Agency group.	Fritz institute July 2004	1. Developing a Multi-Disciplinary Model of the Humanitarian supply chain 2. The Logistics model:- The Logistics model itself work will serve as a proxy for the real system. It will take variables and environmental parameters as input to obtain a specific output objective
2. Transportation research	The objective is to minimize the total network costs, which are generalized costs that may include the monetary, risk, time, and social cost.	Patrick Qian ,Anna Naguran ey	In this paper develop a supply chain/logistics network model for critical needs in the case of distribution
3. Disaster management in India	To study the weakness of our disaster management effort & give proper solution of these weakness.	IIT Kanpur	1. India disaster resource network 2. Development of GIS based National Data Base for disaster management 3. Installation of early Warning and Hazard detection Equipment

## 2. Problems and challenges in humanitarian supply chain

### 2.1 Challenges in humanitarian supply chain

Disasters are creating havoc on humans and nations' economies at a frightening and rising rate.

In order to achieve fast response towards any tragedy, we must address and recognize the main challenges of HSCM:

#### High demand uncertainty

It is unpredictable about any disaster. They are mainly due to change in atmospheric conditions or due to manmade reasons. They are mainly affected by dynamic and hard-to-measure issues such as tragedy characteristics.

#### High uncertainty in timing

In general, it is very difficult to predict exactly the time of any disaster to happen. Therefore, one needs to be ready and flexible to handle the same.

#### High uncertainty in location

It is very difficult to predict the exact location where the disaster can going to be happen.

#### High uncertainty and challenges in supply

Due to adverse conditions occur at the place of disaster, transportation facilities may get affected. Also the distance from affected place and help center matters. The relief material collection and supply is also main issue.

### 2.2 Challenges in association between the multiple performers and decision-makers in a HSCM

- The influence of the political and traditional conditions of the region

4. Humanitarian Logistics and Supply Chain management	The purpose of this paper is to identify the underlying issues of humanitarian disaster relief logistics in order to provide an understanding of the challenges facing humanitarian organizations in a wider context.	Christopher Sandwell Business School, University of Central Lancashire, Preston, UK)	The paper takes a qualitative approach, adopting a two dimensional multi strategy research design, culminating in a model of theoretical understanding.		n choice.		
5. Research issues in humanitarian aid supply chain management	1.To benefit from the tools developed by operation management community 2. It also provides a direction for futuristic research efforts and the role operations management community can play in addressing some of these problems	Avninder Gill	probabilistic inventory model for recovery planning during hurricanes to assess what would be the optimal delay in decisions to achieve a good balance between logistics efficiency and forecast accuracy	7.Mathematical Models Humanitarian Supply Chain Management: A Systematic Literature Review	To know the current status of research of the mathematical model and status of unexplored areas in the field of HSC	Moh. Habib, Young Hae Lee & Moh. Saad Memon Hanyang University, Ansan KOREA	Dividing in parts • facility location • network design and relief distribution • mass evacuation
6. Humanitarian supply chain management literature review and future research	To develop knowledge in distribution planning, information and communication system, sourcing and supplier management, supply chain coordination and integration, performance measurement and transformation	Watcharavee Chandra prakaiikul Bangkok, Thailand	Analytical conceptual/theoretical, mathematical modeling, case interview, experimental design	8.SCM Humanitarian Organizations A structuring Framework for sustainable School Feeding	To establish development intervention that simultaneously addresses multiple objectives including education, nutrition, and value transfer	Andreas Kretschmer, Stefan Spinler, Luk N. Van Wassenhove CHICAGO U S A	To solve the problem using networked work model.
				9.Humanitarian Relief Supply Chain performance Evolution: Literature Review	To improve overall performance of HSCM with the help of technique and used recent technique of supply chain performance evaluation	Bethlehem Tamiru Gizaw & Alev Taskin Gumus Yildiz University Besiktas, Turkey	Method – neural • artificial neural networks • SCOR (Supply chain operation reference) • Fuzzy logic system

10.Humanitarian aid: an agile supply chain	To investigate the nature of the humanitarian aid supply chain and discuss the extent to be certain business supply	Richard Olorunbob a Queensland university technology, Brisbane ,Australia And Richard Gray ,UK	1.Concept of agility in Supply Chain Management for humanitarian aid
	chain particularly supply chain ability, are relevant to humanitarian aid		
11.OR/MS research in disaster operations management	Providing better OR/MS research in disaster operations management	Altay et al.	Better management of disaster operations will improve readiness, increase response speed, and ease recovery
12.Humanitarian logistics	To managing of Humanitarian logistics	Celik et al.	The management of humanitarian logistics operations involves many challenges such as conflicting objectives from multiple stakeholders, coordination and collaboration, high uncertainty, and scarcity of resources.
13.Humanitarian logistics : A new field of research and action	To understanding problems face in Humanitarian logistics field of research and action	Apte Aruna	Humanitarian logistics is inherently chaotic and complex, and it is difficult to do research in this area ,the complexity and obstacles can be dealt with by the researchers

14. Inventory policies for humanitarian aid during hurricanes	To minimizing costs using inventory policies for humanitarian aid during hurricanes	Sales et al.	A stochastic programming model minimizing costs, to support the decision process of inventory policy which best satisfies the demand for food in shelters when hurricane winds are about to impact a town
20.Heuristic approaches for the multi-period Location transportation problem with reuse of vehicles in emergency logistics.	To reducing transportation problem with reuse of vehicles in emergency logistics.	Moreno et al.	Developed two stochastic mixed-integer programming models to integrate and coordinate facility location, transportation and fleet sizing decisions in a multiperiod ,multi-commodity, and multi-modal context under uncertainty
21.Flexibility in logistic systems — modeling and performance evaluation	Model and evaluate the performance of the logistic	Barad, M., & Sapir, E. D.	Trans-routing flexibility and A multi-factor design of Experiments

22.Performance evaluation of a multi-echelon production, transportation and distribution system: A matrix analytical Approach	Evaluate complex supply chains	Wang, F. F., & Su, C. T.	Matrix analytical computing Approach
23.Multi-Criteria Decision Making: An Operations Research Approach	Objective is the development of approaches for optimal decision making	E. Triantaphyllou, B. Shu, S. Nieto Sanchez, and T. Ray (Louisiana State University Baton Rouge, LA 70803-6409, U.S.A.)	provides a comprehensive survey of some methods for eliciting data for MCDM problems and also for processing such data
24.Defining "Fast": Factors Affecting the Experience of Speed Humanitarian Logistics	To explored how logistics stakeholders in a large international humanitarian organization and perceive speed of operations	Mark Haselkorn University of Washington	Method based on control of decision-making can make both clients and service providers more likely to experience the logistics process as fast.

25.An empirical study of supply chain performance in transport Logistics	Obtaining a selfassessment of supply performance in transport logistics by service providers in the transport logistics industry	Lai, K. H., Ngai, E. W. T., & Cheng, T. C. E.	Cross-sectional survey
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### 3. METHODS AND TECHNIQUES

We explained some methods & techniques given by some researchers.

1. SCOR (SUPPLY CHAIN OPERATIONS REFERENCE)
2. FUZZY LOGIC SYSTEM
3. RECOURSE-BASED STOCHASTIC PROGRAMMING
4. ARTIFICIAL NEURAL NETWORK
5. MULTI CRITERIA DECISION MAKING METHOD
6. LEAN& AGILETECHNIQUES

#### 3.1. SCOR (SUPPLY CHAIN OPERATIONS REFERENCE)

SCOR is a tool used to address, progress and connect SCM results within a corporation with suppliers and customers of a company. It also helps to explain the processes along the entire supply chain and provides a basis for how to increase those procedures.

This frame work focuses on 5 areas the SC i.e. plain, source, make, deliver & return.

#### 3.2. FUZZY LOGIC SYSTEM

According to Olugu & Wong, 2009, fuzzy logic operation can model the uncertainties which characterize supply chain management; is easier to perform, and; more accommodating compared to the conventional approaches, especially when the number of operated input data is large (p.209). Fuzzy logic technique has been applied by many researchers to measure supply chain performance

#### 3.3. RECOURSE-BASED STOCHASTIC PROGRAMMING

Stochastic programming is a framework for modeling optimization problems that involve uncertainty. Whereas deterministic optimization problems are formulated with known parameters, real world problems almost invariably include some unknown parameters. When the parameters are known only within certain bounds, one approach to tackling such problems is called robust optimization. Here the goal is to find a solution which is feasible for all such data and optimal in some sense.

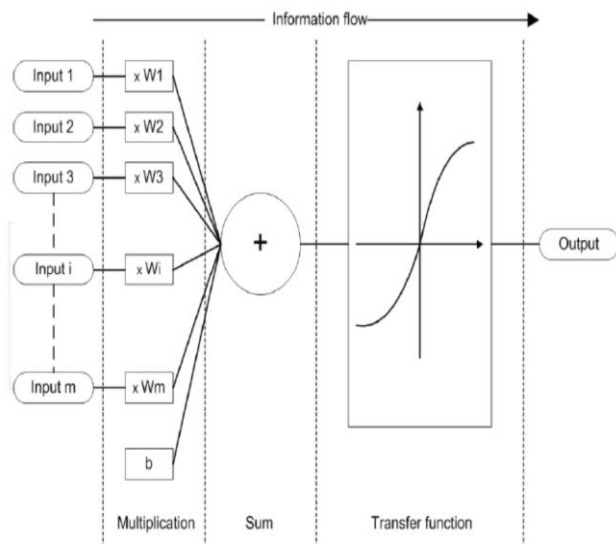
We can sub classify stochastic programs into linear, integer, and non-linear models.

- Stochastic Linear Programming
- Stochastic Non-linear Programming
- Stochastic Integer Programming

### 3. 4. ARTIFICIAL NEURAL NETWORK

An artificial neuron network (ANN) is a computational model based on the structure and functions of biological neural networks. Information that flows through the network affects the structure of the ANN because a neural network changes - or learns, in a sense - based on that input and output.

ANNs are considered nonlinear statistical data modeling tools where the complex relationships between inputs and outputs are modeled or patterns are found.



**Fig.3.2.4** working principle of an artificial neuron

### 3.5. MULTI CRITERIA DECISION MAKING METHOD

Multiple-criteria decision-making (MCDM) or multiple-criteria decision analysis (MCDA) is a sub-discipline of operations research that explicitly evaluates multiple conflicting criteria in decision making (both in daily life and in settings such as business, government and medicine). Conflicting criteria are typical in evaluating options: cost or price is usually one of the main criteria, and some measure of quality is typically another criterion, easily in conflict with the cost. In purchasing a car, cost, comfort, safety, and fuel economy may be some of the main criteria we consider – it is unusual that the cheapest car is the most comfortable and the safest one. In portfolio management, we are interested in getting high returns but at the same time reducing our risks, but the stocks that have the potential of bringing high returns typically also carry high risks of losing money. In a service

industry, customer satisfaction and the cost of providing service are fundamental conflicting criteria

### 3.6. LEAN

Lean manufacturing or lean production, often simply "lean", is a systematic method for waste minimization ("Muda") within a manufacturing system without sacrificing productivity. Lean also takes into account waste created through overburden ("Muri") and waste created through unevenness in workloads ("Mura")

## 4. CASE STUDY

### UTTARAKHAND DISASTER (HIMALAYAN TSUNAMI) (June 2013)

#### UTTRAKHAND DISASTER

Uttarakhand has a total land area of 53,584 km<sup>2</sup> of which 94% is hilly and 64% covered by forestry. Most of the area is covered by Himalayan Mountains and glaciers. Uttarakhand is also referred as THE LAND OF GOD. The state is well known for "Char Dham"

- Badrinath
- Kedarnath
- Gangotri
- Yamunotri

Uttarakhand is considered as one of the most beautiful state.

#### CAUSES

- Heavy rainfall way of excessive floods
- 144% surplus rain hits uttarakhand
- Government negligence
- Infrasructure

#### DAMAGES

- 580 people dead and over 3000 missing. The entire village settlement of Gaurikund and the transition point of Kedarnath have been totally destroyed, while the Sonpryag market town suffered heavy damage and loss of lives.
- On June 18 more than 12000 pilgrims were stranded at Badrinath located at bank of Alaknanda River.
- Over 85000 people were struck in various region of damaged or road blocked. People in important location like Valley of Flowers, Roopkund and the Hemkund were stranded for more than 3 days without ration or survived with little food.
- National Highway 58 near Jyotimath and many other places were washed away.
- Rescuers at Haridwar on the river Ganga recovered bodies of 40 victims washed down by flooded river on 21 June
- In UP more than 600 villages covering population of 7 lakhs was affected by flood and more than 120 deaths were reported.



**DEATH & DESTRUCTION**

90 percent of cash crops, particularly the apple crop, has been completely destroyed by the floods. Loss to the public and private property estimate around Rs 2,575 crores as mentioned by the government, June 30, 2013. Insurance companies are looking at claims worth more than Rs 1,000 crore, Hundreds of porters and over 2,000 ponies are still untraceable. A total of 2145 animal loss and 185 animal owners have been affected.

**RESCUE OPERATIONS**

The army, air force, Indo-Tibetan border police (ITBP), BSF, National disaster response force (NDRF), Public works department and local administration worked together for quick rescue operation.

Helicopter was used to rescue people, but due to rough terrain, heavy fog and rain fall, man rewiring them was a challenge. Army deplored 10,000 soldiers and 11 helicopters, navy sent 45 navel divers, air force deployed 43 air crofts including 36 helicopters. From 17 to 30 June 2013, the IAF airlifted a total of 18,424 people - flying a total of 2,137 sorties and dropping/landing a total of 3, 36,930 kg of relief material and equipment.

On 25 June, one of 3 IAF Mil Mi-17 rescue helicopters returning from Kedarnath, carrying 5 Air Force Officers, 9 of the NDRF, and 6 of the ITBP crashed on a mountainous slope near Gauri Kund, killing all on board. The deceased soldiers were given a ceremonial Guard of honor by Home minister of India, at a function organized by the Uttarakhand State Government.

**CALCULATION (DATA UTTRAKHAND DISASTER), METHODS, STEPS AND STRATEGIES**

**1 RESCUE OPERATIONS DATA AND CALCULATION (UTTRAKHAND DISASTER)**

NO. ARMY SOLDIERS	NO. NAVAL DRIVERS	TOTAL NO. OF PEOPLE	TOTAL ARMY MEN	RATIO
10000	45	18424	10045	1.83

TABLE 5.1(a)

**CALCULATION**

No. of army soldiers=10,000  
 No. of navel drivers=45  
 Net=10,045  
 No. of safe people =18,424  
 Ratio = (no. of safe people/ (no. of army soldiers+ no of navel drivers))  
 = (18,424/ (10,000+45))

= (18,424/ 10,045)  
 = 1.83(about2)

NO. HELICOPTERS	NO. AIRCRAFTS	TOTAL NO.	NO. PEOPLE SAFE	RATIO
47	43	90	18424	204.7

TABLE 5.1(b)

**CALCULATION**

No. of helicopters= 47  
 No. of aircrafts = 43  
 Total =90  
 Ratio= (no. of safe people/ (no. of helicopters+ no. of aircrafts))  
 = (18,424/ (47+43))  
 = (18,424/90)  
 = 204.7(In this safe people by other process included)

**BENEFITS OF RATIO INCREASES**

- Target to maximum no. of people safe.
- Decreases no. of army men to save the extra cost.
- Decrease no. of helicopters and aircrafts to increase their man carrying capacity.
- Cost will be decreases.
- Response time improve.

**ACTIVITY BY WHICH RATIO WILL BE INCREASED**

- To make a well-maintained helipad for landing helicopters in hill region
- Improve road facilities, widen the bridges and roads and have good pavement
- Keep provision of satellite phones on army ports. Ask telecom operators to provide more cellphone towers in mountain.
- Increasing no of seat in helicopters.
- Rescue helicopter are manufactured.

**METHOD OR STEPS SHOULD BE IMPLEMENT TO ENHANCE HUMANITARIAN SUPPLY CHAIN MANAGEMENT IN INDIA**

There are no standard methods/models that can be exists for using supply chain management (SCM) techniques to provide relief to populations affected by disasters in India But through our study and survey based on newspaper, research papers of researchers and the help of data related to UTTRAKHAND and other disaster, we are giving some method and steps by applying them we enhance humanitarian supply chain

in India.

## 1. CENTRAL LEVEL

At the central level, Ministry of Home affairs is assigned with the nodal duty of managing disaster. At the top level, there are two cabinet boards viz. cabinet committee on national disaster and cabinet board on security. All the main issues concerning natural disasters are placed before cabinet board on natural disaster whereas disasters which can affect internal safety or which may be caused due to use of atomic, biological or biochemical weapons etc are placed before cabinet board on security. The NCMC (National Crisis Management Committee) is the next significant representative. It includes secretaries of respective section/ministers. Its main function is to provide path to Crisis Management Group (CMG) and any minister/section for exact action needed for meeting the crisis condition. CMG lies below the NCMC.

## 2. STATE AND DISTRICT LEVEL

At the state level, there are state relief officials who are in charge of the relief actions in wake of natural tragedy in the perspective states. The chief secretary is the whole in charge of the relief processes in the state. At the district level, districts are headed by District Collector or district judge who is responsible for the overall management and checking of relief actions and preparation of tragedy management strategies. DSO/SDM will take care of the disaster management at tehsil level.

## 5. DEVELOPMENT OF BETTER RESPONSE SYSTEM

Mitigation and preparedness measures go hand in hand for vulnerability reduction and fast response to tragedy.

### 5.1. PREPARATION OF SPECIAL RESPONSE TEAMS

The central Govt. is now in the process of training and preparing professional and rescue squads. Each squad includes specialized doctors, operational engineers etc. These squads will be posted in diverse parts of the nation.

### 5.2 OCCURRENCE COMMAND SYSTEM

In order to professionalize the response structure, it is planned to progress occurrence command system. It is a very effective system in which the most experienced and educated person at a tragedy site is selected as incident chief who is charged with the duty of inter-agency coordination and administration of the incident.

## 5.3 STANDARD OPERATING PROCEDURE

Standard working process are being laid down to confirm that all step must to be taken for disaster management are put in place. Each division/sector will have their own SOP's for each level of officials.

## 5.4 ALTERNATIVE ACTION CENTRE

It has also been suggested for setting up of alternative operation centers at the national capitals, state capitals and district H.Q... EOC will function as nerve centers for combined command and control assembly. They will be meeting points for all inter agency coordination and will be equipped with the state of the art communication network.

## 5.5. IMPROVE TECHNOLOGICAL DEVELOPMENTS

Technical inventions are vital for actual disaster management, the DST, Govt. of India is taking several measure to upgrade technical inputs. The significant developments include:

### 5.6.1 INDIA TRAGEDY RESOURCE NETWORK

This is a web enabled centralized data base which will certify quick access to assets to minimize response time tune in emergencies. This database shall be presented at National, State and district level simultaneously. Police network is additional significant communication network to be used for tragedy management. In emergency, mobile satellite based elements which can be conveyed to disaster located are being procured.

### 5.6.2 DEVELOPMENT OF GIS BASED NATIONAL DATA BASE FOR HUMANITARIAN SUPPLY CHAIN MANAGEMENT

The GIS is an effective tool for emergency responders to access information in terms of critical parameters for the disaster affected areas. This comprises location of public facilities, communication links, transport system etc. The GIS data is already available with government agencies, it is currently being upgraded. Comprehensive data district wise, multi layered maps based on this data are being generated.

### 5.6.3 INSTALLATION OF EARLY WARNING AND HAZARD

### DETECTION EQUIPMENT

Early warning system have already been installed for cyclones and floods in the country by IMD and CWC. There is a well-established organizational set up for detecting, tackling and forecasting cyclones. There are six cyclone warning centers at Kolkata, Bhubaneswar, Vishakhapatnam, Chennai, Mumbai and Ahmedabad. Cyclone tracking is done with the help of INSAT satellite. Cyclone detection radars are located at ten centers in different coastal areas. CWC does flood forecasting. There are nearly 700 station from where hydrological and hydro meteorological data are collected. Now, govt. has also succeeded in acquiring and installing the Tsunami warning and detection system in the aftermath of Tsunami disaster of 2004.

### 5.7 THE FIVE STRATEGIES

The five strategies each contribute to enhance HSCM at world level are as follows:

1. Forming an expert logistics community will enable humanitarian logisticians to share knowledge and understanding on common issues and to create a consistent, powerful voice with all the stake-holders in the sector.
2. Spending in standardized training and certification will help build a pool of logistics specialists that share common procedures and vocabulary, promoting professionalism and collaboration.
3. Concentrating on metrics and performance measurement will empower humanitarian logisticians to demonstrate and improve the efficiency of the HSC.
4. Communicating the strategic importance of logistics will enable humanitarian logisticians to create responsiveness of the contribution that logistics makes and to get needed funding and capitals.
5. Developing flexible technology resolutions will increase responsiveness by creating visibility of the materials pipeline and increasing the effectiveness of people and processes. Furthermore, advanced information systems will create the infrastructure for knowledge management, performance measurement and learning.

### CONCLUSION AND FUTURE SCOPE

#### 6.1 CONCLUSION

In India, the management of disaster relief was not good, but in recent year government, NGO's and other

private organization have done great work to reduce the effort or damage caused due to disasters. A new culture of preparedness, quick response, strategic thinking and prevention is being entered. In this review paper, a literature classification scheme has been presented according to the distribution of journal publication, publication years and research method. It seems that future research is need to develop knowledge in distribution planning, information and communication system, sourcing and supplier management, supply chain coordination and integration, performance measurement and transportation choices. The content describes, how to pro-actively deal with the potential for future crisis like Uttarakhand rain fall related to tourism. This paper leads to a systematic approach which improves destination restoration techniques and also describes about the reasons for the collapse of tourism destination area and enumerating on the aspects of an ideal area development, with relation to Uttarakhand. The losses faced by tourism industry, due to disaster are extensive. The season accounted for 30 % ( around 3500 crore), they were witnessing 99% cancellation from affected travelers and from prebooking. Thus, when the Char Dharma Yatra has been cancelled for 3 years, the possible losses can be imagined.so through the proper implementation of several disaster techniques, such losses can be avoided and the credibility of a destination restored. Techniques developed for disaster management is quit useful and also have its future scope. However, there are different technique available, but there is a lot more effective and efficient techniques need to disaster management in future.

#### 6.2 FUTURE SCOPE

According to previous recorded data the frequency of disaster striking continuously increasing in India, there is need for continued vigilance, preparedness and conscious efforts to reduce the occurrence and for the mitigation of impact of disaster. The steps which should Indian gov. take to avoid disasters like Uttarakhand floods in future

- There should be a proper multi-tier organizational structure in a focused and coordinate manner which are responsible for the overall management at national, state, district and village levels.
- There should be a special course related to the disaster study and prevention added in Universities and provided degree to increase employment in this field.
- Make a well experience experts team who always prepared for the upcoming emergencies in future.
- Government organization, NGO's and Industry are linked to the humanitarian supply chain.
- Special people should be trained for these types of emergencies.
- Gov. should work towards infrastructure overhaul. Move all physical structures away from bank of

Alakhnanda, Bhagirathi, Mandakini and all other measure streams and goes.

- Improve road facilities, widen the bridges and roads and have good pavement. Place rock catching mesh where there is likelihood of landslides.
- Create and mark helicopter landing spots in mountains and keep fueling option available every 100-km. distance. Also place a helicopter lay and 10 spots to execute rescue operations.
- Provision of a simple telephone number for helpline and co-ordination center which must be in the center of pilgrim routers say at RUDRAPRAYAG and not to be kept in Dehradun.
- Keep provision of satellite phones on army posts. Ask telecom operators to provide more cellphone towers in mountain.
- Medical facilities of every 100-km. range or in major spots where there is helicopter landing or bay.
- Stock up the mountains with food grains and establish from May 10 when peak period of pilgrims begins. There should never be a food shortage from May 10 to June 30.
- Future research might also incorporate not only collaboration between humanitarian organization and their suppliers, but also between humanitarian organizations that use cloud computing technology doing so might further develop a holistic model for optimizing collaboration and agility humanitarian context.

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