

MATERIAL MANAGEMENT DURING THE NATURAL DISASTERS IN INDIAN CONTEXT

**A Dissertation Submitted to the Panjab University, Chandigarh for the Award of
Master of Philosophy in Social Sciences, in Partial Fulfillment of the Requirement
for the Advance Professional Programme in Public Administration (APPPA)**

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I have the pleasure to certify that **Brig Manish Bakshi** , has pursued his research work and prepared the present dissertation titled ‘**Material management during the natural disaster in Indian context**’ under my guidance and supervision. The same is the result of research done by him and to the best of my knowledge; no part of the same has been part of any monograph, dissertation or book earlier. This is being submitted to the Panjab University, Chandigarh, for the purpose of Master of Philosophy in Social Sciences in partial fulfillment of the requirement for the Advanced Professional Programme in Public Administration (APPPA) of Indian Institute of Public Administration (IIPA), New Delhi.

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ACKNOWLEDGMENT

I am very grateful to GOD ALMIGHTY for his blessings as without his graces and blessings, this study would not have been possible. This research has also been made possible with the help of many people who have directly or indirectly contributed in completing the same; therefore I express my gratitude to all of them.

I would also like to express my sincere gratitude to my 'GURU', Guide and Mentor, Dr Pawan Taneja, Assistant Professor, IIPA, for playing his role well in continuously supporting me, albeit her busy schedule, without which the research would not have been possible. His grasp of the subject has been a source of immense motivation to me and his dedication coupled with commitment was more encouraging. Further, I would like to thank him for providing a very congenial environment for research with an aim to enhance knowledge during the dissertation core curriculum.

I also would like to thank the Indian Institute of Public Administration (IIPA) for providing me with the opportunity to select this relevant topic in which the research has been conducted and for all the infrastructural support and facilities in completing the research work. I also want to thank Dr Roma Debnath for teaching me the right way of doing research. I would like to express my gratitude to the IIPA Library Staff, who were ever smiling and always available to help me notwithstanding their busy schedule. In the course of my research I contacted a large number of subject experts and people who gave me their valuable advice and comments that aided me with the research, for which I am indebted to all of them.

I would also like to thank Mr V K Sharma, Professor, IIPA for sharing with me adequate literature on the subject. I would like to acknowledge the assistance provided by the entire APPPA office staff for their support throughout my Course. I would finally like to thank my wife Mamta and my children Daakshi and Gaurav for the unstinted support during this research work.

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EXECUTIVE SUMMARY

1. Introduction

India is facing an increasing frequency and intensity of natural and manmade disasters that have devastating impact on life, livelihood and economy of the affected communities. In such a scenario, the disaster response planning and preparedness to minimize human and economical loss should be of highest standards. Inventory management in relief operation is unique as in that the time value of the commodities are much greater than the inventory carrying cost. Precise material management is the only answer to the challenges thrown open by the wide range of perils of disaster by nature or human brains. The present study was carried out on the topic “Disaster Management During the Natural Disaster in Indian context”. The aim of the study was to carry out a review of the material management framework to combat the disasters as also to suggest a streamlined process/ procedure to minimize the loss of men and material by delivering the right items at the right place in the right condition and quantity. This study aims to explore the scope for improvement of the management of materials and stores during disasters.

Material Management has become a growing science and presents new challenges in fighting disaster for the inventory manager. The gambit is to maintain and balance for the distribution of manager stocks, additional inventories, continuous feeding from hinterland, supply issues partnership and other unforeseen dimensions including the high inventory carrying cost of the inventory held. The need for this integration results from the changes required from time to time and disaster distribution matrix which will add to the efficiency indirectly depending on :-

- (a) Pressure on reducing the inventory carrying cost.
- (b) Subcontracting to the professionals is a lucrative proposal.
- (c) Optimum stockholding is affordable.
- (d) Transport and claim distribution system practical across the globe.
- (e) Means of Transportation which are changing fast and are available to reach remotest of the area.
- (e) International support in relief operations.

There is always a need to identify the major demand and supply variable and to quantify the variabilities. The need to cover the changeability of demand is the main task of the inventory manager. Unexpected demand always requires a laid down level of reserves to cover the consumption. Using the previous disaster wastage data, the unexpected demand can be anticipated, or at least taking into account these, future material requirements in disaster for similar kind can be worked out. The more the reserve the better we are prepared for disaster. In case of no data percentile, forecasting and fixed working proportion can be used for determining the level of stocks.

Disaster, natural as well as man-made, by now has become a global phenomenon. To cope with the disaster, authorities should not only be well-equipped but also to be able to put in place the proper system, through which stockholders can draw out material listing, holding and management strategy to meet future unforeseen changes. The developed countries are well equipped in advance with adequate machines and material for facing any kind of disaster be it natural or man-made. Analyzing some of the studies reveals that Material Management in disasters has undergone changes with expert oriented handling in terms of automation, warehousing and advanced distribution systems.

Disasters occur rapidly, instantaneous and indiscriminately. These extreme events either natural or man-induced, exceed the tolerable magnitude within or beyond certain time limits, making material adjustment difficult, generally resulting in catastrophic losses to property, income and life. These events aggravate natural environment processes to cause further damages to human society such as sudden tectonic movements leading to earthquakes and volcanic eruption, continued dry conditions leading to prolonged drought, floods and atmospheric disturbance. The intensity of any disaster is to be weighed in terms of the quantum of damage done to human society in an inclusive manner.

2. Methodology and Research Questions

There is a vast literature on disaster but comparatively little on Material Management in disaster. However there is a relative gap in the literature available vis-à-vis linking the existing policies with the Material Management in disaster and about the possible impact of the revised policy on the region under disaster effects.

Scholarly works have also been forthcoming on disaster and its damages to individuals and infrastructure. Yet, not much comprehensive literary work is available which studies the role of Material Management to mitigate the disaster affects and the key steps undertaken by the various agencies to connect the two. How Material Management is going to play a crucial role in bringing support closer to the affected population and the benefit would accrue out of the effective Supply Chain Management is something the research would in particular try to find out.

In conducting this study, the method of analyzing various important documents and official policies has been followed. Since it is based on observation and interpretation, therefore, this requires a detailed study of the documents, reports, policies, regulatory frameworks of our and other countries. Accordingly, the qualitative method of the study has been adopted during research to study the approach of different countries Supply chain process.

To seek the views of the stakeholders on the subject of the research questions of this study, a quantitative approach of the study was considered by taking their opinion through the survey.

Accordingly, this study has been done employing a mixed research strategy- qualitative and quantitative. Finally, in writing this dissertation attempts have been made to objectively study and analyze the subject as far as possible, though no work can be carried on without directions and targets. The study employs a mix of both qualitative and quantitative analysis.

We are facing an increasing frequency and intensity of natural and manmade disasters that have devastating impact on life, livelihood and economy of the nation. Therefore, the Research aims to find answers to following questions:-

Research Q1. What are the shortcomings of our current Disaster Emergency Response framework with respect to material management in comparison to other developed nations?

Research Q2. What is the role played by Armed Forces and its reappraisal in disaster relief activity to mitigate the limitations of NDRF / SDRF?

Research Q3. How best can we learn from best practices of other Nations to evolve a comprehensive material management plan during disasters?

Research Q4. What are the proposed disaster relief stores bricks (Medical stores, Rescue / Relief stores & Equipment, Food items) to strengthen our immediate response to the Disaster?

India's hazard risk profile and institutional framework

This chapter addresses various disaster hazard risks and the vulnerability profile of India. It highlights the effect of different types of disasters on the Indian populace like cyclone, flood, earthquake, landslides, snow Avalanches, drought, thunderstorms etc. It summarizes the effect of disaster on the nation's infrastructure and degree of preparedness needed for disaster risk mitigation. The chapter also analyzes policy guidance and institutional framework, the National Disaster Management Act 2005, NDMP 2019 and related latest DRR policies and their effectiveness in dealing with Disaster situations. The institutional framework in form of various Govt bodies and agencies along with their responsibilities and capabilities has been enumerated. Though, both the central and state governments have already made significant strides, however they will continue to work diligently to make our Disaster response more effective and preemptive rather than reactive.

Material Strategy in Disasters Scenario

Material Management concern arises essential on two grounds. First, non availability of stores could lead to excessive casualties and loss of lives and secondly a reckless use of resources to maximize coverage can lead to accelerated wastages which would adversely affect operation in neighboring sectors which may also be under effects of disaster.

A Major development in provision and procurement has been a decrease in the number of supplies and to develop confirmed supplies. This stems from the need for improved supply and has led to tighter control and higher quality standards. One solution to the unreliable procurement is seen to have a single supplier for each item, rather than multi suppliers of various component of the single item. The approach toward single sourcing can be made in the same way as any other quality improvement process.

There are many ways to promote economic efficiency in the use of resources, timely and systematic quantitative analysis of choices and improved institutional arrangement to fight the disaster as there is always pressure to accomplish more with less. There is a need to plan in advance to optimize budget and resources in such a manner that the public gets what they need during critical hours. The demands of the economy both from the standpoint of the allotted budget and from the principle of economy of force dictate that logistic support in disaster be furnished with the least possible waste and in such a way as to develop the maximum fighting power against the disaster aftermath. All that it implies is that the objective of all material management efforts should be the creation of continued and effective material support at the earliest.

Logistics involves planning, implementing and controlling the physical flow of material and final goods from points of origin to points of use to meet customer requirements. Logistic is, therefore, the study of flow management that can provide a level of distribution services to customers through effective planning, organizing and controlling of stock movement. It is the set of facilities, equipment, people, and the related flow of information from acquisition of raw material through production and distribution possible so as to fight the disaster with a scientific approach. Every logistic task must be the clear responsibility of someone, and each person must be responsible to

someone for performance. It is required to ensure disaster fighting readiness of the equipment, as well as high cost involved. We must have a system that requires a minimum inventory and redundancy, and still meet challenges of the disaster. Accountability should invariably encompass quality control. While improvement both in the quality of the product in hands and technical support is a constant quest, change for the sake of change, with no significant improvement in quality will be a serious drain on the support system.

Drivers of Material Management in Disaster are : -

(a) The actual location where product is stored, assembled or fabricated to be made available round the clock. The two major types of facilities are production sites and storage sites. Decisions regarding the role, location, capacity, and flexibility of facilities have a significant impact on the material management in disaster.

(b) Inventory encompasses all raw material, work in process, and finished goods. The inventory held and reported as an asset will be the start point of further material management in any disaster. Changing inventory policies can dramatically alter the relief operation and responsiveness, therefore these changes must be communicated from end to end to have seamless supply chain management.

(c) Transportation entails moving inventory from point to point or from higher supply echelons to the last disaster hit agency. Transportation can take the form of many combinations of modes and routes, each with its own performance characteristic. Transportation choices have a large impact on material delivery and efficiency during disaster relief.

(d) Information consists of data and analysis concerning facilities, inventory, transportation throughout the chain. Information is potentially the biggest driver of performance of material management in disaster because it directly affects each of the other drives. Information presents management with the opportunity to make changes and be more responsive and more efficient to the needs of the population involved.

(e) Sourcing is the choice of who will perform a particular supply chain activity such as production, storage, transportation, or the management of information. It can range

from Govt, Pvt, Public Partnership, NGO or local bodies, at the strategic level, these decisions determine what functions an agency performs and what functions will be outsourced. Sourcing decisions affect both the responsiveness and efficiency of a supply chain.

(f) Economy of material management-determine how much quantity of the goods and services will be available in the chain for disaster relief and to what extent for a particular sector keeping in view the overall requirement of stores in Range and Depth.

There is a well-developed technique for planning to work out the demand in anticipation called Material Requirement Planning. This is a generally applicable technique for all types of dependent demand. The basic concept is to have stock when it is needed and to have minimum stock level the rest of the time. The demands must carry complete details such as type, model, size and timing of the requirement to meet needs. Planning can therefore give unexpected results in material management during disaster. During research, it was found that the material support shortcomings during Disaster relief activities can be summarized as follows: -

- (a) Inadequate exploitation of Advance warning systems and technology for disaster prediction and identification of related risks and vulnerabilities.
- (b) Appropriate disaster prevention and mitigation strategies are not executed on the ground.
- (c) Lack of clarity on roles and responsibilities for different stakeholders concerned while fighting the disasters so that materials in disasters can be managed more effectively.
- (d) Non conduct of mock drills and community building/ participation.
- (e) Non availability of storage warehouses, Rescue and relief inventory to meet requirements of victims at all levels. Inadequate arrangements for accessing resources, equipment, supplies and funding in preparation for disaster that might occur.

- (f) No procedures are in place to mobilize the resources and capability for relief, rehabilitation, reconstruction and recovery from disasters in quick time frame.
- (g) Lack of awareness and preparedness in providing advice and training to the agencies involved in disaster management and to the community at large.
- (h) Inadequate coordination with material supplying agencies related to disaster management in any location and those at the national and international level.
- (j) Relief / assistance to the affected is in many occasions marred by discrimination of caste, creed or community.

US disaster logistics management and resource support system

The research examines the disaster response system of a US Govt especially with respect to their material support Plans and infrastructure. Moreover the good practices of their system have been brought out so as to incorporate them with due modification in our disaster response system. It deals with the FEMA i.e Federal Emergency Management Agency, the primary agency in the United States which is charged with responding to national crises. It deals with FEMA's logistics supply chain. It was found that in most developed nations, the vast disaster relief network is backed by meticulous preparedness, elaborate communications network, facilitates relief assessment and prompt operations. The management of disasters is a multidisciplinary field of study that requires a proactive strategy through the implementation of a number of different precautions to ensure an efficient institutional and policy framework, as well as disaster prevention, mitigation, and preparedness. When it comes to achieving our goal of reducing the risk of disasters, the participation of central and state governments, as well as the community, organizations of civic society, and the media, all have an important part to play in developed countries.

Case Studies.

The chapter critically examines the role of various Govt agencies, Armed forces /NDRF /SDRF, NGOs and media in disaster relief activities in Orissa, Gujarat and Kashmir Disasters. It deals with the loss suffered, the early response to the disaster that was taken in the different disasters and the material supplied by various organizations during the disaster. It also brings out the takeaways as well as shortfalls of relief work during these tragedies. After going through the relief measures taken by different organizations to overcome the losses and saving the lives of the people it was found that time and time again, nature's wrath has shown us the gaps in our disaster preparedness. We are even more vulnerable to damage in this kind of incident due to our lack of preparation, mitigation, response, and recovery planning. The States must take action through their SDMA to prevent and mitigate the effects of disasters, including flood disasters, and to undertake a comprehensive, coordinated, and prompt reaction to any disaster situation. It was found that there is a lack of a proper forecasting system. Moreover, there is a lack of preparedness planning, lack of adoption of prevention and mitigation, lack of coordination between the government and non-government organizations providing aid, Poor Recovery Planning.

Data Analysis and Findings.

An endeavor to interpret the feedback of various respondents (who were Govt officials, ordinary citizens and people residing in disaster prone areas) through the medium of a Questionnaire. The views of various govt officials who are directly or indirectly involved in Disaster relief works were also obtained during focus interaction have also been mapped to understand the efficacy of existing setup and also satisfaction level with respect to material availability during all stages of Disaster Management.

This chapter also summarizes the various aspects of the material management activity that were found lacking and the urgent need to be addressed by various Govt agencies involved in policy making and execution of relief work during natural disasters. Some of the shortcomings in our Material relief network are:-

Lack of Preparedness. Government preparedness programs in high-risk regions are insufficient and poorly timed. For example, Orissa did not have any grassroots NGOs when the catastrophe struck in 1999.

Inadequate Coordination amongst Relief Agencies. There was inadequate coordination between government and non-government aid organizations. Therefore, these organizations' distribution of rescue supplies and rehabilitation aid was largely erratic, inadequate, and delayed. There has been an oversupply of rescue and rehabilitation aid in many neighborhoods and communities.

People Participation. The disaster preparedness program should include training and education of local communities to facilitate their participation in minimizing the damages caused by any disaster. This is evident in the case of Gujarat and Orissa wherein post rehabilitation the buildings and Structures were disaster resilient.

Health Services. Any disaster incident had a significant negative impact on the state's vital services. Many hospitals, clinics, and pharmacies in Kashmir were severely destroyed after spending several days submerged in water. Critical diagnostic equipment placed at the hospital, such as X-ray and ultrasound machines, has been damaged, according to the city's major hospital and other hospitals.

Sanitation. Important infrastructure and fundamental services, such as the provision of water and power, have been damaged and must be repaired. Markets, homes, government buildings, the secretariat, and roadways in Srinagar had to be dewatered and cleaned of silt and trash as a result of the flooding. Immediate remedial measures are essential to prevent epidemic-like situations.

Lack of Disaster Resilient Infrastructures. Non adherence to Multi-hazard resistant construction capable of withstanding cyclones, earthquake and other natural disasters. In all three cases, most houses /structures were without incorporating any modern technology or technology advancements.

Deductions And Recommendations

This chapter suggests a way forward based on feedback from respondents, best practices prevalent in other Developed Nations and in line with various DRR related

policy frameworks. It highlights the importance of coordinated regional action to improve crisis management everywhere it can be done by sharing knowledge and resources (both human and material). An efficient crisis management system necessitates regional cooperation in the areas of hazard and vulnerability assessment, human resource development, infrastructure preparation, and funding allocation.

It was found that in order to carry out the disaster recovery plan as a whole, the state or local government must be a key player in the implementation strategy. While in operation, the temporary institution should be able to handle complex duties within clear parameters. During a crisis, the recovery centers will send personnel to assist the state and local emergency management authorities.

Building in a culture of preparedness and mitigation, Operational guidelines of integration material management practices into operational development, and specific development scheme for beforehand material procurement for disaster, having robust early warning systems coupled with effective material response plans at district, state, national and international level. Building capacity of stakeholders, involving the community, NGOs, trades and the media at all stages of Disaster Management in the answer to Material Management. Addressing gender issues in disaster management planning and developing a strategy for inclusive approach addressing the weaker sections of the society to meet their material needs in an early time frame.

The risks associated with forecast error must be considered when planning for the disaster. Errors in forecasting can cause significant misallocation of resources of scarce inventory, facilities, transportation, sourcing and information sharing means. Forecast errors during a disaster may cause too many, too few, or the wrong type of build up. Forecast of the inventory, production, transportation, sourcing, and pricing to build up resources depend on the accurate data. Even on a logistic level, forecasting plays a vital role in the actual day-to-day activities that are executed. As one of the initial processes in each of these phases that affect many other processes, forecasting contains a significant amount of inherent risk. Any factors that lead to either local optimization by different stages of the supply chain or an increase in information delay, distortion and variability are the obstacles in coordination. If managers in a supply chain are able to identify the

key obstacles, they can then initiate suitable actions to help fight disaster in a short span with the material support.

One of the major reasons for out-sourcing is that there are private players at cheaper options than Govt/administration Material Management Deptt. By outsourcing, one can allow suppliers to do things that the Govt is not good at, and the suppliers are most competent in doing so. During all the functions related to sourcing, purchasing of raw material, part or component, holding of inventories, and distribution of product stretches the resources in the manner that it becomes invisible at times to exercise managerial control over all the activities by Govt relief agencies. This outsourcing provides greater flexibility and development of resources in disaster areas. Also, partnership and outsourcing of products and services helps them to have greater control over the critical material management activities in disaster.

8. Conclusion

Training at functional or lower level of all those involved in the material management in disaster is necessary if each activity is to be properly implemented. The failures if any in disaster mitigation, preparedness, and material management are largely due to the gaps that exist between different stakeholders/agencies involved. Also another key area is lack of specific training for storage and distribution of stores. Many professionals have never received training or experienced a disaster to manage the disaster related inventory and services under stress and adverse conditions which may develop be due to nature or manmade disaster.

The protective process embraces measures which enable all agencies to respond rapidly with disaster related material to cope with them effectively. Material Management includes the formulation of viable emergency plans, working out warning systems, and the maintenance of inventories beforehand. It may also embrace search and development of new products as well as back loading of stocks from areas that may be at risk from a recurring disaster.

Tiered Storage Infrastructure. The suggested method for selecting a secure site has the potential to ascertain the bare minimum number and possible locations of off-site

storage facilities while simultaneously preserving an optimal balance between the efficacy of operations and the economy of resources.

The mission is wastage reduction of all types of stores/equipment be it in natural or man-made disasters so that adequate reserves are available to meet the crisis situation. This is not an easy task to achieve, especially keeping in view the vast population, and the multiple agencies which handle material movement and extensive distribution systems. The people on the ground will always find the task, though difficult, but achievable and this is only feasible through an effective material management to meet unprecedented challenges faced in disaster.

Disaster Management requires a multi-disciplinary and proactive approach. Besides various measures for putting in place institutional and policy framework, disaster prevention, mitigation and preparedness enunciated in this study and initiative being taken by the center and state government, the community, civil society organization and media also have a key role to play in achieving our goal in moving together, towards a safer drive to material management in disaster. In order to move towards safer and sustainable development, each project should be sensitive towards the requirement of disaster mitigation.

CHAPTER 1: INTRODUCTION

1.1. Background

India is the world's most populous democracy and the seventh-largest country in terms of land area. Its population is close to 1.4 billion. Land boundaries are shared with Pakistan to the west, China, Nepal, and Bhutan to the north-east, and Burma and Bangladesh to the east. The country is bounded by the Indian Ocean to the south, the Arabian Sea to the south-west, and the Bay of Bengal to the south-east. Our nearest neighbors to the south and east are the Maldives and Sri Lanka, respectively. Our Andaman and Nicobar Islands share a maritime boundary with both Thailand and Indonesia.

Due to its geographical location and extreme susceptibility to natural disasters, India is among the world's most disaster-prone nations. A disaster occurs when a society's normal functioning is severely disrupted, leading to widespread losses of life, property, or the environment that surpass the capacity of the affected society to recover on its own. It is occasionally useful to distinguish between "natural" disasters and "man-made" disasters. Examples of natural calamities include floods, droughts, tidal waves, and earthquakes. Human-made or human-induced catastrophes are those that are the direct result of human action, such as chemical or industrial mishaps, environmental pollution, transport accidents, and political instability.

Since most disasters are the result of the action or inaction of people and their social and economic institutions, a more modern and social perspective of disasters sees this divide as artificial. This occurs when humans create and maintain socioeconomic systems that contribute to environmental degradation, when they expand into and populate metropolitan areas, or when they choose lifestyles that have a negative impact on the natural world. Because of their socioeconomic status, communities and populations living in locations prone to the impact of a raging river or the strong earthquakes of the earth are placed in positions of high vulnerability. The unpredictability of the timing, frequency, and scale of natural disasters is a further complicating factor, as

is the fact that every facet of nature is vulnerable to seasonal, annual, and sudden variations.

Etymology

The word ‘Disaster’ derives from Middle French *désastre* and that from Old Italian *disastro*, which in turn comes from the Greek pejorative prefix *δυσ-*, (*dus-*) “bad”+ *στήρ* (*aster*), “star”. The root of the word *disaster* (“bad star” in Greek and Latin) comes from an astrological theme in which the ancients used to refer to the destruction or deconstruction of a star as a disaster.

In the current times the disasters are becoming more and more frequent all over the world. The developing nations have to be prepared and equipped to meet these challenges as disasters can happen with little or no warning. The damages caused by any kind of disaster to human life and property can be devastating. The material management in a disaster relates to the right use of available resources for relief purposes, coordination between various organizations, efforts of each individual, focus on large scale events, right knowledge of geographic locations, nature of society and economic support coupled with the sound local administration, Disaster Management. Disaster both natural and manmade finally narrows down to involvement of Men and Material.

There is enormous need to work on this crucial aspect of material management in disaster as there are five distinctive regions of the country which are under threat around the year for natural disasters as far as geographic dimensions are concerned:-

- (a) Himalayan Region is prone to earthquakes and floods/slides.
- (b) The Central Plateau region is prone to droughts.
- (c) Hilly parts including NE are prone to floods/ landslides.
- (d) The Coastal Zone is prone to Cyclones or Tsunami.
- (e) Alluvial Plains are prone to Floods.

According to the NDMP 2019, out of 36 states and Union Territories, 28 are prone to disasters, 58.6% of landmass is affected by Earthquakes and 40 million hectares

are affected by Floods or River Erosion. 5700 km out of 7516 km of the Indian coastline is prone to Cyclone or Tsunami, whereas 68% cultivable lands are vulnerable to Droughts.

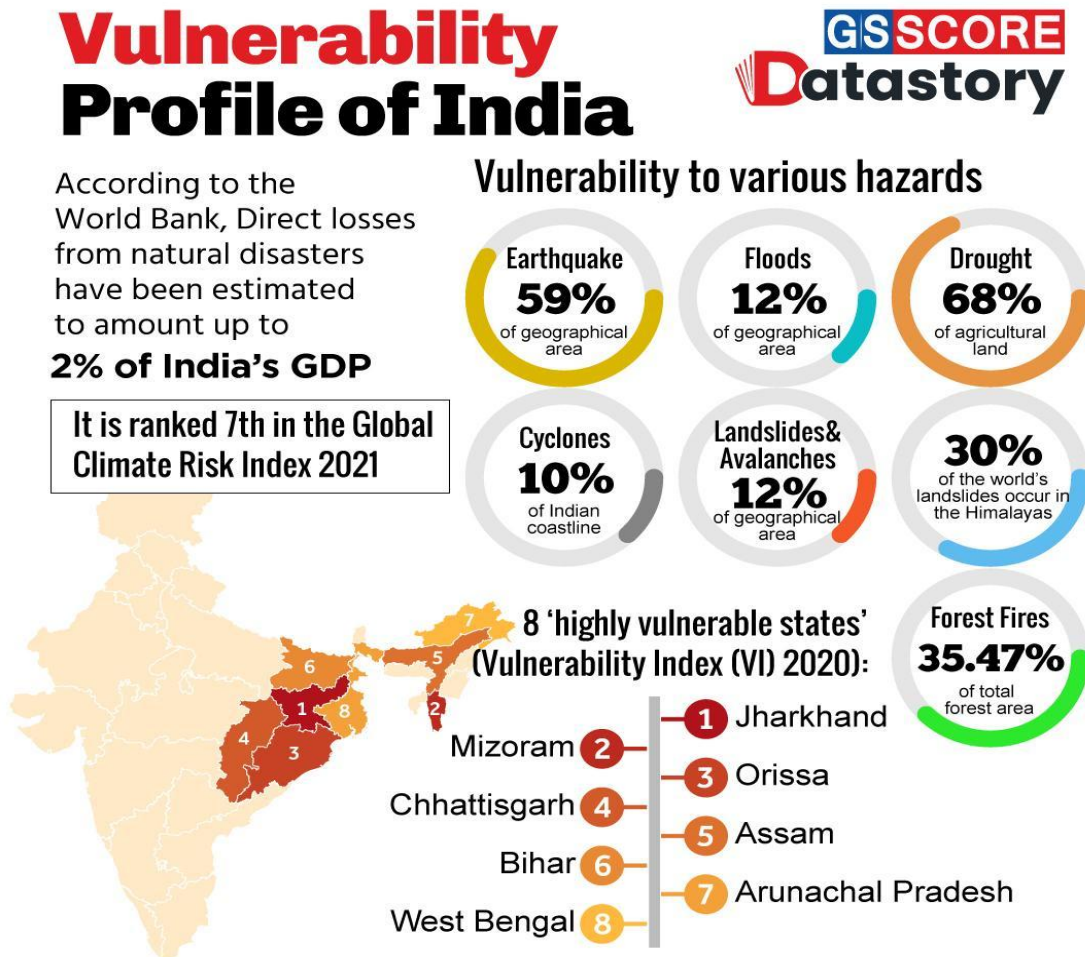


Fig. 1.1 Vulnerability Profile In India

In most countries, the policies involving material management in disasters are governed by the following:-

- (a) **National Development.** It is the ability of the nation to improve the social welfare of people struck by disaster in terms of water, transport infrastructure and medical assistance. The welfare of masses by social and economic structural development such as health, hygiene, sanitation and security

especially of women and children will dictate the material requirements and plan pre-positioning of the resources.

(b) **Nation's Economic Policy.** Any nation's economy is the most critical factor as it decides the purchasing power of the government. With the GDP gaining importance in deciding the material support, the relief requirements can be divided into three phases: Pre-disaster, During the act and Post-disaster. The concerned authorities have to earmark the reserves for the disaster and within that a dedicated portion for material support in disaster.

(c) **Funds.** There is always uncertainty in forecasting the actual losses and availability of funds. It is difficult to have ready funds available to meet the full material requirement in any disaster. No organization has unlimited finance to an extent to catch up with 100% commitments to meet challenges. However arrangements can be worked out by pooling in resources, commercial insurances at international level and bank linked solutions besides Public Private Partnership to meet the deficit financing.

(d) **Environment.** The international and the national environment is the single most important factor pushing the material delivery system. The issue to be taken into concern is dynamic and these require constant force to drive the material support with or without friendly foreign countries.

(e) **Relief Measures.** These range from meals a day to the gigantic infrastructure recreation. The relief measures both small and large require material and workforce. The relief component availability is governed by determining the extent of the sanctioning and executing authorities' empowerment. Hence, there is a need to redefine these limits at regular frequency after every disaster experience / feedback report.

(f) **NGO Role.** These can be innovative, rooted to the ground and participating in providing the material support. These agencies are involved initially for disaster management and later in infrastructure development and recovery of the material. Wherever limited resources, logistics shortage and lack of facilities are of concern the NGO can be involved in material management as well as build up. This will further help in damage control and mitigation of disaster effects.

(g) **Media.** The process to help individuals to reach the right material at the right place and right time can be best achieved by notices, posters, photographs, films, film clips, videos, insert into ongoing programs, short radio or television features and talks or presentations. Hence the media has a main role for those affected by disaster as well as those miles away just waiting for more news, warnings and situational reports.

Accountability of Material. There is a paradigm shift in the material management during the disaster in comparison to routine inventory control. Substantial scientific and management programs have to be incorporated to reduce the loss of lives and damage to the property in the event of disaster. The following are the main pillars of the Material Management in general:

(a) **Taxpayer Audit.** The capital involvement or revenue budget is always limited. Hence, the endeavors are to drive maximum resources out of the minimum expenditure. The finance is the backbone of a nation's capability to deal with the disaster. Hence each action will be audited and monitored in terms of expenditure and the justification after the disaster.

(b) **Dated Inventory.** There are a number of short shelf life stores where the procurement, storage, consumption and final disposal has to be planned and executed in an optimum manner. The vital, essential and desirable analysis coupled with automation will help in judicious and timely utilization.

(c) **Quality Assurance.** Any material is of use only if it is manufactured to the specification and quality so as to meet the user's aspirations. Quality control

from the raw material stage to the finished product has to be imposed at all levels and well in time to ensure Quality Assurance to neutralize the disaster effects and its implications on the minds of the population.

(d) **Stocking and Related Implications.** As on date the space is the biggest constraint in any logistics set up. Gainful utilization of available material handling equipment and storage bays is the key to the success of the material manager. This directly affects the inventory carrying cost, security and fire fighting arrangements of any installation supporting the disaster relief.

(e) **Visibility at Higher Authorities.** Every organization has an hierarchical system and the authority is directly linked to the responsibility. Hence, the Sr Manager needs to peep into the manager's domain who has to closely supervise ground workers. The automation and gadgets available do facilitate the transparency in material management from top to bottom. However the need of the hour is to provide visibility of action and integrity of operations.

(f) **OGW (On Ground Worker).** A material manager has to be on the inventory floor to ensure right provision, procurement, receipt, storage, maintenance, preservation, issue and disposal of the material as per sequencing of the effects of disaster. Though aiming at 'Management by Objective', the manager has to be prepared for 'Management by Crisis'. This will guide him the kind of disaster relief material supply required as the mitigation measures.

(g) **Stock Check.** In a disaster the condition and situation changes faster than the time. The material manager's action and reaction to a situation has to be dynamic, flexible and accountable under the worst circumstances. There is a definite requirement to have a checklist from 'Womb to Tomb' for each activity related to material support.

Statement of Problem

The management of material before, during and after the disaster is the key to the damage control as well as to the speed of recovery. The material management challenges are governed by:

- (a) Availability of conditioned space
- (b) Responsiveness of location vis a vis distance
- (c) Shelf life of the material required
- (d) Security and means of communication
- (e) Transportation/Packaging of material
- (f) Support from other organization
- (g) Establishment of Supply Chain Management System

Material storage policy is best arrived at by finding answers to the following questions by those experts involved in planning, financing, procurement and supply of the material before, during and after the disaster has struck.

- (a) What can be done?
- (b) How much or to what extent?
- (c) Can the material be pre-stored?
- (d) What are the chances of deterioration if not utilized?
- (e) What are the payoffs of the partnership with locals?
- (f) Have the local public resources been exploited?
- (g) Requirement of sharing of info with all carried out or should it be on a need to know basis?
- (h) What action has been taken on lessons learnt earlier?

1.2. Rationale Of The Study

On reviewing the existing documented information available, it is found that there has not been enough work done on the material management in the disasters.

Lack of logistics knowledge and the back seat given to logisticians has created a wide gap and hollowness in the disaster management material and the action plan at National / Regional level.

Today besides natural, the man made disasters are on the rise with increased intensity and frequency. There is a need to dovetail technology advancements and economy boom in the Material Management Gambit to protect the mankind and his belongings in any kind of disaster both as preventive and curative action.

Keeping in view the importance of management of material before, during and after the disaster, I am presenting herewith the proposal titled Material Management during the Natural Disasters in Indian context. Thus the research will be beneficial to the Policy Makers, NDRF Bns, State / District Disaster management Establishments to provision and place stores in preparatory as well as relief stages to combat the disaster effectively.

1.3. Objective Of The Study

The aim of the study is to carry out a review of the material management framework to combat the disasters as also to suggest a streamlined process/ procedure to minimize the loss of men and material by delivering the right stores at the right place in the right condition and quantity. Therefore, the study has been carried out keeping in view the following objectives:

1.4. Research Objectives

Objective 1. To examine the existing India's Disaster relief stores management setup at center/state level in India

Objective 2. To identify the issues / challenges and suggest a way forward in the material supply chain during disasters.

1.5. Research Questions

Research Q1. What are the shortcomings of our current Disaster Emergency Response framework with respect to material management in comparison to other developed nations?

Research Q2. What is the role played by Armed Forces and its reappraisal in disaster relief activity to mitigate the limitations of NDRF / SDRF?

Research Q3. How best can we learn from best practices of other Nations to evolve a comprehensive material management plan during disasters?

Research Q4. What are the proposed disaster relief stores bricks (Medical stores, Rescue / Relief stores & Equipment, Food items) to strengthen our immediate response to the Disaster?

1.6. Scope Of The Study

India is facing an increasing frequency and intensity of natural and manmade disasters that have devastating impact on life, livelihood and economy of the affected communities. In such a scenario, the disaster response planning and preparedness to minimize human and economical loss should be of highest standards. Inventory management in relief operation is unique as in that the time value of the commodities are much greater than the inventory carrying cost. Precise material management is the only answer to the challenges thrown open by the wide range of perils of disaster by nature or human brains. This study aims to explore the scope for improvement of the management of materials during disasters. The research will undertake case study in respect of following disaster to arrive at / understand the material requirements:-

- (a) Gujarat Earthquake
- (b) Orissa Super cyclone
- (c) Kashmir Floods

1.7. Chapterisation Scheme

Chapter 2 : Literature Review and Research Methodology This chapter summarizes the gist of various GoI Acts , NDMP 2019, Articles Journals, Various research papers and books published by renowned Authors related to disaster management. It also deals with the Research Methodology and Design adopted to analyze and interpret both primary and secondary data.

Chapter 3 : India's Hazard Risk Profile and Institutional Framework
This chapter addresses various disaster hazard risks and the vulnerability profile of

India. It highlights the effect of different types of disasters on the Indian populace. It summarizes the effect of disaster on the nation's infrastructure and degree of preparedness needed for disaster risk mitigation. The chapter also analyzes the National Disaster Management Act 2005, NDMP 2019 and related latest DRR policies and their effectiveness in dealing with Disaster situations. The institutional framework in form of various Govt bodies and agencies along with their responsibilities and capabilities has been enumerated.

Chapter 4: Material Strategy in Disasters Scenario. This chapter examines the Material support infrastructure and policies existing for response during various stages of Disaster. Various checks and balances and Supply Chain bottlenecks have also been analyzed.

Chapter 5: US Disaster Logistics Management and Resource Support System. The Chapter also studies the Disaster response system of a US Govt specially with respect to their material support Plans and infrastructure. Good practices of their system have been brought out so as to incorporate them with due modification in our disaster response system.

Chapter 6 : Reappraisal of Role of Armed Forces in Disaster Response. The role played by the Armed Forces in various disaster relief activities in the past, both in India and Abroad have been brought out. Also the chapter deliberates in detail on capabilities as well as limitations of the Armed Forces in dealing with Disasters on its own or in conjunction with the NDRF / SDRF Battalions.

Chapter 7: Examination of Case Studies . The chapter critically examines the role of various Govt agencies, Armed forces /NDRF /SDRF , NGOs and media in disaster relief activities in Orissa, Gujarat and Kashmir Disasters . It also brings out the takeaways as well as shortfalls of relief work during these tragedies.

Chapter 8: Analysis of Feedbacks and Data Collected. The chapter makes an endeavor to interpret the feedback of the respondent (who are Govt officials, ordinary citizens and people residing in disaster prone areas) through the medium of a

Questionnaire. The views of various govt officials who are directly or indirectly involved in Disaster relief works obtained during focus interaction have also been mapped to understand their sentiments and satisfaction level with respect to Disaster Management.

Chapter 9 : Findings and Recommendation This chapter summarizes the various aspects of the Material Management activity that we found lacking and the urgent need to be addressed by various Govt agencies involved in policy making and execution of relief work during Natural Disasters. It also suggests a way forward based on feedback from respondents, best practices prevalent in other Developed Nations and in line with various DRR related policy frameworks .

1.8 Scope/Limitations/Delimitations

The scope of the research is to access the Material Management aspect of Natural Disasters in Indian Context and it's our preparedness and Response effectiveness. Research is based on the data and information received from the primary sources and by using secondary sources such as GoI Acts , Relief Plans, Various research papers , books published by renowned Authors and various SOPs being followed by different states and that of NDRF / Armed Forces. However, due to the logistics constraints including paucity of time and resources , the study has been carried out based on the information gathered from limited primary sources such as NDMA, SDMA, MHA officials and also NDRF / Armed forces officers directly or indirectly involved in providing logistics relief during various Natural Calamities through the medium of questionnaires and Interviews. The following delimitations are also hereby pronounced:-

- (a) The Material Management framework for Natural Disaster is still in the nascent stage . Data available on the NDMA website, other secondary sources and through primary survey has been analyzed for the study.
- (b) The research was conducted through personal interaction and an online response of a varied range of respondents from disaster prone areas / geographies across India.

(c) The number of respondents who were approached for the primary data collection has been limited to a small number because of limitations of reach, time and resources.

CHAPTER 2

LITERATURE REVIEW AND RESEARCH METHODOLOGY

2.1 Overview of Literature

Before proceeding further it is pertinent to take stock of the available literature on the research problem. The useful literature for this research work is books, articles in journals and periodicals written with varying degrees of relevance on disaster as well as Material Management. Particular comprehensive publications have appeared over the last many decades along with journal articles that touched on the various types of disaster and its effects on Men and Material . Thus, the books and articles would be material that is related to the changing contours of disaster and its possible implications on Supply Chain Management. There is a vast literature on disasters but comparatively little on Material Management in disasters.

Disaster Management Act 2005, GoI, This act lays down the definition and types of Disaster, both Natural and manmade. It clearly defines the role and responsibilities of various Central and State Govt agencies involved in Disaster Policy making and relief activities. It gives Legal and statutory backing to different forces involved in various stages of Disaster relief.

National Policy on Disaster Management 2009 (NPDM),GoI has been prepared in tune with and in pursuance of the Disaster Management Act, 2005. National Policy on Disaster Management (NPDM) provides the framework/roadmap for handling disasters in a holistic manner. The Policy covers all aspects of disaster management covering institutional, legal and financial arrangements; disaster prevention, mitigation and preparedness, techno-legal regime; response, relief and rehabilitation; reconstruction and recovery; capacity development; knowledge management and research and development.

National Disaster Management Plan 2019, GoI, This Compendium explains the paradigm shift of our approach from disaster relief to Risk reduction since the enactment of the Disaster Management Act, 2005. The definition of disaster is now all

encompassing, which includes not only the events emanating from natural and man-made causes, but even those events which are caused by accident or negligence. It covers guidelines issued by the National Disaster Management Authority (NDMA) with the objective of wide circulation and public awareness amongst the educated citizens of India. The National Disaster Management Authority (NDMA) has prepared a no of guidelines & policies for the effective prevention, preparation & response to any kind of disaster..The book captures information about all such events occurring across the sectors and efforts made to mitigate them in the country and to collate them at one place in a global perspective.

Dr Anil Kumar (2016), in his book titled Supply Chain Management: Theories and Applications, Brings out that the Cross Border Supply Chains have significant role in material management in disaster as Globalization offers opportunities to producers and exporters in developing countries, can shipp at competitive costs to the markets where demand exits. As a result, multinational corporations, importers and retailers have expanded their international operations to meet new consumer demands with food safety as the one of the most important concerns.

Cross-border supply chains involve suppliers, or groups of suppliers, or companies from a particular country who export produce to the markets/ buyer organizations in importing countries. Through these cross-border chains, new forms of on-farm production technologies. Labor processes and organizational networks are introduced in the supplier countries. Supply chains not only benefit the companies directly involved, they also stimulate social, and economic development within a region or country from where food in fresh or processed form is sourced. Besides, the cross-border supply chain stimulates the development of local agro-industry. imparts valve addition to products, decreases product losses, and increases export earnings of the exporting (mostly developing) countries. When it comes to managing supply chains, it's important to take a holistic strategy in which all parties involved (from raw material suppliers to ultimate customers and back again) work together to plan and manage the flow of goods, information technology, and money.

So that you can efficiently and promptly meet the needs of your customers. Management of the supply chain prioritizes the customer. Supply chain management seeks to reduce production costs and maximize profits through better coordination of the various stages of the manufacturing process. There is a need for a multidisciplinary strategy because of the wide range of tasks and considerations involved. The supply chain management method has many benefits. For this reason, it is difficult to devise a framework for the disaster relief supply chain that can handle the complications that develop under extreme conditions and a great deal of unpredictability. Especially in terms of getting people the medicine they need after a natural disaster. It would be fascinating to talk about how to create inventory models that would help with supply chain and logistics issues in the hospital after a disaster.

Supply and goods acquisition, as well as the means to convey them, are crucial to disaster relief operations. In the aftermath of a natural disaster, the distribution and transportation of essential supplies can encounter delays. This is due to the fact that earthquakes and volcanic activity have wreaked havoc on the existing infrastructure and access highways. Damage to the supply chain's primary access road would have a negative impact on distribution schedules and material procurement plans in disaster-stricken areas.

Pujawan et al (2009), Principles of supply chain for DROs (Disaster Relief Operations) proposes an application framework approach for assessing disaster relief logistics management. Having someone in charge of making decisions during disaster operations is crucial. In the field of disaster management, researchers have developed a model for the logistics of humanitarian relief efforts. In the past 20 years, numerous studies have been conducted on disaster-related topics. These studies examined various aspects of disaster administration, particularly the coordination and cooperation among the various organizations involved in humanitarian efforts, such as the evacuation of victims, the distribution of aid supplies, and the planning and distribution of relief materials. However, the importance of HSC in emergencies has received very little attention. Academics and researchers will find it increasingly necessary and interesting to

study the intersection of healthcare supply chain and supply chain disaster, especially in the context of natural disasters.

Mete & Zabinsky (2010) used a stochastic model optimization strategy to the issue of disaster-related medical supply storage and distribution.

Dasaklis et al (2012), Additional study could focus on issues including how best to distribute medical supplies (such as equipment, pharmaceuticals, vaccines, and anti-virus software), how long it takes to do so, and how much money is needed. Stochastic approaches provide a different way of posing the problem that can be used to avoid disastrous outcomes.

Mohanty (2013) has discovered a discrepancy between the number of patients and the number of medicines available in hospitals, making a pandemic extremely improbable. Healthcare disaster relief operations are increasingly reliant on a reliable supply chain in the case of catastrophic events. Supply chain management in the healthcare industry needs to be efficient and successful in emergency situations. And so that it may mitigate and avert more severe consequences, such as the loss of life among a large number of disaster victims.

Wassenhove (2006), Operational challenges in humanitarian logistics, emphasizes the need to advance the science of more efficient logistics. Natural disasters feature elements of an emergency, including uncertainty, complexity, and dynamic change. Many scholars have been motivated by these issues to create a framework model for logistic operation that may be used to combat natural disasters.

L. B. Davis (2013) He suggested employing a stochastic programme approach to strategically prepare for inventory capacity and coordinate amongst storage networks during disaster relief activities. Humanitarian aid teams need efficient and effective strategy planning and collaboration to satisfy the needs of those affected by disasters.

Manopiniwes & Irohara (2014) a proposed to use an optimization model to improve the logistical aspects of disaster relief. A placement facility, distribution models, and inventory models are three elements of logistics that play a role in disaster

assistance. For the future, researchers will need to take into account all three of these logistical issues by integrating data from before and after the tragedy.

Sharma, V K, (2013) Disaster Management, has discussed the country's disaster response plan comprehensively. The book has useful information regarding Natural Disasters such as Disaster History Report, Progress in IDNDR, but the book has limited details about the nation's emergency response force as well as the logistics challenges faced by various agencies while undertaking relief and rescue operations.

AK Singh, (2016), Disaster and Tsunami Management has discussed the role of employment of the NDRF and Armed Forces in search and rescue management post any major Disaster but has not brought out the complexities and limitation of the capabilities of these agencies.

Dangi. HK (2014), Disaster Management: Humanitarian Logistics in Relief Operations, 2014 discusses a systematic approach to relief logistics, global best practices and discusses briefly the role of military and NGOs in relief operations.

Badhani, NC (2016) Disaster Management and the Role of Armed Forces had been taken up as a research project by Maj Gen NC Badhani as part of his doctoral research project. His research has focussed on the role of Armed Forces and how to improve its effectiveness. However it has still not analyzed the capabilities of NDRF and its synergised response with the Armed Forces.

Afshar, A., & Haghani, A. (2012). Modeling integrated supply chain logistics in real-time large-scale disaster relief operations The study's overall objective is to build a model detailing integrated logistical operations in the wake of natural disasters. In this paper, they present a mathematical model for managing the distribution of multiple relief supplies, beginning at their respective origins and ending in the hands of their intended beneficiaries. The network was built to accommodate the elaborate logistics system used by FEMA in times of emergency. In addition to taking into account things like vehicle routing and pick-up/delivery schedules, the proposed model also takes into account finding the optimal locations for multiple layers of temporary facilities and taking into account multiple capacity constraints for each facility and the transportation

system. With the help of such a unified framework, we can better use our scarce resources and get rid of unnecessary delays.

Lloyd, Barrette, Chaudhary P., Chenji S. (2013). Leveraging Resources for Community Resilience Building. A study of multi-hazard affected villages in Bihar documenting best practices seek to better understand the processes of leveraging government resources for CBDRR and to understand how such processes could be integrated into existing flagship schemes. In order to carry out this study, 12 villages and 11 schools in Bihar were visited where CBDRR has been implemented. An analysis of UNICEF inputs into the CBDRR programme compared to its outputs was employed to understand programme effectiveness. Focus was given to particular funds and resources that were leveraged so as to highlight programme outcomes in clear and tangible terms. Along these lines, the methods used for leveraging resources were identified and examined to better understand how outcomes were obtained.

Gandhi P. Jegadish (2007), In 'Disaster Mitigation and Management: Post-Tsunami Perspectives' has written on the need for institutional approach It is the context that symbolizes the susceptibility and vulnerability of groups of people in a nation. This could be in response to national disasters or man-made ones. The next step after understanding the positional impact of such disasters is the relief and rehabilitation work that determines how a society faces and emerges from a disaster. In this paper, a specific context of tsunami in Tamil Nadu is taken up for study. Post tsunami, it is imperative to know how and what the affected people have been provided with rehabilitation entitlements. Before that a brief review of literature regarding relief and rehabilitation works of natural disasters is given to understand the various perspectives.

Sumanta Banerjee (2005) understands the uncertainty of natural disasters as a clash between nature and humanity. Commenting on the lack of support services, the opinion that "the unsuitability and inefficiency of the existing infrastructure to cope with the after-effects, gets exposed in all its horrid manifestations", gets highlighted. In the case of payments made to the affected people, the issue of monthly payments versus the lump-sum payment needs to be dealt with.. The idea is to look at what form of relief

would be conducive for boosting one's sense of livelihood security. In the case of donor agencies, the three attributes of direct, fair and equity in the delivery mechanism, must exist. For this, it suggests that an innovative mechanism has to be thought out by those delivering aid to the affected people.

Rao, D.P. (2009) Disaster management. Due to the tropical heat, unstable landforms, and dense population, there is also a high rate of illiteracy, poverty, and inadequate infrastructure. The frequent occurrence of various natural disasters, such as drought, flood, cyclone, earthquake, landslide, forest fire, hail storm, locust, volcanic eruption, etc., which have a devastating effect on human life, the economy, and the environment, makes India one of the most vulnerable developing countries. The damage brought on by disasters was almost impossible to fully repair, but it was possible to reduce the risks by creating early warning systems, creating and implementing development plans to provide resilience to such disasters, mobilizing resources, such as communication and telemedicine services, and aiding in rehabilitation and post-disaster reconstruction. Space technology is essential for effective disaster mitigation. Earth observation satellites provide the necessary data for pre-disaster preparedness programmes, disaster response, monitoring activities, and post-disaster damage assessment, reconstruction, and rehabilitation. While communication satellites aid in disaster warning, relief mobilization, and telemedicine support. This study explains the role of space technology in developing an appropriate strategy for disaster preparedness and an operational framework for their monitoring, assessment, and mitigation. It also evaluates any gaps and suggests suitable strategies for disaster mitigation in light of likely developments in the ground and space segments.

Raja, D.S. and Narasimhan, N. (2007). Inclusive Disaster and Emergency Management for Persons with Disabilities: The aim of this study was to serve as a primer on the needs of persons with disabilities in disasters and emergencies, and to provide a comprehensive compilation of effective policies, practices and strategies for inclusive disaster and emergency management. The goal had been achieved and there were some policies for disabled persons regarding Disaster Management. This policy document would serve the right to lives for persons with Disabilities.

Allen, (2006). Community Based Disaster Preparedness, How could one build the capacity of local people and reduce the elements of vulnerability. CBDP strategies leveraged the knowledge and capabilities of local community resources. Successful implementation of CBDP would be required to understand the communities involved. Community participation has played a greater role for disaster mitigation.

Hale, T. &R. Moberg, C.R. (2006). Improving supply chain disaster preparedness: The research uncovered a five-stage disaster management process for supply chains that can be used as a framework for a proposed choice process for secure site placements. Recommendations from FEMA's Disaster Management Guide and a set cover location model from location sciences were taken into account during the decision process to help construct a network of safe sites. Businesses that aren't ready for supply chain disruptions due to external catastrophes may suffer severe financial and operational losses. Thus, it was vital to strengthen supply chain readiness for emergencies. The safekeeping of emergency materials, tools, and documentation was a crucial part of supply chain disaster management preparations. The objective was to suggest a decision-making procedure for constructing a network of safe storage facilities that could efficiently backup a number of different nodes in the supply chain. It may be prohibitively expensive to keep an inventory of emergency supplies at each link in the supply chain. In addition, natural disasters like fires and storms can render on-site emergency supplies useless, making it impossible to obtain them. By determining the optimal quantity and locations of off-site storage facilities, the suggested secure site selection procedure might strike a compromise between operational efficiency and cost-effectiveness.

Lakshmi, S. (2005) In this case study ,the investigator has collected data of the tsunami victims. In that the children who had lost their parents and the help got by those children. Experience of eye witness of disaster and those children needing guidance and counseling post the traumatic Experience.

Kangabam, R.D., et.al. (2005). Preparedness among the Resident Community: Book brings out that in recent years, due to the technological revolution, natural disasters have become more frequent, massive, intense, and devastating, claiming thousands of lives and wreaking havoc on the global economy. This has been ascribed in recent decades to an increase in population around the world and related trends including urbanization, use of vulnerable areas or degraded land, and changes in the environment. In the second half of the twentieth century, around 1.4 million people were killed in about 250 major natural disasters, the majority of whom were caused by windstorms or floods. Just the 1990s alone saw a 15-fold surge in economic losses and a four-fold increase in disasters compared to the 1950s. Preparedness of Urban infra to meet the challenges of new forms of Disaster needs to be strengthened and planned well in advance at the time of city planning.

Peter R.J., Trim (2004). An integrative Approach to Disaster Management and Planning: The book highlights that frequency of major disasters both manmade and natural occurs due to increase in world's population. A holistic setting was needed for disaster management and planning and shared responsibility was viewed as new initiatives in disaster management. Further attention was needed for the concept of community policy. The local community leaders needed to be consulted during the disaster limitations and containment stage. It was essential to bring experts from overseas countries to communicate fully and openly with community leaders in order to gain the support of the community.

Perry and Lindell, 2013. Community Awareness regarding Disaster Mitigation Tools highlighted the vulnerability of some areas to natural disasters because of their location. The authors concluded that a mock drill was crucial for raising awareness about how to respond in emergency situations. Except for a select few, almost none of them had a catastrophe plan for their homes or families. Members of the group did not have a solid foundational understanding of the community's situation or its people. The general public was uninformed about the government and non-profit resources available in the wake of a natural disaster, and they lacked adequate contingency plans in the event that such an event ever occurred in their area.

Victoria, L. (2002), Impact Assessment Study of the Orissa Disaster Management. The project was designed to start Community Based Disaster Preparedness and Mitigation linked to the development planning process in 1,100 villages in 10 blocks within 7 coastal districts (Astarang- Puri, Bahanaga- Balasore, Baliana- Khurda, Erasama, Balikuda- Jagatsinghpur, Ganjam- Ganjam, Kantapada- Cuttack, Mahakalpada and Rajanagar- Kendrapada). The approach was successful in getting local government officials and PRIs to prioritize catastrophe preparedness and mitigation. Within the project's covered blocks, a capable local disaster management system has been established and integrated into the development process from the Village to Gram Panchayat and Block levels.

Pathak ,Brig Kuldip (2020) ,has highlighted India's vulnerability to different kinds of calamities and shortcomings of our existing disaster response system and evaluated it with Japan's Disaster Management System . The research for prediction has focused on community based Disaster response and training of PMF along with use of technology. However the research concentrated more on policy and training aspects of the relief force and less on Humanitarian & Stores Logistics issues.

Srivastav, Brig Rajesh (2019), has critically examined the shortcomings of our emergency response system and compared it with developed nations. It has recommended changes to the response mechanism of NDRF Battalions as well as coordination infrastructure with armed forces.

Gupta, Pawan (2016), has analyzed the impact of Earthquakes on the housing sector in National Capital Territory Delhi (NCTD) and examined the shortcomings of our current housing policies. He has recommended a strategy limited to formulation of public policy and safety issues for existing and new houses.

Cohen, Charles and Werker, D Eric(2008), have used the case study to explain why some nations prepare well for disasters and others do not. The presence of International aid distorts this choice and incentivizes some governments to under invest in disaster preparedness. It recommends that wealthy nations must offer free prevention

and preparedness rather than going for free reliefs as direct relief to affected populations leads to reduced political benefit of disaster.

Upadhyay, Sherya(2018), takes stock of India's disaster relief efforts in south Asia which have grown manifold in the last few years. India itself being vulnerable to the disasters has given it the expertise and wherewithal to deal with disaster services in the neighborhood. India's contribution in China (Sichuan 2008), Nepal in 2015 and Bangladesh in 2017 as well as regular contribution in Red Cross Society is reflection of India's growing stature in supporting disaster relief.

Goel Dr S L (2006), Encyclopedia of Disaster Management, These three Vol. of books is a comprehensive compilation of some important aspects of disaster management to include policy framework, challenges, planning and material cum financial management during disasters. The author has brought out that there has been a paradigm shift in India from the erstwhile relief centric response to a proactive prevention , mitigation and preparedness driven approach for conserving development gains and to minimize loss of life , livelihood and property. However the book does not adequately cover the on ground infrastructure needed or currently deficient with our civil Administration.

Singh, Dr SR (2008), Disaster Management in his book takes a realistic and practical approach to the topic at hand by discussing methods and tactics for managing disasters after they have occurred. It investigates a wide variety of issues related to the topic at hand and gives its readers content that is geared towards offering workable answers to their problems. It provides case studies and examples to back up its claims, and it also details the latest developments in the field of catastrophe management. Disasters are unpredictable however one can always make sure that preparedness is always maintained in unforeseen circumstances so that post disaster management is deftly handled. The book focus is on post disaster relief instead of preventive or preparedness related activity.

Henderson , James H (2007), Disaster Relief Support Operations, This book is meant to serve as a manual for civilian and military logisticians involved in Disaster Relief operations. Helps federal, state, and local governments establish a common ground on which to build their support operations strategies and carry them out. Methods, both human and automatic, for keeping tabs on who's where and what's what in a disaster zone are outlined for the benefit of those in charge of the ground staff. New ideas and concepts are provided to aid civilian and military leaders in disaster relief operation planning. This study does not provide an account of previous relief efforts but rather proposes ideas to aid in the planning, coordination, and development of Logistical Disaster Relief Support Operations.

Peter, Tatham and Martin, Christopher (2018),Humanitarian Logistics: Meeting the Challenge of Preparing For and Responding To Disasters, The book gives readers an inside look at the difficulties encountered by relief workers in the aftermath of natural disasters. The authors and collaborators all agree that humanitarian logistics may learn a thing or two from the private sector. Human life is obviously more valuable than stock, yet a few of the same methods can help prevent both stock-outs and the loss of life. Both industries face the difficulty of having to react appropriately to unknown circumstances. Uncertainty in commercial supply networks is typically connected with disruption or quality problems. The sheer unpredictability of the incident and its aftermath poses the greatest challenge to humanitarian efforts. It's been shown that effective communication is the difference between success and failure in situations with ambiguity. There will inevitably be interruptions in the flow of data, and it will be necessary to find ways to work around these problems. This book provides a starting point for the business and humanitarian communities to share knowledge and collaborate.

Cozzolino, Alessandra (2012), Logistics Service Providers Engagement In Disaster Relief : An Exploratory Analysis , The Study is helpful since it summarizes the research done on humanitarian logistics and how it connects to other fields of study, such as supply chain management. Poor coordination between important players is noted as a reason for performance gaps, whereas increased collaboration with these actors can help to decrease costs, boost speed, and improve the leanness/agility level in the

humanitarian supply chain. Complex crises call for increased cooperation between public and private sectors, including government agencies, military forces, and humanitarian organizations. The primary objective of this research is to delve into the topic of for-profit and non-profit organizations working together to carry out disaster relief activities.

Kellenberg Derek and Mobarak A. Mushfiq (2011) The Economics of Natural Disasters published in *Annual Review of Resource Economics* , 2011, Vol. 3 (2011), pp. 297-312 This article explores the varied responses to natural disasters among nations, based on factors like socioeconomic status, degree of development, and pre existing vulnerability. It also delves into post-disaster relief and long-term growth prospects as well as ex ante disaster prevention measures like better natural disaster risk information and natural disaster insurance markets. The authors have brought attention to the economics of natural disasters and identified areas of interest for future research by emphasizing some of the latest discoveries in this field.

Cohen Charles and Eric D. Werker (2008) The Political Economy of "Natural" Disasters article published in *The Journal of Conflict Resolution* , Dec., 2008, Vol. 52, No. 6 pp. 795-819 , This article highlights the fact that political contexts play a role in the occurrence of natural disasters. The amount of government readiness and response significantly mitigates the extent of suffering caused by the affected population, despite the fact that events beyond our control may spark a disaster. Case studies and early empirical evidence back up the authors' political-economic model of disaster prevention, which they use to shed light on the discrepancy between the levels of preparedness of different governments. The authors demonstrate how international aid affects this choice and increases the likelihood that states would under invest. They have also gone over some of the Policy proposals that have the potential to remedy this situation.

Coyle John J & Symon Eric J (2016) Weather proofing Supply Chains: Enable Intelligent Preparedness with Data Analytics published in *Transportation Journal* , Vol. 55, No. 2 (Spring 2016), pp. 190-207 Specifically, the study looks at Companies and their supply networks facing varying degrees of danger from natural disasters, extreme weather, and seasonal shifts. These dangers include stock outs, major

delays in receiving supplies, and rising prices as emergency plans are put into action at the last minute. Assuming these possibilities materialize, the resulting financial damage might be in the millions. Intelligent preparedness is defined in this study as the capacity to sense, capture, and evaluate meteorological data in order to derive useful insights. The manner that weather big data is used (or not leveraged) in managing weather-related hazards is the basic distinction between traditional and intelligent preparedness.

2.2. Research Methodology And Data Sources

2.2.1 Research Strategies

The selection of the method to be adopted for any study is dependent both on the nature of the study as well as on the nature of the event / activity to be probed. Based on the review of the related literature (Chapter 2) and International best practices(Chapter 6), an effort has been made in the present study to bring together all the issues related to the Material Management aspects of Disaster Relief in India.

The various aspects of this research are based on the study and analysis of diverse inputs from multiple sources. The objectives of this study are firstly to review the existing India's Disaster relief stores management setup at center/state level in India. Secondly to identify the issues/ challenges and suggest a way forward in the material supply chain during disasters.

To assess the Material Management policy in natural disasters adopted by India, it is necessary to understand the our effectiveness and shortcomings wrt disaster relief works. Therefore, this requires a detailed study of the documents, reports, policies, regulatory frameworks of our and other countries. Accordingly, the qualitative method of the study has been adopted during research to study the approach of different countries Supply chain process.

To seek the views of the stakeholders on the subject of the research questions of this study, a quantitative approach of the study was considered by taking their opinion through the survey.

Accordingly, this study has been done employing a mixed research strategy-qualitative and quantitative. A qualitative approach has been adopted based on the study

of the kinds of literature and the approaches adopted in different countries mainly via secondary data and the quantitative approach has been employed based on the analysis of data received in response to the questionnaire.

2.2.2. Research Design

For this study, a flexible research design has been adopted using historical case studies and qualitative analysis of the current situation. Examination of case studies wrt three major Natural calamities faced by the nation have been undertaken and effort have been made to put forth some recommendations based on the learnings from them. The study has been done in the exploratory mode employing qualitative research methods. Descriptive research has been used to understand the paradigm shift in our National approach from Disaster Response to Disaster Risk Reduction.

2.2.3. Research Methods/ Data Sources

To get responsive feedback on the objectives, relevant information was collected using both primary and secondary sources.

2.2.3.1. Secondary Sources of Data

The secondary source of data comprises of:-

- (a) Review of policy documents: Important policy documents such as Disaster Management Act 2005, NPDM 2009, NDMP 2019 and various directives and advisories issued by MHA, NDMA have been analyzed.
- (b) Study of SOPs of NDRF /SDRF and after action reports of various Disaster Relief Organisations have been examined.
- (c) Websites/databases/reports: Data has been collected by PMCARES, MHA, NDMA, MoD Sites and twitter handles.
- (d) Secondary data available in the national & international journals, articles published in newspapers & magazines.

2.2.3.2. Primary Source of Data

Based on the research questions formulated, a structured questionnaire with a few open-ended questions has been prepared and administered to the stakeholders of the Disaster Relief activity and also local populace of the Disaster prone Areas.

The survey questionnaire consists of questions related to the profile of the respondent, problems/ satisfaction level on Material support during disasters , response of various agencies etc and a few open-ended questions related to Supply Chain Effectiveness during disasters.

The study will follow the broad design of Content Analysis research method in which the already available data or information on the subject from multiple sectors will be analyzed incorporating the personal experience to make a critical evaluation of the material management in the disaster. This research is based on both types of data i.e primary and secondary. The survey and focused interview method was used to collect data. The present study will make extensive use of primary data which includes information on different aspects of research problems. The secondary data will be collected from research reports, Govt publications, newspaper articles, research journals, magazines, case studies, websites etc. For the purpose of data collection IIPA library, NDMA, ministerial offices, army logistics /medical directorates , State /District Disaster Management Authority and other related places expected to be useful will be visited.

The study analyzes the role of logistics in the management of natural and manmade disasters. The importance will be given on the fundamental aspects of logistics. The study will provide some active logical options to the logisticians, policy makers, administrators and social workers in management of materials in disasters.

Research Strategy and Design.

- (a) Research Methodology: Mixed Research
- (b) Research Design: Explanatory and Descriptive

CHAPTER-3

INDIA'S HAZARD RISK PROFILE AND INSTITUTIONAL FRAMEWORK

Make India disaster resilient across all sectors, achieve substantial and inclusive disaster risk reduction by building local capacities starting with the poor and decreasing significantly the loss of lives, livelihoods, and assets in different forms including economic, physical, social, cultural, and environmental while enhancing the ability to cope with disasters at all levels.

PM's Ten-Point Agenda for DRR

3.1 Background

Human activity, natural phenomena, or a confluence of the two are the usual suspects behind disastrous events. The effects of a natural disaster can be considerably magnified by man-made causes. The United Nations Intergovernmental Panel on Climate Change (IPCC) found that worldwide, the frequency and intensity of extreme weather events have both increased significantly due to human-induced climate change. The effects of natural disasters like hurricanes, typhoons, and earthquakes can be exacerbated by human actions. Extensive industrialization and urbanization both increase the likelihood of human-induced catastrophes and the potential level of damage to life and property from both natural and human-induced disasters. Chemical, Biological, Radiological, and Nuclear (CBRN) dangers and occurrences also pose a risk to human society and could lead to catastrophes.

3.2 Natural Hazards

Globally, the Sendai objectives are monitored using the Disaster Information Management System's classification system, which divides disasters caused by natural hazards into five broad groups:-

S.No	Family	Main Event	Short Description/ Secondary Disaster
(a)	Geophysical	Earthquake/ movement of earth materials	Mass earthquakes; • Landslide following earthquake; • Urban fires triggered by earthquakes;

		Volcano	<ul style="list-style-type: none"> • Surface displacement of earthen materials due to ground shaking triggered by volcanic eruptions • A type of geological event near an opening/vent in the Earth's surface including volcanic eruptions of lava, ash, hot vapour, gas, and pyroclastic material.
		Tsunami	Tsunamis are difficult to categorize; they are essentially an oceanic process that is manifested as a coastal water-related hazard. A series of waves (with long wavelengths when traveling across the deep ocean) that are generated by a displacement of massive amounts of water through underwater earthquakes, volcanic eruptions or landslides.
(b)	Hydrological	<ul style="list-style-type: none"> • Flood • Landslides • Wave Action 	<ul style="list-style-type: none"> • A large mass of loosened earth material, that slides, flows or falls rapidly down a mountainside under the force of gravity
			<ul style="list-style-type: none"> • Coastal Erosion - The temporary or permanent loss of sediments or landmass in coastal margins due to the action of waves, winds, tides, or anthropogenic activities • Coastal flood - Higher-than-normal water levels along the coast caused by tidal changes or thunderstorms that result in flooding, which can last from days to weeks • Flood - Heavy or excessive rainfall in a short period of time that produces immediate runoff, creating deluge conditions within minutes or a few hours during or after the Rainfall. • Wave Action: Wind-generated surface waves that can occur on the surface of any open body of water such as oceans, rivers and lakes, etc.
(c)	Meteorological	Hazard caused by short-lived, micro- to meso-scale extreme weather and atmospheric conditions that may last for minutes to days	<ul style="list-style-type: none"> • Cyclone, Storm Surge, Tornado, Convective Storm, Extratropical Storm, Wind • Cold Wave, Derecho • Extreme Temperature, Fog, Frost, Freeze, Hail, Heat wave • Lightning, Heavy rain • Sandstorm, Dust-storm • Snow, Ice, Winter Storm, Blizzard

(d)	Climatological	Unusual, extreme weather conditions related to long-lived, meso- to macro- scale atmospheric processes ranging from intra-seasonal to multi-decadal (long-term) climate Variability	<ul style="list-style-type: none"> • Drought • Extreme hot/cold conditions • Forest/Wildfire Fires • Glacial Lake Outburst Flood (GLOF) • Subsidence
(e)	Biological	Exposure to germs and toxic substances	<ul style="list-style-type: none"> • Epidemics: viral, bacterial, parasitic, fungal, or prion infections • Insect infestations • Animal stampedes

Table 3.1 Summary of the five main kinds of natural catastrophes

Table 3.1 provides a concise summary of the five main kinds of natural catastrophes, along with their subcategories. The classification listed below is not completely accurate. In actual life, many disasters are a synthesis of various disaster types. In addition, disasters may be followed by secondary disasters.

Heightened vulnerabilities to disaster risks can be related to expanding population, urbanization, and industrialisation, development within high-risk zones, environmental degradation, and climate change.

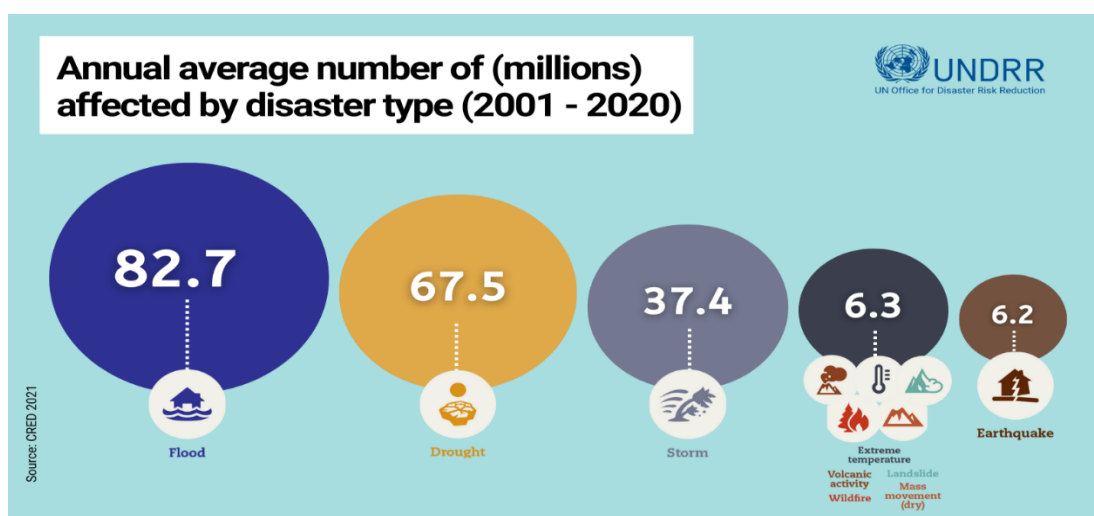


Fig: 3.1. Annual average number of (millions) affected by disaster type (2001-2020)

In the context of human vulnerability to disasters, economically and socially weaker segments of the population are the ones that are most seriously affected. Within the vulnerable groups, elderly persons, women, children especially women rendered destitute, children orphaned by disasters and differently abled persons are exposed to higher risks. The DM Act 2005 and National Policy on Disaster Management 2009 consider disasters to be a) natural and b) human-induced including CBRN for defining the roles and responsibilities.

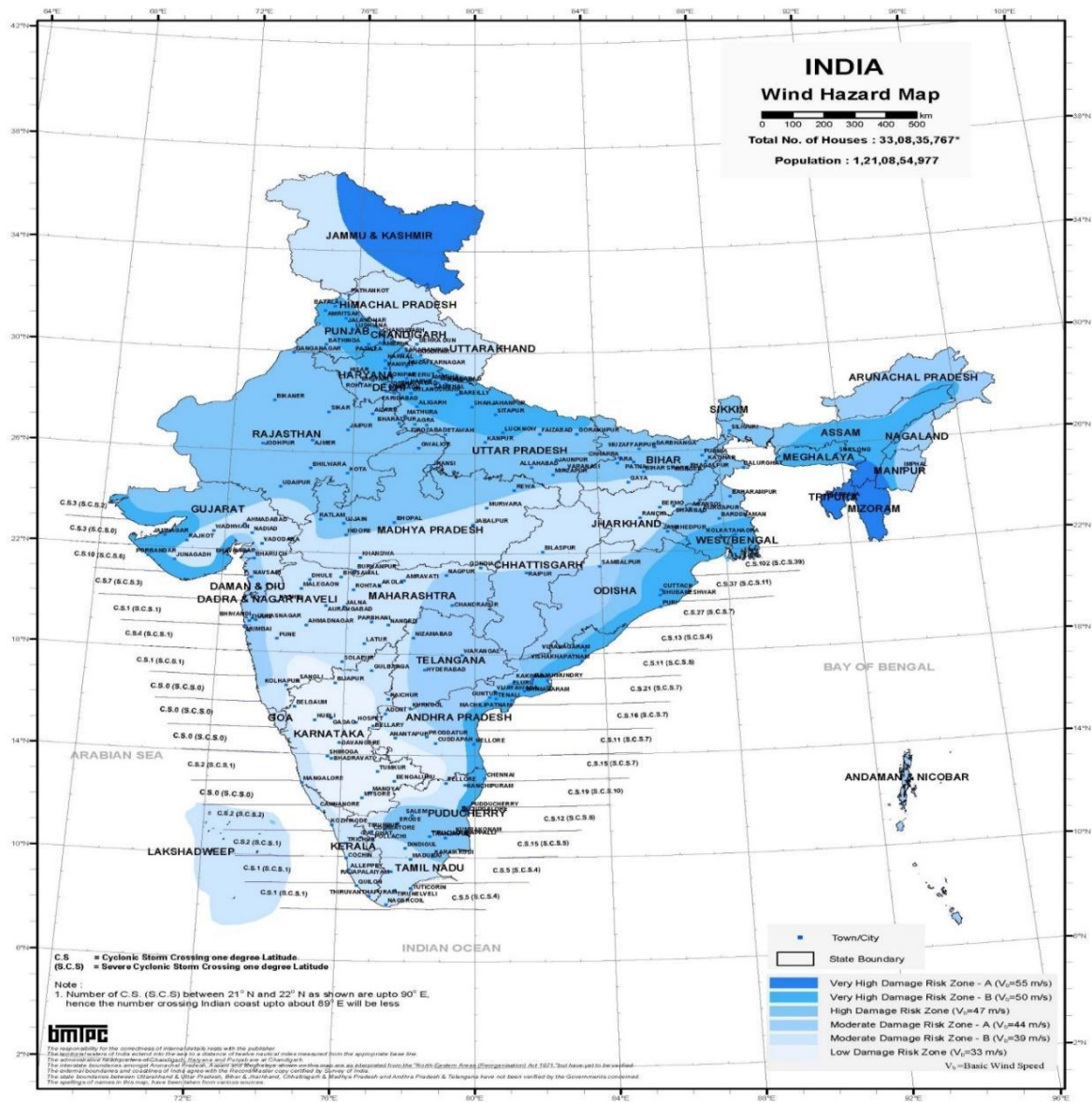


Fig 3.2: Vulnerability Atlas: Wind hazard map

3.4 Cyclone

Nearly 7,500 kilometers of coastline may be found in India, with 5,400 kilometers located on the mainland, 132 kilometers located in Lakshadweep, and 1,900 kilometers located on the Andaman and Nicobar Islands. Roughly 10% of all tropical cyclones hit the coast of India. Most of these develop over the Bay of Bengal and hit the east coast of India. Five or six tropical cyclones form each year, with the potential for two or three to become quite intense. In India, tropical cyclones occur in the months of May-June and October-November. The cyclones of severe intensity and frequency in the northern part of the Indian Ocean are bimodal in character, with their primary peak in November and secondary peak in May.

Flood

There is usually about a yearly average of 7.5 million hectares of land lost to flooding. In 1980, the National Commission on Floods estimated that over 40 million hectares of land was at risk from flooding; of this area, roughly 80% may be protected using feasible measures (32 million ha). In India, riverine flooding is one of the most serious climate-related risks. National policies for water resource management often include flood control as an important component. Extreme weather events including floods and droughts have been related to the summer monsoon season. There are floods in nearly every river basin in the United States. Inadequate drainage that slows the flow of rainwater to streams and rivers, inadequate capacity of rivers to carry the high flood discharge, and heavy rainfall are the main causes of flooding. Uncertainties pertaining to floods would naturally worsen as a result of global climate change and the subsequent increase in extreme weather events.

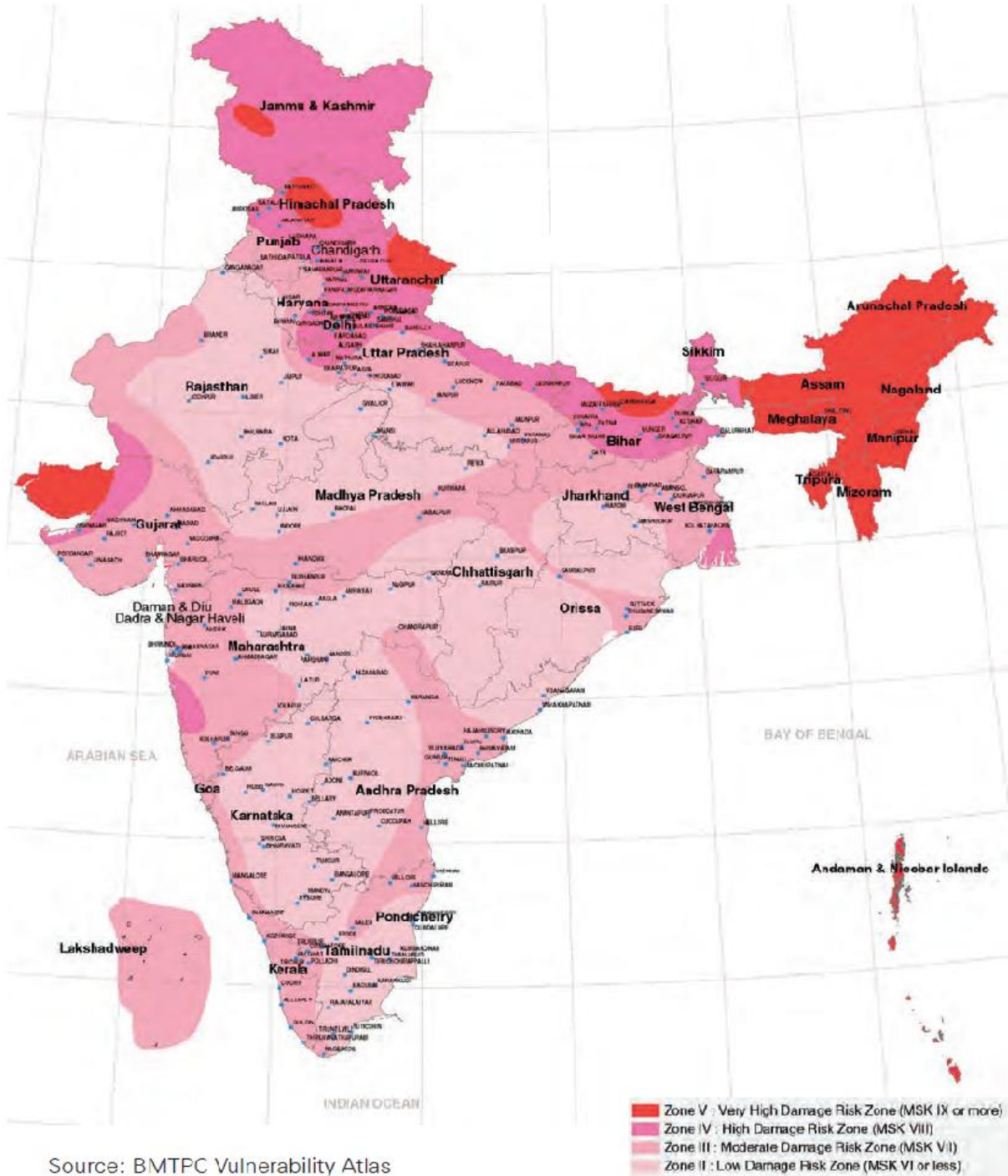
Urban Floods.

Natural disasters and land-use changes due to urbanization both contribute to the urban flooding problem. A major distinction between urban and rural flooding is the fact that urbanization typically results in developed catchments, which can raise flood peaks by a factor of 1.8 to 8 and flood volumes by a factor of up to 6 compared to those in undeveloped catchments. Because of the increased velocity of the water, flooding can occur in a matter of minutes. Weather, water, and people all work together to bring about urban floods. Urban areas are more vulnerable to sudden, high-volume floods because of human alteration of the soil. Urban flooding disaster management (UFDM) presents unique issues not seen in other types of floods. The NDMA issued its own UFDM guidelines in 2010. The effects of urban flooding can range from being localized to widespread, leaving vast sections of cities submerged for several hours or even days. Incidences may be localized or widespread. People may have to temporarily relocate, animals may be dispersed, public facilities may be damaged, water quality may worsen, and the possibility of diseases increases.

Earthquake

Approximately 59% of India is at risk for minor to major earthquakes. Gujarat in January 2001, Jammu and Kashmir in October 2005, and Sikkim in 2011 were all hit by large earthquakes in recent years. Throughout India, numerous minor quakes have been happening. Assam, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, and Meghalaya, as well as the Andaman and Nicobar Islands and portions of eight other States/UTs (Bihar, Gujarat, Himachal Pradesh, Uttarakhand, Jammu & Kashmir, Ladakh, Punjab, and West Bengal) are in Seismic Zone V, where the risk of damage from earthquakes is extremely high. The earthquake may have severe repercussions, including widespread death and destruction of property and essential services. There could be tens of thousands of people uprooted, many of whom will end up in the North and North-isolated East's mountain regions.

Map 1 EARTHQUAKE ZONES IN INDIA



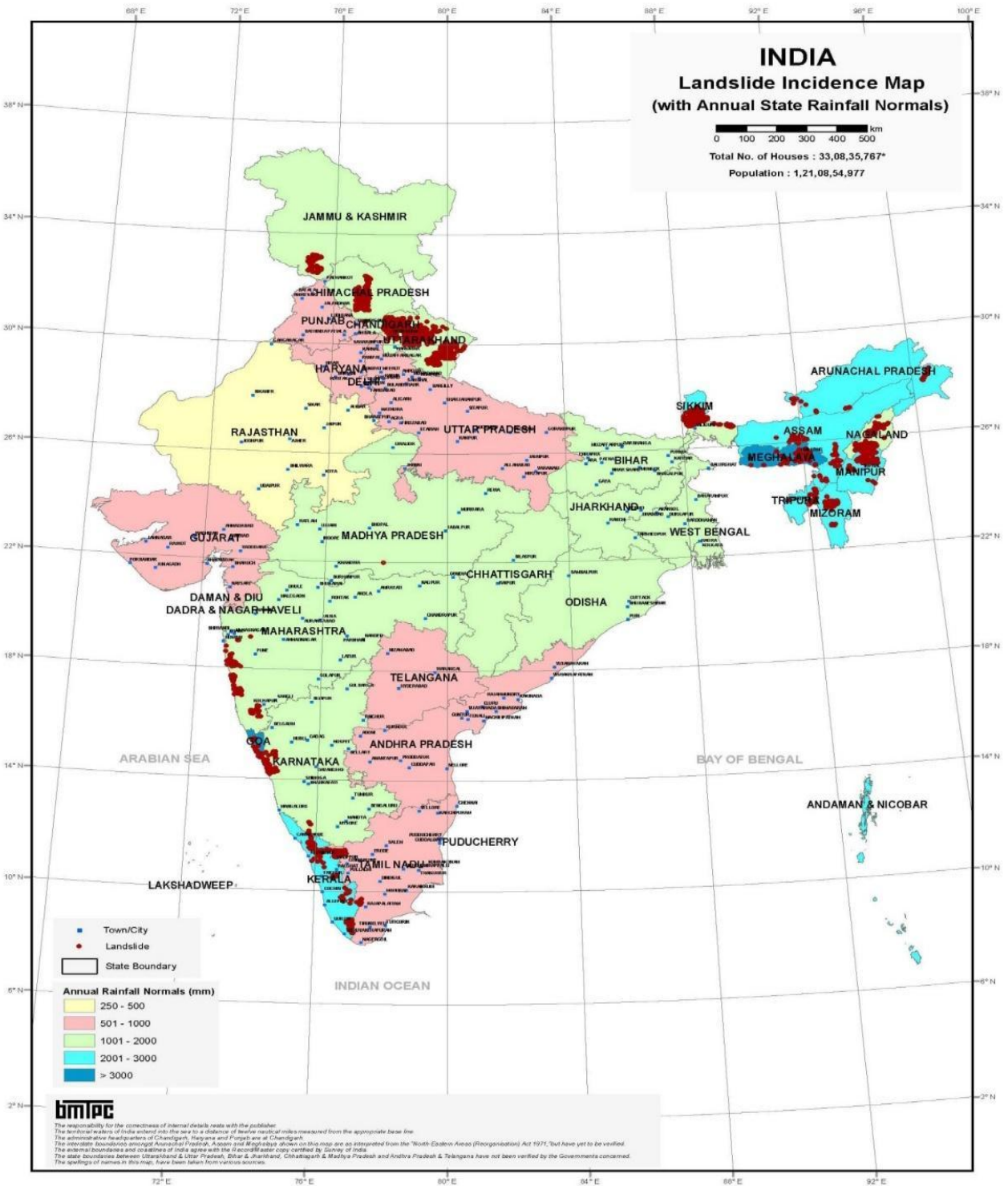
Source: BMTPC Vulnerability Atlas

Fig. 3.4. Earthquakes zones in India

Landslides and Snow Avalanches

Landslides

The “Himalaya, North-East India, Nilgiris, Eastern Ghats, and Western Ghats” experience landslides. The Himalayas account for 30% of global landslides. The youngest and most dominant mountain system in the world, the Himalayas, is a series of seven curvilinear parallel folds stretching along a grand arc for 3,400 kilometers. Western Ghat also sees landslides. In 1978, enormous rains produced 100 landslides in the Nilgiris, damaging communication cables, tea estates, and other crops. Scientists in north Sikkim and Garhwal in the Himalayas found two landslides per square kilometer. Land loss averages 120 meters per km and soil loss 2500 tonnes per sq. km. Landslides, a widespread natural calamity that often kills and damages property, are a big issue.



BMTPC: Vulnerability Atlas - 3rd Edition: Peer Group, MoHUA, GOI: Map is Based on digitised data of SOI: Landslide Incidence data GSI: Annual Rainfall data IMD. Houses/Population as per Census 2011; * Houses including vacant & locked houses. Disclaimer: The maps are solely for thematic presentation.

Fig: 3.5. Landslide incidence Map of India (with annual state rainfall normal)

Snow Avalanches

Avalanches are fast-moving snow or ice blocks from mountaintops. They destroy lives and property. Drass, Pir Panijal, Lahaul-Spiti, and Badrinath experience avalanches in the Himalayas. Snow and Avalanche Study Establishment (SASE) of Defence Research and Development Organisation (DRDO) estimates that this disaster kills 30 people annually in various Himalayan regions. Avalanches destroy highways, buildings, and villages as well as individuals. Avalanches regularly destroy roads, retaining walls, and traffic. The following Himalayan regions are more susceptible to snow avalanches:

- (a) “Western Himalaya -the snowy regions of J&K, Ladakh, HP and Uttarakhand, especially Tehri Garhwal and Chamoli districts
- (a) J&K and Ladakh – Higher reaches of Kashmir and Gurez valleys, Kargil, Ladakh and along some of the major roads
- (c) HP – Chamba, Kullu-Spiti and Kinnaur

Drought

Drought has no universal practical definition. This is why policymakers, resource planners, and other decision-makers and administrators have more trouble recognising and planning for drought than other calamities. The Global Assessment Report (GAR) 2015 cautions that agricultural drought is the most "socially created" catastrophe risk (UNISDR 2015b) and that global climate change will affect its frequency. Operational definitions use the degree of divergence from the long-term (typically 30 years) average of precipitation or another climatic variable to define drought. Drought is a severe water shortage caused by natural hydro-meteorological causes, agro-ecological conditions, crop moisture requirements, and cropping choices (systems, patterns).

The WMO views drought as a slow-moving natural hazard caused by climate variability. Climate change has raised global concerns about droughts becoming more frequent. Most drought responses worldwide are reactive, uncoordinated, and late. General conceptual definitions help individuals understand drought. Drought is

characterized by prolonged precipitation deficits, agricultural damage, and production loss. Operational definitions determine drought onset, severity, and end. Policymakers, resource planners, and others have more problems recognising and planning for drought than other natural catastrophes because there is no one operational definition of drought. Most decision-makers and planners use quantitative indexes to determine when to begin water conservation or drought response. Operational definitions use the degree of divergence from the average precipitation or other meteorological variable during a period to define drought. Comparing the current situation to the historical average, usually based on at least 30 years, does this.

Droughts span states. Drought affects 30% of the nation. Droughts harm livelihoods and children's nutrition. "Rajasthan, Gujarat, Maharashtra, Madhya Pradesh (MP), Uttar Pradesh (UP), Chhattisgarh, Jharkhand, and Andhra Pradesh" are chronically affected. Some regions experience drought. Droughts are devastating.

Thunderstorms

In some sections of the country, thunderstorms occur all year long. Nonetheless, summer is when they occur most frequently and with the most severity (March to June). The most intense heating of the atmosphere at surface level is the most essential factor for the development of thunderstorms, and as this occurs at its peak in the summer months, the frequency of occurrence is highest then. If there is thunder and lightning, then it is a thunderstorm. Thunder can usually be heard for up to 40 kilometers away from its origin. Having a range of around 220 km in space and a timescale of a few hours.

- (a) **Moderate thunderstorm.** maximum wind speeds of 29 to 74 kph
- (b) **Severe thunderstorm.** Wind speed > 75 kilometers per hour.



BMTPC: Vulnerability Atlas - 3rd Edition: Peer Group, MoHUA, GOI; Map is Based on digitised data of SOI; Thunderstorm data from IMD. Disclaimer: The maps are solely for thematic presentation.

Fig: 3.6. Thunderstorm incidence Map of India

3.5. India's Policy Guidance And Institutional Framework

The Policy addresses all critical aspects of disaster management encompassing the institutional, legal and financial arrangements; to include disaster prevention, mitigation and preparedness, techno-legal regime; response, relief and rehabilitation; reconstruction and recovery; capacity development; knowledge management and research and development.

The NPDM aims to bring in transparency and accountability in all aspects of disaster management through involvement of community, community based organizations, Panchayati Raj Institutions (PRIs), local bodies and civil society.

Vision

To build a safe and disaster resilient India by developing a holistic, proactive, multi-disaster oriented and technology driven strategy through a culture of prevention, mitigation, preparedness and response.

Objectives

The objectives of the national policy on disaster management are:-

- (a) Promoting a culture of prevention, preparedness and resilience at all levels through knowledge, innovation and education.
- (b) Encouraging mitigation measures based on technology, traditional wisdom and environmental sustainability.
- (c) Mainstreaming disaster management into the developmental planning process.
- (d) Establishing institutional and techno-legal frameworks to create an enabling regulatory environment and a compliance regime.
- (e) Ensuring efficient mechanism for identification, assessment and monitoring of disaster risks.
- (f) Developing contemporary forecasting and early warning systems backed by responsive and failsafe communication with information technology support.

- (g) Promoting a productive partnership with the media to create awareness and contribute towards capacity development.
- (h) Ensuring efficient response and relief with a caring approach towards the needs of the vulnerable sections of the society.
- (i) Undertaking reconstruction as an opportunity to build disaster resilient structures and habitat for ensuring safer living.
- (j) Promoting productive and proactive partnership with media in disaster management.

3.6 Sendai Framework for DRR

7 GLOBAL TARGETS	Reduce	Increase
	Mortality/ global population 2020-2030 Average << 2005-2015 Average	Countries with national & local DRR strategies 2020 Value >> 2015 Value
	Affected people/ global population 2020-2030 Average << 2005-2015 Average	International cooperation to developing countries 2030 Value >> 2015 Value
	Economic loss/ global GDP 2030 Ratio << 2015 Ratio	Availability and access to multi- hazard early warning systems & disaster risk information and
	Damage to critical infrastructure & disruption of basic services 2030 Values << 2015 Values	assessments 2030 Values >> 2015 Values

Fig 3.7. Sendai Framework for Disaster Risk Reduction - 7 Global Targets

3.7 Sustainable Development Goals (SDG) and Disaster Resilience

The Sustainable Development Goals (SDGs), which were adopted by the UN General Assembly on September 25, 2015, and consist of 169 targets and 17 Global Goals (Fig. 3-2), are a global call to action to eradicate poverty, safeguard the environment, and guarantee that everyone lives in peace and prosperity. The 17 Goals expand upon the achievements of the Millennium Development Goals (MDGs) while also addressing new issues like climate change, economic inequality, innovation, sustainable consumerism, peace, and justice, among other top objectives. The objectives are connected, thus achieving one generally requires addressing problems that are more frequently connected to another.



The possibilities of attaining SDGs are jeopardized because disasters undermine economic growth and social progress. No country or sector is immune to the impacts of natural hazards, many of which – the hydro-meteorological – are increasing in frequency and intensity due to the impacts of climate change. While necessary and crucial, preparing for disasters is not enough, to realize the transformative potential of the agenda for SDGs, all stakeholders recognize that DRR needs to be its integral core. Progress in

implementing the Sendai Framework contributes to the progress of attaining SDGs. In turn, the progress on the SDGs helps to substantially build resilience to disasters. There are several targets across the 17 SDGs that are related to DRR. Conversely, all seven global DRR targets of the Sendai Framework are critical for the achievement of the SDGs.

3.8 PM's Ten-Point Agenda for Disaster Risk Reduction

At the Asian Ministerial Conference on Disaster Risk Reduction 2016, held in New Delhi in November 2016 (AMCDRR), the PMr, Shri Narendra Modi, announced a Ten-Point Agenda, which has also been integrated in the NDMP. The following are the ten essential components:-

(a) **First, all development sectors must imbibe the principles of disaster risk management.** This would guarantee that all construction initiatives including airports, roads, canals, hospitals, schools, and bridges are carried out in accordance with the necessary standards and enhance the resilience of the communities they are intended to benefit. The majority of the world's new infrastructure will be built in Asia during the next few decades. This emphasizes the requirement to ensure that all infrastructure development complies with the best disaster safety standards currently available. Such a tactic is wise and will be profitable in the long run. Considerations for disaster risk must be incorporated into all public investments. Such prospects are represented in India by the "housing for everyone" programme and the "smart cities" effort. India will develop a coalition or framework with other partner nations and stakeholders to support disaster-resistant infrastructure in the area. This will contribute to the creation of new information for the evaluation of hazard risk, the development of disaster-resistant technology, and the implementation of methods for risk reduction in infrastructure funding.

(b) **Second, it is imperative to work towards risk coverage for all,** starting with low-income households and extending to major multinational companies,

small and medium-sized businesses, and individuals. Currently, only a small segment of the population, particularly those in the medium and upper middle income ranges, has insurance coverage in the majority of the region's countries. To expand the risk insurance coverage, big-picture thinking and creative thinking are required. States play a significant role in encouraging coverage for those who most need care, in addition to regulating it. To promote financial inclusion and risk insurance for the most vulnerable, certain audacious measures have been adopted. Millions of people have accessed the banking system thanks to the Jan Dhan Yojana. Millions of those who most need it have access to risk insurance thanks to the Suraksha Bima Yojana. Crop insurance under the recently launched Fasal Bima Yojana will cover millions of farmers' risks. These are the fundamental components of household resilience.

(c) **Third, it is necessary to encourage greater involvement and leadership of women in disaster risk management.** Disasters have a disproportionately negative impact on women. They also possess special abilities and perspectives. To meet the unique requirements of women affected by disasters, India must train a significant number of women volunteers. Women engineers, masons, and builders are also required for post-disaster reconstruction and to support women's self-help organizations that can aid with livelihood recovery.

(d) **Fourth, it is necessary to invest in mapping risks globally.** There are generally established criteria and parameters for mapping risks connected to hazards like earthquakes. India has created a map of seismic zones based on this, designating two as low risk and five as high risk. India has to implement internationally recognised criteria and classifications for disaster risk relating to other risks such as chemical hazards, forest fires, cyclones, and various forms of floods. This would enable India to compare its disaster risks with those in other regions of the world and guarantee that there is a common understanding of their nature and severity.

(e) **Fifth, efforts must be made to leverage technology to enhance the efficiency of our disaster risk management efforts.** In order to maximize the overall impact, an e-platform that unites businesses and individuals and enables them to map and exchange resources, technology, and expertise would be very helpful.

(f) **Sixth, it will be helpful to develop a network of universities to work on disaster-related aspects** because colleges also have social obligations. A global network of universities working together on issues of disaster risk management can be developed over the first five years of the Sendai Framework. In this network, many universities may focus on interdisciplinary study on the disaster topics that are most important to them. Universities in hill cities may concentrate on managing risks from mountain hazards, while those in coastal communities could specialize in controlling risks from coastal disasters.

(g) **Seventh, utilize the opportunities provided by social media and mobile technologies.** Disaster response is changing as a result of social media. It makes it easier for citizens to communicate with authorities and aids in the speedy organization of reaction services. Affected individuals are using social media to support one another in tragedy after calamity. The potential of social media must be understood by those in charge of disaster management, and they must create applications pertinent to many facets of disaster risk management.

(h) **Eighth, disaster management must build on local capabilities and initiatives.** Governmental structures can only play a supporting role in catastrophe risk management due to the sheer scale of the undertaking, which is especially daunting in economies that are expanding rapidly. Detailed plans and procedures must be developed and executed at the regional level. The majority of community-based initiatives during the past two decades have focused on short-term disaster prevention and contingency planning. There has to be more help given to communities so that they can figure out how to reduce risks in their own area and then put those plans into action. These kinds of initiatives lessen danger

and open up chances for local development and sustainable ways of life. To further ensure that traditional best practices and indigenous knowledge are utilized effectively, disaster risk reduction must be implemented at the local level. Agencies tasked with responding to disasters must engage with the public and teach them the basics of disaster drills. If a fire department in a given area visited only one local school once a week, it could educate thousands of students in just one academic year.

(j) **Ninth, ensure that the opportunity to learn from a disaster is not wasted.** Studies and reports on lessons learned are published after every disaster, but they are rarely put into practice. Unfortunately, such blunders tend to be repeated frequently. A lively and vivid learning system is essential. The United Nations might launch a worldwide contest for documentaries that chronicle disasters and their aftermath in terms of scope, aid provided, and the ability to rebuild. The time after a disaster strikes is a window of opportunity to "build back better" in more ways than one. This is true both in terms of physical infrastructure and of institutional processes for handling risk. This calls for the establishment of mechanisms that can generate risk evaluations rapidly. Developing a center for providing technical assistance in the rebuilding of homes after natural disasters is an area in which India needs to collaborate with other countries and multilateral development agencies.

(k) The **tenth** and last, **it is necessary to bring about greater cohesion in international response to disasters.** Disaster relief workers arrive from all around the world following a major disaster. If all of these initiatives were coordinated under one roof, it would give the group even more power and unity as a whole. The United Nations may organize a unified branding strategy for the organizations providing aid in the areas of relief, rehabilitation, and reconstruction.

3.8. Institutional Framework

Disaster management vests are coordinated centrally with the Ministry of Home Affairs (MHA). The National Crisis Management Committee (NCMC) and the Cabinet Committee on Security (CCS) are the primary bodies involved in making broad policy decisions in the aftermath of a tragedy. The National Disaster Management Authority (NDMA) is the government entity in charge of vetting the NDMP and helping to get it put into action. Institutional framework for DM at the national level is depicted schematically in Figure 1-3. The diagram is not meant to reflect a hierarchical structure, but rather the institutional channels for disaster management coordination, decision-making, and communication.

National Disaster Management Institutional Mechanism

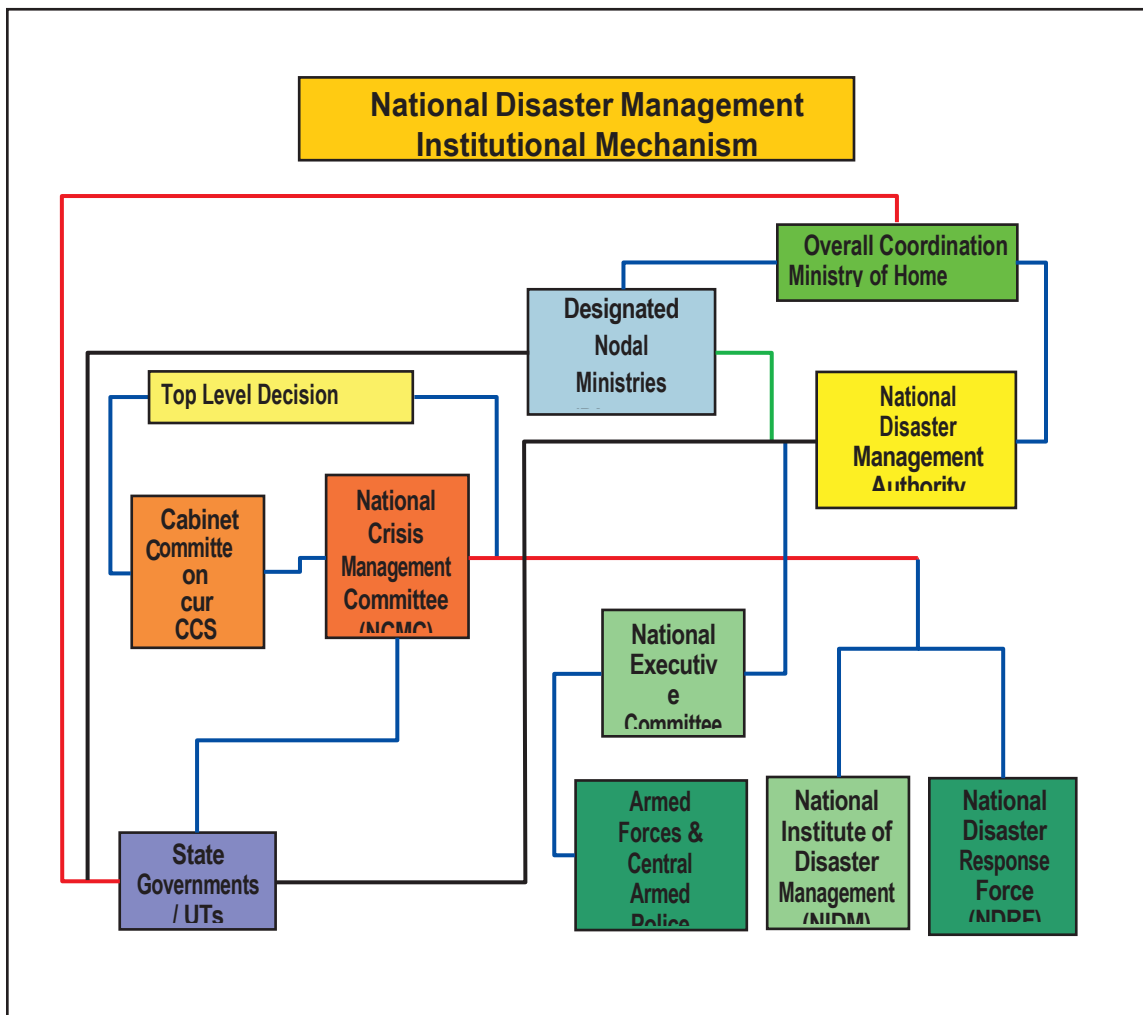


Fig 3.8 National Disaster Management Institutional Mechanism

	Name	Composition	Vital role
1	“Cabinet Committee on Security (CCS)	<ul style="list-style-type: none"> • PMr, Minister of Defence, Minister of Finance, Minister of Home Affairs, and Minister of External Affairs 	<ul style="list-style-type: none"> • Evaluation from a national security perspective, if an incident has potentially security implications • Oversee all aspects of preparedness, mitigation and management of Chemical, Biological, Radiological and Nuclear (CBRN) emergencies and of disasters with security implications • Review risks of CBRN emergencies from time to time, giving directions for measures considered necessary for disaster prevention, mitigation, preparedness and effective response
2	National Crisis Management Committee (NCMC)	<ul style="list-style-type: none"> • CCabinet Secretary (Chairperson) • Secretaries of Ministries/ Departments and agencies with specific DM responsibilities 	<ul style="list-style-type: none"> • Oversee the Command, Control and Coordination of the disaster response • Give direction to the Crisis Management Group as deemed necessary • Give direction for specific actions to face crisis situations
3	National Disaster Management Authority (NDMA)	<ul style="list-style-type: none"> • PMr (Chairperson) • Members (not exceeding nine, nominated by the Chairperson) 	<ul style="list-style-type: none"> • Lay down policies, plans and guidelines for disaster management • Coordinate their enforcement and implementation throughout the country • Approve the NDMP and the DM plans of the respective Ministries and Departments of Government of India • Lay down guidelines for disaster management to be followed by the different Central Ministries, Departments and the State Governments

4	Nodal Ministry	<ul style="list-style-type: none"> • Agriculture, Atomic Energy, Defence, Drinking Water and sanitation, Environment, Forests and Climate Change Finance (Expenditure), Health and Family Welfare, Power, Rural Development, Science and Technology, Space, Telecommunications, Urban Development, Water Resources, River Development and Ganga Rejuvenation, The Chief of the Integrated Defense Staff of the Chiefs of Staff Committee, ex officio as members. • Secretaries in the Ministry of External Affairs, Earth Sciences, Human Resource Development, Mines, Shipping, Road Transport and Highways, Chairman, Central Water Commission and Secretary, NDMA are special invitees to the meetings of the NEC. 	<ul style="list-style-type: none"> • Monitor the implementation of the National Plan and the plans prepared by the Ministries or Departments of the Government of India • Direct any department or agency of the Govt. to make available to the NMDA or SDMA's such men, material or resources as are available with it for emergency response, rescue and relief • Ensure compliance of the directions issued by the Central Government • Coordinate response in the event of any threatening disaster situation or disaster • Direct the relevant Ministries/ Departments of the GOI, the State Governments and the SDMA's regarding measures to be taken in response to any specific threatening disaster situation or disaster. • Coordinate with relevant Central Ministries/ Departments/ Agencies which are expected to assist the affected State as per protocols and Standard Operating Procedures (SOPs). • Coordinate with the Armed Forces, Central Armed Police Forces (CAPF), the National Disaster Response Force (NDRF)
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			<p>and other uniformed services which comprise the GOI's response to aid the State authorities</p> <ul style="list-style-type: none"> • Coordinate with all relevant specialized scientific institutions/agencies responsible for providing early warning and monitoring • Coordinate with SDRF, civil defense volunteers, home guards and fire services, through the relevant administrative departments of the State Governments
5	National Disaster Response Force (NDRF)	<ul style="list-style-type: none"> • Specially trained force headed by a Director General Structured like paramilitary forces for rapid deployment 	<ul style="list-style-type: none"> • Assist the relevant State Government/District Administration in the event of an imminent hazard event or in its aftermath

Table 3.2 National Disaster Management Institutional Mechanism

3.9. Nodal Ministry/ Department

From time to time, the central government notifies hazard-specific nodal ministries to function as the lead agency in managing specific disasters as per list below:-

S No	Disaster	Nodal Ministry/ Department
1.	“Accident – Air (Civil Aviation)	Min. of Civil Aviation (MOCA)
2.	Accidents – Rail	Min. of Railways (MOR)
3.	Accidents – Road	Min. of Road Transport and Highways (MRTTH)
4.	Avalanche	Min. of Defence (MOD) - Border Road Organization (BRO)
5.	Biological Emergencies	Min. of Health and Family Welfare (MOHFW)
6.	Cold-Wave	Min. of Agriculture and Farmers Welfare (MAFW)
7.	Cyclone/ Tornado	Min. of Earth Sciences (MOES)
8.	Drought	Min. of Agriculture and Farmers Welfare

		(MAFW)
9.	Earthquake	Min. of Earth Sciences (MOES)
10.	Flood	Min. of Jal Shakti (MOJS)
11.	Floods – Urban	Min. of Housing and Urban Affairs (MHUA)
12.	Forest Fire	Min. of Environment, Forests, and Climate Change (MEFCC)
13.	Frost	Min. of Agriculture and Farmers Welfare (MAFW)
14.	Hailstorm	Min. of Agriculture and Farmers Welfare (MAFW)
15.	Industrial and Chemical	Min. of Environment, Forests and Climate Change (MEFCC)
16.	Landslides	Min. of Mines (MOM)
17.	Nuclear and Radiological	Dept. of Atomic Energy (DAE)
18.	Oil Spills	Min. of Defence (MOD) – Indian Coast Guard (ICG)
19.	Pest Attack	Min. of Agriculture and Farmers Welfare
20.	Tsunami	Min. of Earth Sciences (MOES)”

Table 3.3 Current list of disaster-specific nodal ministries notified by GOI

3.10 National Disaster Management Authority (NDMA)

In 2005, the Indian government formed the NDMA, which is headed by the PMr. In order to ensure a prompt and effective response to disasters, the DM Act of 2005 mandates that the NDMA, as the top agency for disaster management, establish rules and guidelines for disaster management. Central Ministries, Departments, and States can all benefit from NDMA's guidance as they work to develop their own DM strategies. The National Disaster Management Plan and the DM plans of the Central Ministries and Departments will be approved by this committee. It will do whatever else it thinks is essential to prevent, mitigate, or be ready for and equipped to handle a catastrophic situation or disaster. The NDMA's mandate will be carried out with the full collaboration and assistance of the relevant Central Ministries/Departments and State Governments.

In the event of an impending disaster, NDMA has the authority to authorize the relevant Departments or authorities to make urgent purchases of supplies and materials

for relief efforts. The NDMA is entrusted with, and shall exercise, overall supervision, leadership, and control over the National Disaster Response Force (NDRF). The National Disaster Management Agency (NDMA) serves as a framework through which the National Institute of Disaster Management (NIDM) operates. The NDMA is tasked with responding to any disaster, whether natural or man-made. The National Crisis Management Committee will deal with emergencies that call for the close involvement of security forces and/or intelligence agencies, including terrorism (counter-insurgency), law and order situations, hijackings, air accidents, and CBRN weapon systems. This committee will also handle mine disasters, port and harbor emergencies, forest fires, oilfield fires, and oil spills (NCCM). However, NDMA may develop the recommendations with assistance from DAE experts, and it may also support DAE-provided technical advice on RN emergency response training and preparedness initiatives.

3.11 National Institute of Disaster Management (NIDM)

The National Institute of Disaster Management (NIDM), established by the Government of India in accordance with the provisions of Chapter-VII of the DM Act, aims to become the leading institution for disaster management capacity building in India and the region. By enhancing capacity for disaster prevention and preparedness at all levels, NIDM seeks to establish a disaster-resilient India. In the area of disaster management, NIDM has been given nodal duties for policy advocacy, research, documentation, training, capacity building, and human resource development. The NIDM has established strategic alliances with a number of central, state, and local government ministries and departments, as well as with academic, research, and technical institutions in India and overseas, as well as other bilateral and multilateral international organizations. Through the Disaster Management Centers (DMCs) of the Administrative Training Institutes (ATIs) of the States and Union Territories, it offers technical assistance to the state governments. In the specialized fields of risk management, such as flood, earthquake, cyclone, drought, landslides, and industrial disasters, some of them are starting to emerge as centers of excellence.

3.12 State Level Institutions

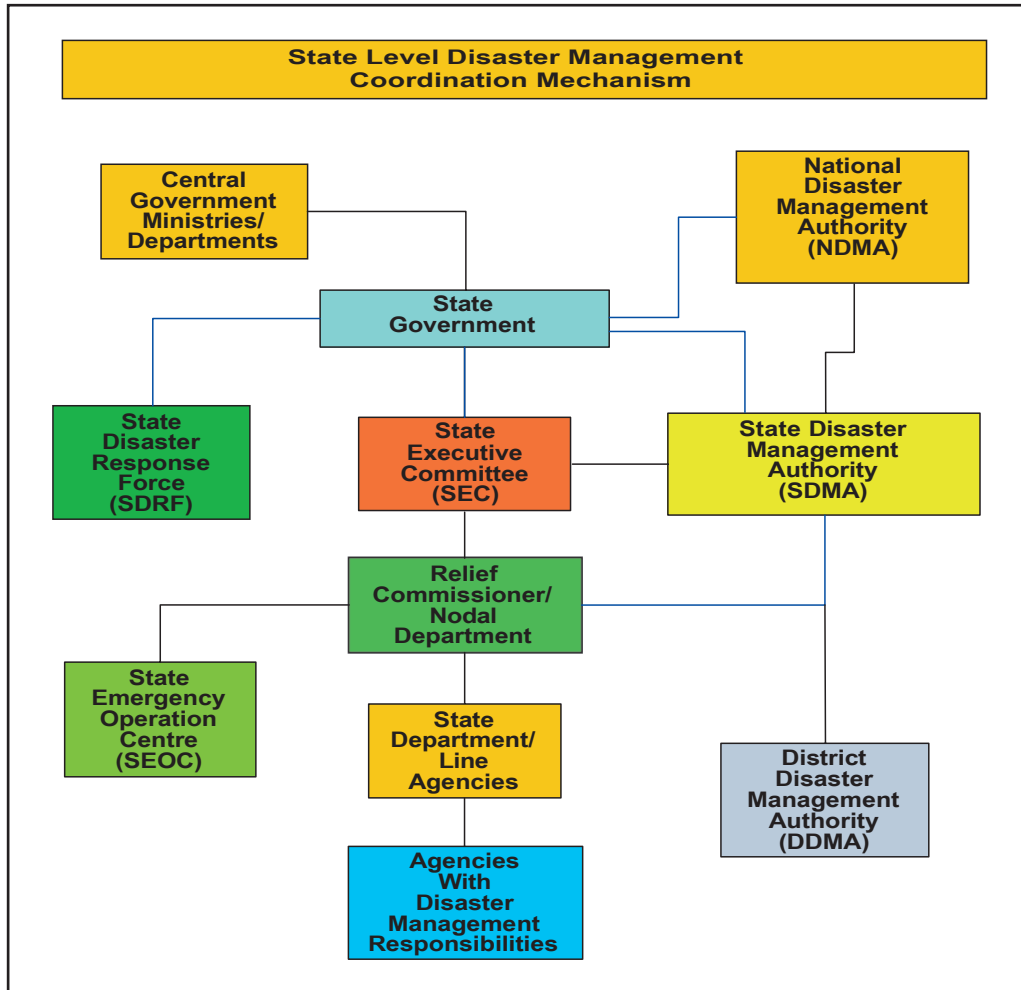


Fig:3.9 State level disaster management coordination mechanisms

Each Indian state/UT has its own disaster management institutional architecture under the 2005 DM Act. Each State/UT has one nodal disaster management department (DMD), albeit the names and departments vary. The DM Act requires States/UTs to prepare DM plans, integrate disaster prevention and mitigation into development plans, allocate finances, and establish EWS. The State/UT will support the Central Government and central agencies in DM as needed. Each state has to create a disaster plan for its vulnerabilities.

The DM Act requires a State Disaster Management Authority (SDMA) and comparable systems in Union Territories. The District Disaster Management Authority (DDMA), District Collector, District Magistrate, or Deputy Commissioner would coordinate disaster management actions and planning at the district level. Figure 3.9 illustrates the typical state-level institutional system. The figure shows institutional paths for disaster management coordination, decision-making, and communication, not a chain of command

3.13 State Disaster Management Authority (SDMA)

Each state has a State Disaster Management Authority (SDMA) or an organization with equal powers, with the Chief Minister serving as its chair, in accordance with Chapter-III of the DM Act. In all other UTs, the authority's head will either be the Lt Gov or the Admin. State Authority for the National Capital Territory of Delhi shall be headed by the Lieutenant Governor and assisted by the Chief Minister. The Chief Minister of any UT (excluding Delhi) with a Legislative Assembly shall preside over the Authority created by this subsection. The SDMA is responsible for developing the State's DM strategy. The SDMA will give the go-ahead to the various agencies' disaster management strategies. State Plan approval, coordination of State Plan execution, funding recommendation for mitigation and readiness measures, and examination of State departmental developmental plans for integration of prevention, preparedness, and mitigation measures are all part of its remit. To aid the SDMA in carrying out its duties, the State Government shall establish a State Executive Committee (SEC). The SEC will report directly to the State Government's Chief Secretary. Implementation of the National Policy, the National Plan, and the State Plan will be coordinated and monitored by the SEC. Additionally, the SEC will supply the NDMA with data on several DM-related topics

3.14 District Disaster Management Authority (DDMA)

Each State Government shall establish a District Disaster Management Authority for each district in the State with such name as may be stated in that notification in accordance with the provisions of Chapter-IV of the DM Act. The District Collector, Deputy Commissioner, or District Magistrate will serve as the DDMA's chairman, with the elected local authority representative serving as co-chairperson. The Chief Executive Officer of the District Authority shall be appointed by the State Government from among officers not below the level of Additional Collector, Additional District Magistrate, or Additional Deputy Commissioner of the district. The DDMA will serve as the organizing, coordinating, and carrying out body for district-level DM and will take all necessary actions to achieve DM goals in accordance with the standards established by the NDMA and SDMA. It will, among other things, create the District's DM plan and keep an eye on the execution of all pertinent national, state, and district plans. The DDMA will also make sure that the district-level offices of the various State Government ministries adhere to the preventative, mitigation, preparedness, and response procedures given out by the NDMA and the SDMA.

3.15 NDRF

The Disaster Management Act has statutory provisions for the constitution of the National Disaster Response Force (NDRF) for the purpose of specialized response to natural and man-made disasters. Accordingly, in 2006 NDRF was constituted with 8 Battalions. At present, NDRF has a strength of 15 Battalions with each Battalion consisting of 1149 personnel. In the beginning, the personnel of NDRF were deployed for routine law and order duties also. In a meeting of the NDMA with the Prime Minister on October 25, 2007, the need of NDRF being made a dedicated force was highlighted and accepted. This led to the notification of NDRF Rules on February 14th , 2008, making NDRF a dedicated force for disaster response related duties, under the unified command of DG NDRF. At present, the National Disaster Response Force consists of 15 battalions from the BSF, CISF, CRPF, ITBP, SSB and Assam Rifles. Each battalion has

18 self-contained specialist search and rescue teams of 45 personnel each including engineers, technicians, electricians, dog squads and medical/paramedics. The total strength of each battalion is 1,149. All the 15 battalions have been equipped and trained to respond to natural as well as man-made disasters. Battalions are also trained and equipped for response during chemical, biological, radiological and nuclear (CBRN) emergencies.

LOCATIONS OF NDRF BNs

These NDRF battalions are located at 16 different locations in the country based on the vulnerability profile of country and to cut down the response time for their deployment at disaster site.

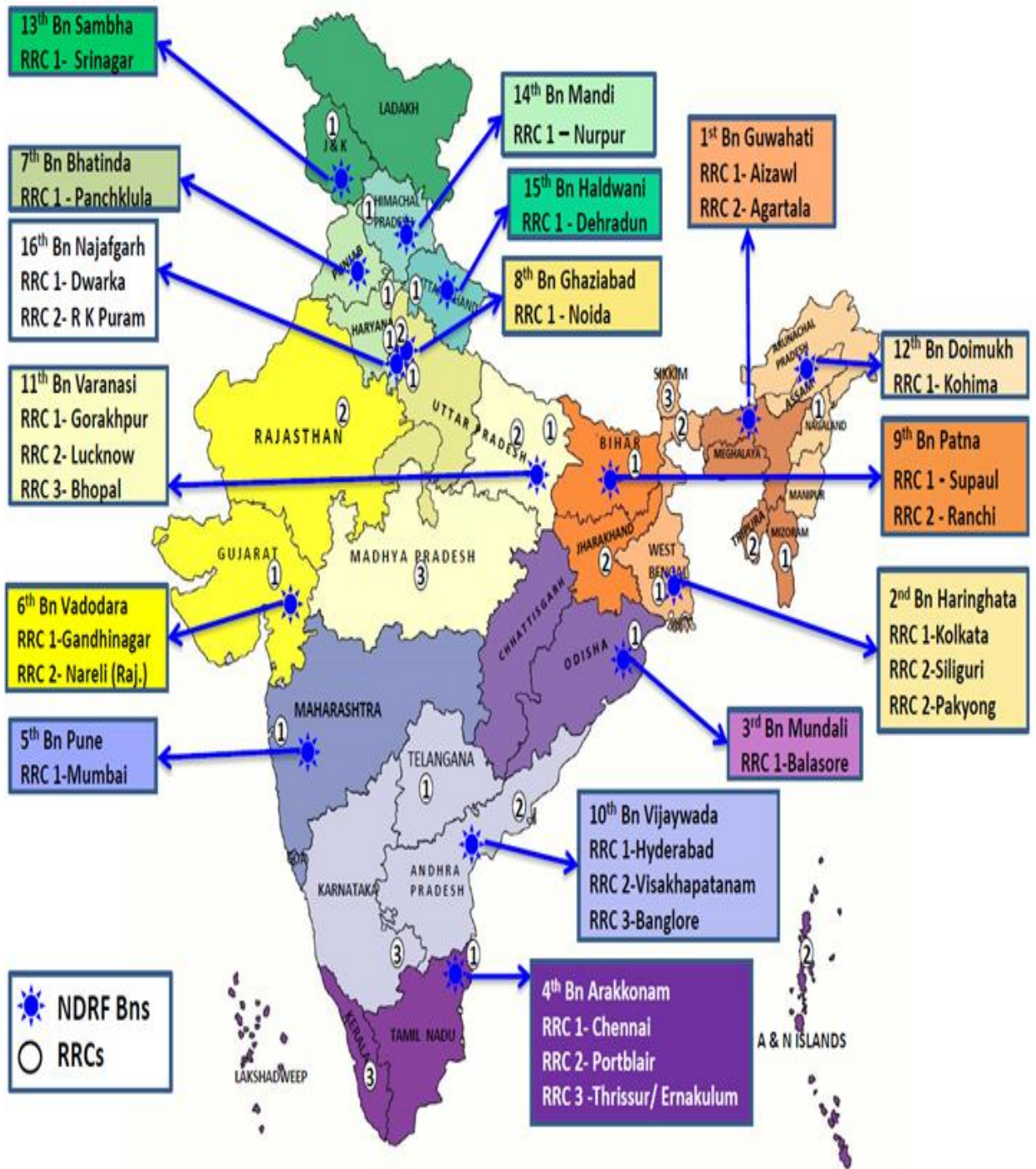


Fig 3.10. Locations Of NDRF BNs

Aapda Mitra

NDMA has been implementing a central sector scheme namely Aapda Mitra since May 2016 with a focus on training of 6000 community volunteers (200 volunteers per district) in disaster response in selected 30 most flood prone districts of 25 States of India.

The scheme aims to provide the community volunteers with the skills that they would need to respond to their community's immediate needs in the aftermath of a disaster thereby enabling them to undertake basic relief and rescue tasks during emergency situations such as floods, flash-floods and urban flooding.

The objectives of the scheme:-

- (a) Development and Standardization of training modules at National Level;
- (b) Development of Information Knowledge Management System at National level linked to States/UTs;
- (c) Training institutions to be empanelled by respective States/UTs at the State/UT level.
- (d) To train 6000 community volunteers in life saving skills of disaster response (flood relief and rescue), coordination, assistance, and provide personal protective equipment and emergency responder kits;
- (e) To create a Community Emergency Stockpile/Reserve at the district/block level containing essential light search and rescue equipment, medical first aid kits, etc.
- (f) To disseminate training and education tools developed under the project to more flood prone districts in subsequent phases of the scheme.

3.16. Conclusion

Both central and state governments have already made considerable progress and they are expected to make sincere efforts for the implementation of the DM plans. The NDMA has prepared and published guidelines covering various aspects of disaster management and including a separate one for response.

CHAPTER 4

MATERIAL STRATEGY IN DISASTER SCENARIO

4.1 Background

One of the key aspects in disaster mitigation is to take into account all aspects of a disaster and not just human relief and rehabilitation. Economic, social and environmental and the material management impacts on disaster need to be anticipated and appropriate measures taken well in time. The entire disaster cycle of prevention, preparedness, assessment, mitigation and response hinges around the material management plans. Prevention and preparedness need to be the cornerstone of any emergency plan. Anticipating the level of damage with geographical information systems, simulation software, early warning, etc. are critical elements of a good disaster preparedness and material management plan. This has to be integrated with a post-disaster assessment, which can be used to draw lessons for preparedness and material management in all future support required by the population hit by a nearly similar kind of disaster since no two disasters are alike.

The variety of possible situations generated due to disasters resulting in displacement of people makes have following effects in varying degrees:-

- (a) Loss of means of livelihood.
- (b) Communities becoming separated from basic services previously provided
- (c) Loss of normal sources of food.
- (d) Lack of shelter and household necessities.
- (e) Lack of fuel.
- (f) Lack of potable water.
- (g) Communicable diseases, epidemic and overcrowding.
- (h) Loss of land holdings, Communication and logistics equipment for specified jobs.
- (k) Overstressed Medical facilities and Hygiene /sanitation resources.

General Inventories

Most of the stores utilized during the disaster are broadly covered in following groups / classification:

- (a) Food/fodders.
- (b) Clothing and textile material
- (c) Health-care equipment
- (d) First-aid essentials.
- (d) Equipment support.
- (e) Infrastructural needs

4.2 Tenets of a Sound Disaster Material Management Setup

Advance Warning and Risk Mitigation System. There is always scope for improvement in obtaining advance information regarding flood, cyclones, earthquake and storm etc with help of latest technological advancements in weather warning equipment. Such projects need further encouragement and newer advanced equipment should be accorded high priority. Even with the best of early warning systems, the impact may still be catastrophic if early warning signals are not properly interpreted and communities are not educated and trained to respond to the early warning signals in real time. Therefore, the technology of early warning, on the one hand, and community response with the right kind of material support on the other hand to the affected population are urgently required. The warning System and related equipment are part of critical inventory to be available in serviceable state all the time.

Reliable Supplier Base. The victims of the earthquake need some essential items like food, clothing, shelter, health, sanitation, etc, since most of them would have lost most of them during the calamity. These supplies have to be made immediately during the period of relief operations, otherwise many more lives may be lost. While making these arrangements, there is a need for various types of materials required for rehabilitation of the affected people. To procure the required material and ensure aid is available to the needy, well in time, poses a major challenge before the administration as

there is a great danger of mis-utilization of materials by unscrupulous people both in terms of creating scarcity of essentials and having abundance of frivolous stores.

A Major development in provision and procurement has been decreased in the number of suppliers and to develop confirmed supplies. This stems from the need for improved supply and has led to tighter control and higher quality standards. One solution to the unreliable procurement is to have a single supplier for each item, rather than multi-suppliers of various components of the single item. Looking at single sourcing from the supplier's point of view the advantages and disadvantages are:-

Advantages

- (a) Single accountability Tractability for detecting cause of failures.
- (b) Tractability for detecting cause of failures.
- (c) Consolidated deliveries.
- (d) Faster replenishment cycle
- (e) Opportunity for product and process development
- (f) Added economy

Disadvantages

- (a) More dependence on one supplier.
- (b) Need to give guaranteed order.

Accountability. Logistics involves planning, implementing and controlling the physical flow of materials and final goods from points of origin to points of use to meet customer requirements. Logistic is, therefore, the study of flow management that can provide a level of distribution services to customers through effective planning, organizing, and controlling of the stock movement. It is the set of facilities, equipment, people, and operating policies that make this flow of the goods and the flow of from acquisition of raw materials through production and distribution possible so as to fight the disaster with a scientific approach. Every logistic task must be the clear responsibility of someone, and each person must be responsible to someone for performance.

Transit Management. The Key to successful control of material lead time is transit management. Transit management is the process whereby procurement lead time

is linked to the needs of the disaster hit population. At the same time, transit management seeks to meet the challenge of increasing the speed of response to the areas where means of communication have broken down and different functions/ activities of logistics interact constantly with one another. Uncoordinated material management makes it impossible to achieve a flow of products that satisfies the needs and relief in disaster hit people.

Finance Administration. The financial aspect of material management provides accounting, procurement, time recording, cost analysis and overall fiscal guidance. Material management in disaster is at the core of all disaster relief activities. Its principal aspects are the formulation of policy and then its implementation for the attainment of the stated objectives in an optimum manner. It is the systematic ordering of material required and the calculated use of resources aimed at making the desired things happen and forestalling further damage.

Financial advisors can help an organization in the Material Management in disaster, through the application of well thought out principles, practices and rationalized techniques of raising, allocating and utilizing financial resources for the fulfillment of organizational objectives, systematically and scientifically. It may be defined as the art and science of policy-making, planning decision-making, coordination, control of the processes of securing adequate resources, ensuring their safe custody, genuine allocations among different areas of social-economic development, effective utilization and avoiding the pilferage of resources and duplication of efforts to attain the objectives of the material management.

Material Requirements Planning. There is a well developed technique for planning dependent demand called Material Requirements Planning This is a generally applicable technique for all types of dependent demand. The basic concept is to have stock when it is needed and to have minimum stock level the rest of the time. The demands must carry complete details such as type, model, size and timing of the

requirements to meet needs. Planning can therefore give good results in material management during a disaster.

Flow of Information. While there is still plenty of room to improve the visibility and reporting of relief information, the relative focus on improved analysis of the kind of material help required to support decision making will continue to grow. Availability of real-time data with the use of latest technology and correct knowledge of Resources at the disposal, will lend flexibility to the Material support systems.. Significant opportunity exists to devise a system that will use real time information to improve transportation and warehousing and make smarter and faster decisions in all material handling operations to fight the aftermath of disasters. The opportunity is to design systems that enable rapid on real-time data to provide a flexi material management model during and after the disaster.

Audit. The stores are assets which need to be accounted for audit at a later date, therefore the following step even in crisis are to be taken care of :-

- (a) Receive all incoming materials and see that the quantities are correct according to challan /invoice.
- (b) See that the Daily Goods Receipt Register is properly maintained.
- (c) Arrange for inspection of the materials received.
- (d) Ensure that Goods Inward Notes are raised and distributed without delay.
- (e) See that materials are properly stored against deterioration, theft, etc, and that they are readily available for issue to the needy.
- (f) Issue materials against authorized requisitions to distribution agencies and other departments.
- (g) Maintain accurate records of material received, issued and in storage.
- (h) Ensure the postings are up-to-date for any agency to audit.
 - (j) Carry out stock verification in accordance with the procedure laid down by the management.

4.3. Type of Inventory Forecasts

Some type of forecasting is used only for specialized purposes. Of those used regularly by inventory managers, the following approaches are the most useful in disaster and form the basis of stock control.

Past Data Techniques. Forecasts can be based on past data and then modified by the special requirement in the current disaster. The only exceptions to this rule are for new products and those which have not been put to use in earlier disasters for the area around.

Area Demand. These are generally based on knowledge of the area and accordingly are specific requirements. All the major factors of terrain and lay of the ground that impacts living conditions then the demand can be accordingly modified and a model can be created as a package applicable to that area. The influence of each factor can be assessed and put into sequential order, or the factors can be input into a simulation which can develop its own parameters so that the peculiarities of the area and prevailing environment can be taken care of.

Minimum Stock Level. Many systems, both manual and automated have a 'minimum stock level field displayed. The field is usually used for the 'reorder level' instead of for the minimum stock and is either a user input field or fixed. This does help for initial take off.

4.4 India Disaster Resource Network (IDRN)

Government has recently launched a technology based material support platform IDRN. It is a nation-wide web based electronic inventory of resources that enlists critical supplies, equipment and human resources collated from districts, states and national level along with private sector and public sector undertakings through line departments and agencies. Primary focus of the IDRN portal is to enable the decision makers to know the availability of resources and equipment required to combat any emergency situation. This

database will also enable them to assess the level of preparedness for specific disasters. Some salient aspects are as under:-

Resources and Equipment. An inventory list of different categories of resources and items have been worked out keeping the varied geo-climatic conditions aligned with various types of hazards, disasters including the pandemics. Similarly, District Administrations shall also compile and update the data related to trained Aapda Mitra Volunteers, Civil Defence Volunteers, volunteers of Nehru Yuva Kendra (NYKS), NCC, NSS, NGOs, Community Based Organizations (CBOs), etc. Inventories related to essential services and service providers like Health, Water and Sanitation, Power, Telecommunication, Transportation and Civil Supplies etc. must also be updated.

Resources available with the Private Sector. District Administration will also include and update data related to the resources (personnel, material and services) available with the Private Sector in respective districts.

Collection of Data. District Administration is responsible for collection of data related to resources available in the District which are required during impending disaster situations/ disasters. District Collectors/ Magistrate through DDMAAs are responsible to collect the latest information about resources available with various line departments/ agencies and uploaded in the portal, using services of District Informatics Officers.

Entry/ Updation of Data. District administration will update the data at regular intervals. Officer identified by the District Administration will be responsible for ensuring the entry of data in the portal. Data collection and uploading on IDRN portal should be done following the instruction regarding data collection available at IDRN website.

Requisition of Resources from Private Sector. District Administration will directly requisition the resources available with the Private Sector and Private Sector shall ensure that these resources are deployed effectively and efficiently in a timely manner. Respective Private Sector shall ensure that the resources available with it are deployed with adequate skilled manpower and fuel, if required. Cost of services provided

by the Private Sector will be considered as part of Corporate Social Responsibility. Normal wear and tear of the equipment shall also be borne by the respective Sector.

4. 5. Material support shortcomings in Indian context

Following are some of the material support shortcomings observed during Disaster relief activity:-

- (a) Inadequate exploitation of Advance warning systems and technology for disaster prediction and identification of related risks and vulnerabilities .
- (b) Appropriate disaster prevention and mitigation strategies are not executed on ground .
- (c) Lack of clarity on roles and responsibilities for different stakeholders concerned while fighting the disasters so that materials in disasters can be managed more effectively.
- (d) Non conduct of mock drills and community building/ participation Ex.
- (e) Non availability of storage warehouses , Rescue and relief inventory to meet requirements of victims at all levels. Inadequate arrangements for accessing resources, equipment, supplies and funding in preparation for disaster that might occur.
- (e) No procedures are in place to mobilize the resources and capability for relief, rehabilitation, reconstruction and recovery from disasters in a quick time frame.
- (f) Lack of awareness and preparedness in providing advice and training to the agencies involved in disaster management and to the community at large.
- (g) Inadequate coordination with material supplying agencies related to disaster management in any location and those at the national and international level.
- (h) Relief / assistance to the affected is in many occasions marred by discrimination of caste, creed or community.

CHAPTER 5

US DISASTER LOGISTICS MANAGEMENT AND RESOURCE SUPPORT SYSTEM

5.1. Introduction

This chapter gives a general idea about disaster management in one of the most advanced foreign countries, namely the USA. Programmes and organizations differ widely in terms of emphasis, financial support, public interest and involvement. The global seismic hazard map is given as under:-

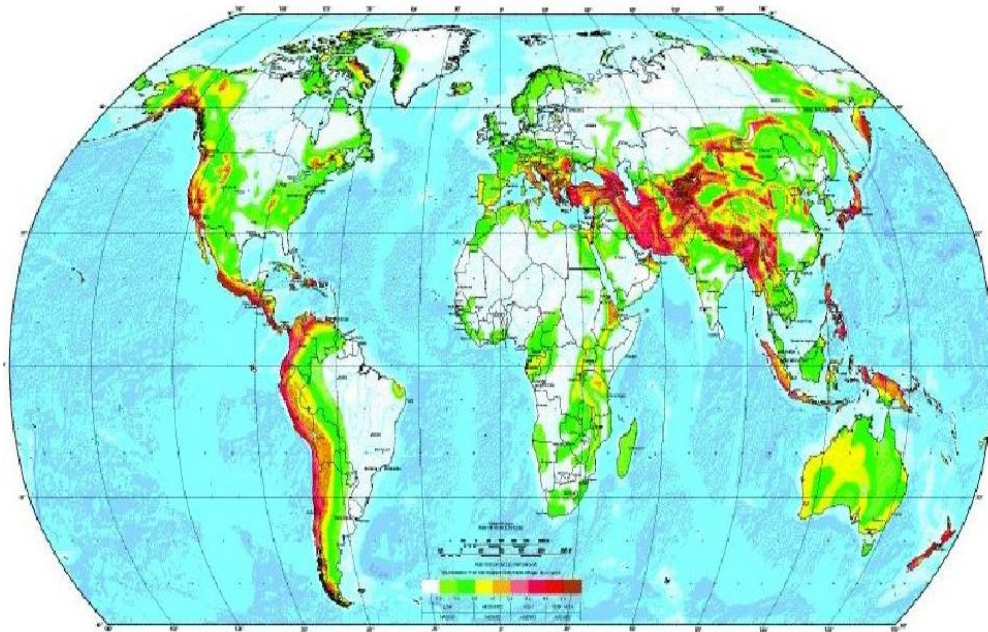


Fig 5.1 Global Seismic hazard map.

5.2. US Disaster Management Framework

Federal Emergency Management Agency (FEMA) is the main organization responsible for dealing with federal level emergencies in the United States. It was initially created in 1979 as an independent organization but On March 1st, 2003 FEMA

became part of the U.S. Department of Homeland Security (DHS) along with 22 other government agencies. FEMA is a relatively small agency with around 2,600 full time employees but it can mobilize nearly 7000 temporary disaster assistance employees to respond to disasters. Besides the headquarters in Washington D.C., FEMA has ten regional offices across the country to coordinate with its state and local government counterparts and with nonprofit and for-profit organizations.

The primary mission of FEMA is

“To reduce the loss of life and property and protect the Nation from all hazards, including natural disasters, acts of terrorism, and other man-made disasters, by leading and supporting the Nation in a risk-based, comprehensive emergency management system of preparedness, protection, response, recovery, and mitigation.” (www.fema.gov)

FEMA’s Strategic Plan establishes strategic goals, objectives, and strategies to fulfill FEMA’s vision. The strategic goals of the agency are to:-

- (a) Lead an integrated approach that strengthens the Nation’s ability to address disasters, emergencies, and terrorist events
- (b) Deliver easily accessible and coordinated assistance for all programs
- (c) Provide reliable information at the right time for all users
- (d) FEMA invests in people and people invest in FEMA to ensure mission success
- (e) Build public trust and confidence through performance and stewardship.

One of the important documents that define the principles, roles, and structures of FEMA is the National Response Framework (NRF). NRF replaced its older version called National Response Plan on March 22, 2008. NRF presents the guiding principles that enable all response partners to prepare for and provide a unified national response to disasters and emergencies. It describes how communities, tribes, states, the federal government, private-sectors, and nongovernmental partners work together to coordinate national response. Following the guidelines of NRF are essential to establish a comprehensive, national, all-hazards approach for disaster response in the United States.

NRF main documents are supplemented by important annexes called Emergency Support Functions (ESF). The ESFs provide the structure for coordinating Federal interagency support for a Federal response to an emergency. They are mechanisms for grouping functions most frequently used to provide Federal support to States and Federal-to-Federal support, both for declared disasters and emergencies under the Stafford Act and for non-Stafford Act incidents. Table 1.1 gives a summary of the 15 ESFs currently present in the NRF.

ESF	Scope
ESF #1 – Transportation ESF #2 – Communications	Aviation management and control; Transportation safety Restoration/recovery of transportation infrastructure; Movement restrictions; Damage and impact assessment Coordination with telecommunications and information technology industries; Restoration and repair of telecommunications infrastructure Protection, restoration, and sustainment of national cyber and information technology resources; Oversight of communications within the Federal incident management and response structures
ESF #3 – Public Works and Engineering ESF #4 – Firefighting ESF #5 – Emergency	Infrastructure protection and emergency repair; Infrastructure restoration; Engineering services and construction management; Emergency contracting support for life-saving and life- sustaining services Coordination of Federal firefighting activities; Support to wild land, rural, and urban firefighting operations Coordination of incident management and response efforts; Issuance of mission assignments; Resource and human capital; Incident action
Management	planning; Financial management
ESF #6 –Housing, and Human Services	Mass care; Emergency assistance; Disaster housing; Human services

ESF #7 – Logistics Management	Comprehensive, national incident logistics planning, management, and sustainment capability; Resource support (facility space, office equipment and supplies, contracting services, etc.)
ESF #8 – Public Health	Public health; Medical and Mental health services; Mass fatality Management
ESF #9 – Search and Rescue	Life-saving assistance Search and rescue operations
ESF #10 – Hazardous Materials	Oil and hazardous materials (chemical, biological, radiological, etc.) response; Environmental short- and long-term cleanup
ESF #11 – Agriculture and Natural Resources	Nutrition assistance; Animal and plant disease and pest response; Food safety and security; Natural and cultural resources and historic properties protection and restoration; Safety and well-being of household pets
ESF #12 – Energy ESF #13 – Public Safety and Security	Energy infrastructure assessment, repair, and restoration; Energy industry utilities coordination; Energy forecast Facility and resource security; Security planning and technical resource assistance; Public safety and security support; Support to access, traffic, and crowd control
ESF #14 – Long-Term Recovery ESF #15 – External Affairs	Long-term community recovery assistance to States, local governments, and the private sector Analysis and review of mitigation program implementation Emergency public information and protective action guidance; Media and community relations; Congressional and international affairs; Tribal and insular affairs

Table 5.1 Emergency Support Function Annexes of the National Response Framework

Emergency Support Function #7, Logistics Management and Resource Support Annex, describes the roles and responsibilities of FEMA and General Services Administration (GSA) to jointly manage a supply chain that provides relief commodities to the victims. Based on ESF #7, FEMA is the primary agency for Logistics Management and is responsible for:-

- (a) Material management that includes determining requirements, sourcing, ordering and replenishment, storage, and issuing of supplies and equipment..
- (b) Transportation management that includes equipment and procedures for moving material from storage facilities and vendors to incident victims, particularly with emphasis on the surge and sustainment portions of response. Transportation management also includes providing services to requests from other Federal organizations.
- (c) Facilities management that includes the location, selection, and acquisition of storage and distribution facilities. These facilities include Logistics Centers, Mobilization Centers, and Federal Operations Staging Areas.
- (d) Personal property management and policy and procedures guidance for maintaining accountability of material and identification and reutilization of property acquired to support a Federal response operation.
- (e) Management of Electronic Data Interchange to provide end-to-end visibility of response resources.
- (f) Planning and coordination with internal and external customers and other supply chain partners in the Federal and private sectors for improving the delivery of goods and services to the customer.

5.3. FEMA's Logistics Supply Chain

FEMA has a complicated and special structure for its supply chain. There are seven main components in the supply chain to provide relief commodities for disaster victims that are briefly described here:

FEMA Logistics Centers (LC) - permanent facilities that receive, store, ship, and recover disaster commodities and equipment. FEMA has a total of 9 logistics centers:-

- (a) 4 Continental United States centers containing general commodities located at Atlanta, Georgia; Ft. Worth, Texas; Frederick, Maryland; and Moffett Field, California.
- (b) 3 Off-shore centers containing general commodities located in Hawaii, Guam, and Puerto Rico.
- (c) 2 Continental United States centers containing special products such as computers, office electronic equipment, medical and pharmaceutical caches located in Cumberland, Maryland and Berryville, Virginia.
- (d) Examples of disaster relief commodities include ice, water, meals ready to eat (MREs), blankets, cots, flashlights, tarps, sleeping bags and tents. Disaster relief equipment include emergency generators, personal toilet kits, and refrigerated vans.

Commercial Storage Sites (CSS) - Permanent facilities that are owned and operated by private industry and store commodities for FEMA. Freezer storage space for ice is an example.

Other Federal Agencies Sites (VEN) - Representing vendors from whom commodities are purchased and managed. Examples are Defense Logistics Agency (DLA) and General Services Administration (GSA).

Mobilization (MOB) Centers - Temporary federal facilities in theater at which commodities, equipment and personnel can be received and pre-positioned for

deployment as required. In MOBs commodities remain under the control of FEMA logistics headquarters and can be deployed to multiple states. MOBs are generally projected to have the capacity to hold 3 days of supply commodities.

Federal Operational Staging Areas (FOSAs) - Temporary facilities at which commodities, equipment and personnel are received and pre-positioned for deployment within one designated state as required.. Commodities are usually being supplied from MOB Centers, Logistics Centers or direct shipments from vendors. FOSAs are generally projected to hold 1 to 2 days of commodities.

State Staging Areas (SSA) - temporary facilities in the affected state at which commodities, equipment and personnel are received and pre-positioned for deployment within that state. Title transfers for delivered federal commodities and cost sharing are initiated in SSAs.

Points of Distribution (PODs) Sites - temporary local facilities in the disaster area at which commodities are distributed directly to disaster victims. PODs are operated by the affected state.

Figure 5.2 better illustrates this structure. At the top of the pyramid there are 3 types of facilities namely FEMA Logistics Centers, Commercial Storage Sites, and Other Federal Agencies or Vendors. These permanent facilities store and ship commodities and equipment and are considered as “sources” in the chain. Mobilization Centers, Federal Operational Staging Areas, and State Staging Areas are 3 types of facilities that mainly play the role of transshipment points. These are temporary facilities at which commodities, equipment and personnel are received and pre-positioned for deployment to the lower levels. At the end, Points of Distribution Sites are temporary local facilities at which commodities are received and distributed directly to disaster victims. PODs can be local schools, churches, or big parking lots in the affected area.

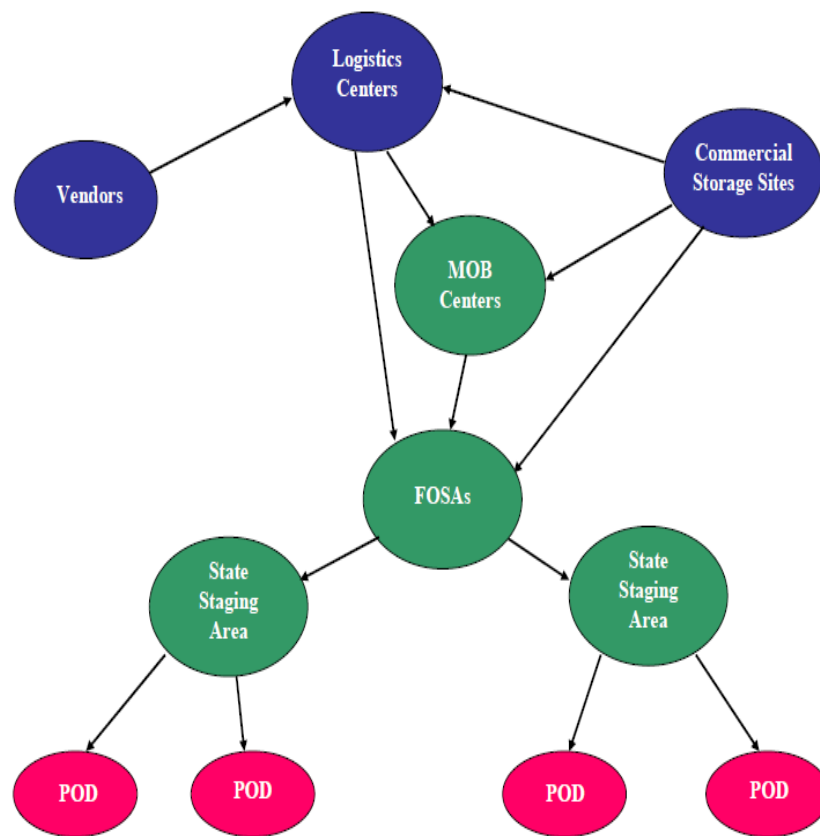


Fig :5.2 FEMA’s Supply Chain Structure

Even this simplified presentation of the FEMA’s logistics supply chain indicates the complex structure of the system. Finding the optimal sites for 4 levels of temporary facilities is a complicated location finding problem. Delivering several types of commodities to disaster victims is a multi-commodity capacitated network flows problem. Optimizing the movement of vehicles in the network is a dynamic vehicle routing problem with mixed pickup and delivery operations. Usually more than one transportation mode is used in disaster response operations which makes the problem a multimodal transportation problem. Other characteristics that make the problem unique include, but are not limited to, importance of quick response and fast delivery, shortage

of supply versus overwhelming demands, insufficient capacity of facilities and transportation system, and dynamic environment of the emergency situations.

5.4. Conclusion

In most developed nations, the vast Disaster relief network is backed by meticulous preparedness, elaborate communications network, facilitates relief assessment and prompt operations. Disaster Management is a multi-disciplinary activity and involves a proactive approach by putting in various measures for effective institutional and policy framework, disaster prevention, mitigation and preparedness. In all advanced countries the involvement of Central and State Governments, the community, civil society organizations and media has a key role to play in achieving our aim of Disaster Risk Reduction.

CHAPTER 6

REAPPRAISAL OF ROLE OF ARMED FORCES IN DISASTER RESPONSE

6.1. Introduction

Numerous major natural calamities have struck the Indian sub-continent during the last decade, they have underscored the need to adopt a multi-dimensional, multi-disciplinary and multi-sectoral approach to disaster management. Within the ambit of this approach, the Armed Forces constitute a significant and potent entity available with the Central Government, for disaster response and relief. As part of the Armed Forces, the Army, by virtue of its organizational strength, motivation, discipline and operational preparedness, has always risen to the occasion, earning the appreciation of the environment for its singular contribution.

The role of the Armed Forces in disaster management is as relevant today as it was earlier, i.e. before the formation of the National Disaster Management Authority. It continues to be amongst the first responders in a disaster situation even before the civilian resources by virtue of its location in the entire country, especially in the far-flung border areas or even remote areas where district administration is weak or non-existent.

Attributes of Armed forces

The following attributes make the Armed Forces a potent instrument for disaster relief :-

- (a) It is suitably poised for rapid response and for mobilizing self-contained, composite task forces to any part of the country, even overseas, in conjunction with the Navy and Air Force.
- (b) It is structured, organized and managed to provide support for a full range of public relief services.

6.2. Role and Employment of the Armed Forces in Disaster Management

Over the years, the scope of Armed Forces role in disaster management post the Disaster Management Act of 2005 has remained focused on critical issues, with optimal utilization of dedicated resources.

The versatile capabilities of the Army to respond to any form of disaster situation can be best exemplified by the assistance provided during the Bhuj Earthquake, Orissa Super Cyclone, Tsunami Disaster, as well as relief operations conducted in the aftermath of the Kashmir Earthquake and Kashmir floods , Uttarakhand Floods and even Kerala Floods. To highlight a few :-

(a) Tsunami Disaster

(i) **Response-** The speed, with which the Indian Army was able to deploy its columns in the first 6 to 9 hours, followed by a systematic build up over long distances, in conjunction with the Navy and Air Force, is perhaps proof of the credibility of our humanitarian response machinery.

(ii) **Mobilization-** The operation involved mobilization of over 8300 troops, suitably grouped into composite task forces, for rescue and relief operations, not only in the Southern peninsular regions of Tamil Nadu, Pondicherry and Kerala, but also overseas in Andaman & Nicobar Islands and Sri Lanka.

(iii) **Relief-** As many as 27,986 persons were rescued / evacuated under extremely hostile conditions. 60 relief camps were established, 41,080 patients were treated in mobile field hospitals / camps, over 990 dead bodies were recovered, debris cleared and essential rations, food packets, medicines, clothing, blankets and kerosene to the traumatized populace.

(iv) **Rehabilitation-** The columns were, thereafter, involved in rehabilitation and reconstruction operations for a sustained period of 6-9 months. All possible tasks like restoration and manning of essential services, restoration of surface communications to include launching of bailey bridges and operation of ferries, erection of temporary dwelling

units and toilets, enforcement of hygiene and sanitation measures to prevent an epidemic outbreak, trauma and psychological counseling, as also informative classes on employment and recruitment opportunities for youth were undertaken by our troops in the most commendable manner.

(b) **Kashmir Earthquake** : Operation IMDAD

(i) The Indian Army, despite the loss of 45 of its own personnel, with severe injuries to another 283 and significant damage to its infrastructure, willingly assumed the role of the primary agency for rescue and relief effort. Our rescue teams were the first to reach the isolated, inaccessible areas.

(ii) 52 columns, comprising 2600 troops, along with 39 medical teams, 31 tons of medicine and specialized mountaineering equipment, were mobilized for rescue and relief.

(iii) 40 relief camps were established, 1200 people rescued, 6000 civil patients treated, 150 tonnes of rations and 18,000 food packets were distributed.

(iv) In keeping with its inspirational desire to provide and oversee infrastructural renovation, the Army has adopted three villages.

6.3. Role of Armed Forces in International Disaster Response

The Indian armed forces have, in the last two decades, been involved in disaster response at the international level, especially in South Asia . During Feb 2023 the role of AF in lifting Army Medical teams ,NDRF and relief stores to Turkey being the latest incident, is indicative of growing regional and global cooperation on the issue, many countries look up to India in case of emergencies. Some instances of rendition of aid further underline the international dimension of the Indian armed forces' response and relief capacity in Katrina Disaster(2005), Philippines Mudslide (2006) , Indonesia Earthquake(2006), Lebanon (2006) to name a few.

Additionally, our armed forces have, on a number of occasions, assisted Pakistan, Sri Lanka and Bangladesh and other neighboring countries, as in the aftermath of the

tsunami (2004) and the Kashmir earthquake (2005). The armed forces play a major role in building our national image in the world fora. The response to disasters in other countries has a number of additional operational, logistic and diplomatic dimensions and will have to be planned, on the lines of out of area contingencies (OOAC). Operational capacities of the formations / units earmarked for such tasks will have to be built to be able to respond to emergencies, professionally and in keeping with the best global standards.

Deployment of Armed Forces

The Disaster Management Act 2005 is a vital instrument which explains the role and functions of various establishments. It is also a tool to bring in a sense of accountability and responsibility. However, this act mentions the “deployment of naval, military and air forces, other armed forces of the Union or any other civilian personnel as may be required for the purposes of this Act” under the heading “Measures by the Government for Disaster Management”. There is no amplification or mention of the role of the armed forces with a view to offer legal support and backup. The Act is surprisingly silent on the aspect of assigning well-defined roles and responsibilities to the armed forces.

From time immemorial, the Indian armed forces have always done a commendable job, when called to aid civil authorities, especially, in the wake of natural calamities or man-made disasters. Although the armed forces are supposed to be called upon to intervene and take on specific tasks only when the situation is beyond the capability of civil administration, in practice, they are the “core of the government response capacity” and tend to be the first responders of the Government of India in a major disaster. Both the government and the public repose tremendous faith in the armed forces and believe that all emergencies and crises can be handled by the armed forces effectively. That notwithstanding, there appears to be a growing concern in some quarters, within the ‘defense fraternity’, that, of late, the armed forces are over-involved in aid to civil authority. There are two divergent views on this: one recommends dampening our response and discourages over-enthusiasm; the other recommends a

larger, proactive and more participative role. However, in view of an increasing propensity on the part of the civil administration to requisition them for incidents of a routine nature, there is an urgent need to carry out reappraisal of the role of the armed forces in aid to civil authority, especially in contingencies relating to disaster management.

The primary role of the armed forces relating to the defense of the country against external and internal threats is unambiguous and needs no deliberation. The secondary role of the armed forces in aid to civil authority is a constitutional obligation, although as an instrument of last resort. The armed forces can be called out to aid the civil authorities to meet various contingencies, as follows:-

- (a) To maintain law and order.
- (b) To maintain essential services.
- (c) To assist in natural calamities.
- (d) To assist in execution of developmental projects.
- (e) Other types of assistance which may be sought by civil authority.

However, based on interactions held with a number of Service officers from across the country, it can be stated that there have been a large number of army columns and engineer task forces (ETFs) deployed every year, all on account of the secondary role of the army.

Technically, the armed forces need to be requisitioned by the civil administration only if the situation is clearly beyond the control and capacity of the local administration. It does not necessarily mean that the armed forces will only be pressed into service after exhausting the resources and efforts of the civil administration in case of a disaster. Sequential deployment of rescue and relief resources, or a graduated response by various entities to emergencies is fraught with the dangers of delay, and the situation going beyond control. Ideally, a quick and comprehensive assessment of the required response to a disaster or impending disaster is needed. This will facilitate deployment of the

necessary resources, including the armed forces elements, without loss of time, to limit the damage and losses to a minimum.

6.4. Resources and Capability of Army

Before looking into the capability and resources at the disposal of the Armed Forces it is important to know what all assistance they can provide to the civil administration at the time of crisis. These are as under-

- (a) **Infrastructure for Command and Control.** Infrastructure for setting up of command and control organizations for providing relief is an important task for the Armed Forces. This would involve provision of communication both telephone, radio and specialist manpower to handle it.
- (b) **Medical Aid.** Provision of medical care with the help of medical teams including treatment at the nearest military hospital is another major task performed by the Armed Forces
- (c) **Transportation of Relief Material.** Provision of logistic backup to include aircrafts, ships and for transportation of relief material to the affected areas is also one of the functions which they may be required to undertake.
- (d) **Establishment of Relief Camps.** Setting up and running of relief camps can be effectively carried out by the Armed Forces.
- (e) **Construction, Repair of Roads and Bridges.** The army engineers can undertake construction and repair of roads and bridges to enable relief teams/ material to reach affected areas. This also includes provisioning of technical and plant equipment such as cranes, bulldozers and boats etc.
- (f) **Maintenance of Essential Services.** Repair, maintenance and running of essential services like transport, railways etc may have to be undertaken in the initial stages of disaster.

(g) **Evacuation of People to Safer Areas.** Assisting in evacuation of people to safe places before and after disaster is one of the most important tasks that the Forces may be assigned to do.

(h) **Stage Management of International Relief.** The Armed Forces with their airlift and sealift capability can undertake stage management of handling of international relief

(j) **Security.** The Armed Forces may also be called to coordinate provisioning of escort for men material and security of various sensitive installation.

6.5. Principles of employment of armed forces.

The operations of the armed forces ever called upon to assist the civil authority in rendering relief are governed by certain guiding principles (IDS, 2009) These are enumerated below:

(a) **Judicious Use of Armed Forces.** The assistance by armed forces should be requisitioned only when it becomes absolutely necessary and when the situation cannot be handled by civil administration from within its resources.

(b) **Immediate Response.** When natural and other calamities occur, the speed for rendering aid is of paramount importance. It is clear that under such circumstances prior sanction for assistance may not always be possible. In such cases the army when approached for assistance should provide the same without delay. No separate government sanction for aid rendered in connection with assistance during natural disaster and other calamities is necessary.

(c) **Command of Troops.** The army units while operating under these circumstances continue to be under command of their own commanders and aid rendered is based on task basis.

(d) **No Menial Tasks.** While assigning tasks to the troops it must be remembered that troops are not utilized for menial tasks. Troops should not be utilized for disposal of dead bodies.

(e) **Requisition of Aid on Task Basis.** The requisition of Armed Forces should not be in terms of number of columns, engineer and medical teams, instead the civil administration should spell out tasks and leave it to army authorities to decide the force level, equipment and methodology to tackle the situation.

(f) **Regular Liaison and Coordination.** In order to ensure that optimum benefit is derived out of armed forces employment, regular liaison and coordination needs to be done at all levels and contingency plans made and disseminated to the lowest level of civil administration and the army.

(g) **Advance Planning and Training.** The army formation located in areas prone to disaster must have detailed plans worked out to cater for all possible contingencies. The troops should be well briefed and kept ready to meet any such contingency.

(h) **Integration of all Available Resources.** All available resources, equipment, accommodation and medical resources with civil administration, civil firms, NGOs etc need to be taken into account while evolving a disaster relief plan. All the resources should be integrated to achieve optimum results. Assistance from outside agencies can be superimposed on the available resources.

(j) **Early Derequisitioning.** Soon after the situation in the disaster affected area has been brought under control of the civil administration Armed forces should be de-requisitioned.

At the national level, the Chief of the Integrated Defence Staff and the Chairman, Chiefs of Staff Committee are already part of the National Executive Committee (NEC). The Defence Crisis Management Group (DCMG) was institutionalized under the chairmanship of CISC. It has nine members to keep a watch, analyze, and overall plan

formulation and coordination role with other agencies. Detailed planning, execution and management will be carried out by the respective services. DCMG prepares detailed strategic estimates for each crisis situation.

6.6. Armed Forces and Civil Administration / NDRF in Disaster Management

Disasters in recent years have shown that in the after-math of major calamities, there is no likelihood of any communications, infrastructure and civil set-up remaining intact. Therefore, in the initial stages, suitable key personnel, both civil and military and infrastructure/communications equipment will have to be moved by the fastest means to the affected areas. Transport aircraft helicopters would have to be earmarked and kept ready to move such elements, at short notice. Some of the challenges that have been experienced recently during relief operations are:-

- (a) Local authorities did not possess any inputs regarding the situation & services first had the task of gaining information of the extent of damage and the relief effort required.
- (b) Heavy rains & poor weather conditions made relief operations difficult.
- (c) There usually was a shortfall of the capability available for evacuation of affected personnel & the requirement.
- (d) Problems were experienced in communication & compatibility of equipment between the different relief agencies.
- (e) State Departments were not available for coordination where the army columns had already reached, leading to delay in affecting relief.
- (f) There also was appreciable reluctance in providing resources of the state to the services.
- (g) The equipment profile of NDRF teams was also found inadequate since during the relief operations they felt the need of having latest technology search and rescue devices.

6.7. Summary of Recommendations

It will be incorrect to state that nothing has been done by various entities / stakeholders in this regard. In fact, there is a great amount of awakening on the part of all

the stakeholders in disaster management in India. While some of the measures / recommendations may already be in practice in some states, what is lacking is the implementation and seriousness with which these are executed on the ground. The need of the hour is to emphasize implementation / execution of all the recommendations, in letter and spirit. A summary of the recommendations is as follows:-

(a) Aid to civil authority in cases of disaster management is not normally declined as long as the term 'disaster' is interpreted correctly. However, military commanders should exercise caution for other requisitions and use discretion and, time permitting, take clearance from higher HQ.

(b) A post-disaster analysis should be carried out to ascertain if the disaster could have been managed by the civil administration. However, this should be only done if ambiguity exists and if there are varying views on the issue.

(c) The armed forces units and formations should be kept in the picture and informed by the local civil administration about a developing disaster situation.

(d) A graduated / sequential response in disaster management should be avoided and the armed forces deployed well in time to be effective. If the situation warrants, the civil administration may warn / requisition the armed forces' assistance in anticipation of a major disaster. Deployment in anticipation of a major disaster should only be resorted to in exceptional circumstances after a comprehensive assessment of emergency.

(e) The armed forces should be deployed as a last resort but not always as the last. An assessment of the situation and need for assistance of the armed forces must be anticipated / ascertained by the civil administration.

(f) The civil administration should carry out a comprehensive "SWOT analysis and scenario building exercise" to be able to take considered decisions before requisitioning the assistance of the armed forces in case of a disaster.

(g) Joint mock exercises involving the local armed forces units and other stakeholders, based on various contingencies, should be organized to develop rapport and synergise the effort of disaster response. This is a major gray area which needs immediate attention.

(h) The formations and units earmarked for disaster response at the international level should be prepared and trained for the role on the lines of OOAC, and tri-Service mock exercises may be organized to develop operational capacities.

(j) Last, but not the least, is that the armed forces should not lose focus and get involved in disaster management at the cost of their primary role. A balanced approach to both the roles would have to be made.

6.8. Conclusion

"First responders - last resort", used to be the basic principle for employment of the armed forces in disaster rescue and relief operations: first responder, meaning response by troops in the close vicinity of the disaster location first, on their own, in grave disaster situations. (Raj, 2008) It is now the NDRF who are the first responders and the Indian armed forces have a secondary role to play. Also there is a need to give the armed forces a charter, an institutionalized role for managing disasters in the country which is supplementary to the charter of NDRF. For state governments the first preference for any disaster management should be NDRF/SDRF and not the Armed Forces.

20. While wars occur once in two or three decades, disasters strike with virtual regularity, almost every year, especially in India. The role of the armed forces in aid to the civil authority, in disaster management situations is well defined and unambiguous. While operational preparedness for disaster complements preparedness for war, deployment in disaster management also affords great opportunities to the armed forces to win the hearts and minds of the masses, specially in areas affected by terrorism and communal strife. The important issue is the optimisation of the armed forces' potential in disaster rescue and relief by integrating them in the state apparatus and synergising all the efforts. Being a very important stakeholder, the armed forces should be formally recognised as part of the planning process of disaster management in the states rather than carrying out only a functional role. The civil administration should keep the principle of last resort in mind while deploying troops in disaster management, and derequisition them as soon as possible.

CHAPTER 7

EXAMINATION OF CASE STUDIES

7.1. The Gujarat Earthquake (2001)

Background

One of the two most deadly earthquakes to strike India in its recorded history was the Bhuj earthquake that shook the Indian Province of Gujarat on the morning of January 26, 2001 (Republic Day). The earthquake caused massive loss of life and injury. It left nearly a million families homeless, and destroyed much of the area's social infrastructure: from schools and village health clinics, to water supply systems, communications and power. The Kutch district of Gujarat is the worst affected; in many villages and several towns the destruction was nearly total.

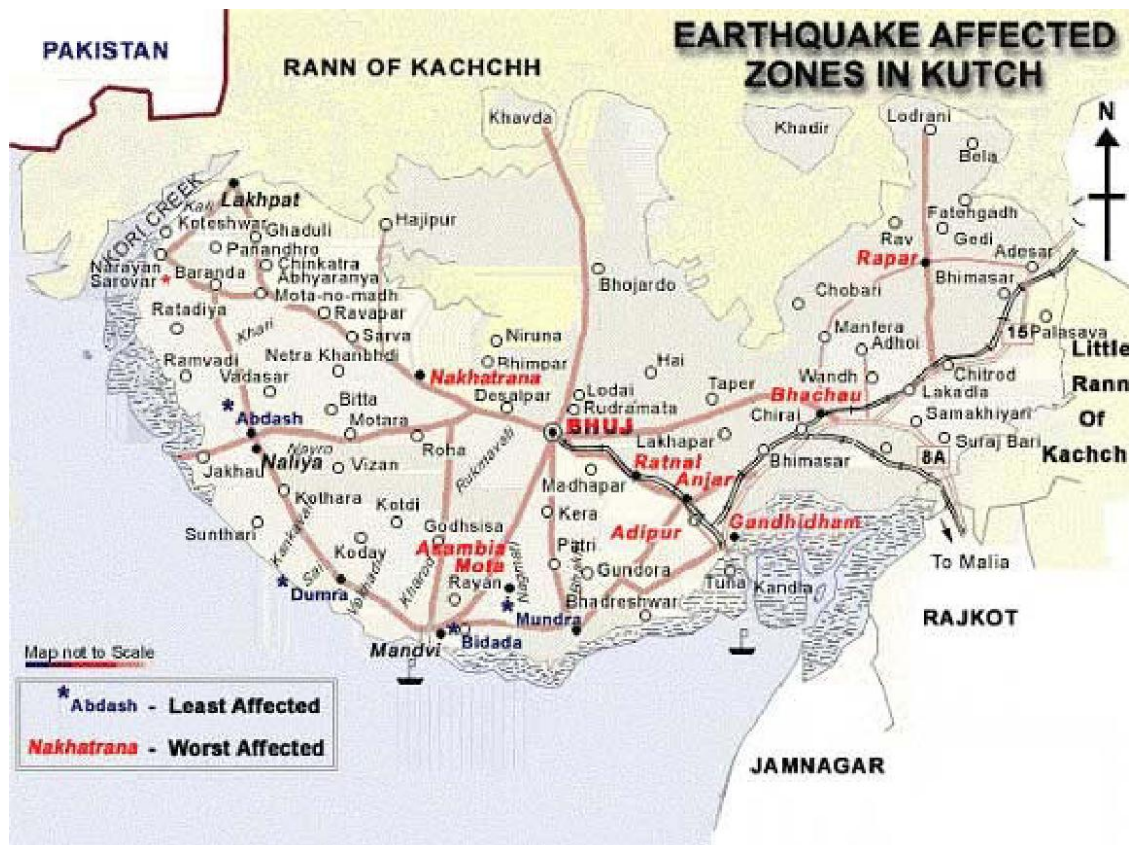


Fig: 7.1 Earthquake affected zone in kutch

Source: GoI website <http://gujarat-earthquake.gov.in/final/bhuj.html>

One month after the earthquake official Government of India figures placed the death toll at 19,727 and the number of injured at 166,000. Indications are that 600,000 people were left homeless, with 348,000 houses destroyed and an additional 844,000 damaged. The Indian State Department estimates that the earthquake affected, directly or indirectly, 15.9 million people out of a total population of 37.8 million. More than 20,000 cattle are reported killed. Government estimates place direct economic losses at \$1.3 billion. Other estimates indicate losses may be as high as \$5 billion.

The earthquake was followed by a large number of aftershocks. The Indian Metrology Department (IMD) recorded more than 500 aftershocks of magnitude 3.0 and above, which continued through the month of March. The state of Gujarat is the heartland of Indian industries like petroleum, power and steel. Indeed, this M7.9 earthquake is the first to hit metropolitan cities of the country in recent times and modern industrial constructions.

Earthquake Information at a Glance.

- (a) Date and time of Occurrence of Earthquake: 26 January 2001 at 8:46 am
- (b) Magnitude: 6.9 on the Richter scale with epicenter at 20 K.M. North East of Bhuj
- (c) No of districts affected: 21 out of 25 districts
- (d) Most affected areas: Kachchh, Ahmedabad, Jamnagar, Rajkot and Surendranagar.
- (e) Death toll: 20,000 approx.
- (f) Affected villages: 7904 villages affected in 182 talukas in 21 districts
- (g) Affected population: 15.9 million (42.06%) affected out of total population of 37.8 million
- (h) Damage:
- (j) Houses Fully Destroyed 1.87 lakh (Pucca), 1.67 lakh (Kachcha) & 0.16 lakh (huts)
- (k) Houses Partially Destroyed 5.01 lakh (Pucca), 3.87 lakh (Kachcha) & 0.34 lakh (huts)

- (1) Total estimated loss of damage Rs. 21262 crore.

Source: The UNDP/DMT Response to the Gujarat Earthquake.

Initial Response

The Government of Gujarat (GoG) had set up the Gujarat State Disaster Management Authority (GSDMA) that would implement the reconstruction and rehabilitation, with support from various other agencies in the quake-hit area. The GoG announced four packages amounting to almost US \$1 billion for reconstruction and economic rehabilitation for more than 300,000 families. The government had also announced a US\$2.5 million package to revive small, medium and cottage industries.

The World Bank and the Asian Development Bank had announced loans worth \$300 million and \$500 million respectively. A number of other bilateral agencies mentioned below had also agreed to provide financial assistance for the rehabilitation program:-

- (a) European Union (EU)
- (b) Department for International Development (DFID)
- (c) United States Agency for International Development (USAID)
- (d) Canadian International Development Agency (CIDA).

While there had been no major impact on industrial units owned by major corporate groups, the leading chambers - the Confederation of Indian Industries (CII) and the Federation of Indian Chambers of Commerce and Industries (FICCI) had offered to adopt clusters of quake-ravaged villages for relief and long-term rehabilitation. A number of business groups such as Reliance, VSNL, Larsen & Toubro, TATA Steel, Coca-Cola, ESSAR and Videocon had decided to contribute to the rehabilitation program. Public sector industries too provided huge donations for rehabilitation.

International Assistance

Financial and Material assistance came from :-

• Australia Disaster management : US\$550,000
• Bangladesh 20,000 tons of rice and 12-member medical team together with first aid supplies
• Belgium US\$920,000 as emergency aid and reconstruction
• Canada \$2 million in aid -- \$1.3 million to help furnish basic necessities to quake victims and \$660,000 to Canadian and Indian relief organizations and the Red Cross
• China \$602,000 in disaster relief; China's Red Cross offered \$50,000
• Greece \$270,000 in financial aid relief supplies
• Israel 150 strong -emergency aid mission
• Italy Team of experts and \$2.3 million for emergency equipment
• Kuwait US\$250,000 in emergency relief from Kuwaiti Red Cross
• The Netherlands US\$2.5 million through UNICEF and other aid agencies
• New Zealand Grant of US\$200,000
• Pakistan 13 tons of relief material comprising of blankets and food material
• Syria Medical and other relief supplies
• Taiwan US\$100,000 through Red Cross
• UK Total of £10 million apart from rescue team and other relief supplies including 1200 tents
• US Relief supplies; USAID to send US\$ 5 million worth of aid supplies apart from 80 tons of relief material it has already sent
• UAE, Vietnam & Saudi Arabia supplied Relief materials and Food supplies

Source: High Commission of India, London, Press Release January 30, 2001, Gujarat Earthquake Relief Update

NGOs

CARE International responded immediately to assist people in need. Overall, 10,000 families received immediate relief such as materials for temporary shelter, clothing, cooking utensils, a kerosene cooker and water purification tablets. In coordination with the Indian Government, other international agencies and local partners, CARE targeted the worst hit blocks in the Kutch region for emergency relief to address immediate humanitarian needs and rehabilitation to re-establish livelihoods in the longer term.

Help Age India's response focused on rural areas, where most people were affected. Working with four local partners - Kutch Vikas Trust (KVT), Shroff Foundation, Navjeevan Trust and Sadvichar Parivar - HelpAge India conducted rapid needs assessments. Basic relief items were delivered to 7,500 older people and their families. Mobile Medicare Units (MMUs) provided emergency medical care in villages in Kachchh, Rajkot and Surendranagar districts.

Oxfam had focused its response on the districts of Kachchh, Surendra Nagar and Rajkot as they were the most vulnerable and worst affected. The immediate relief phase of Oxfam's response work included food distributions to 5,000 families (approximately 25,000 people), shelter and non-food item distributions to 13,000 families (approximately 65,000 people) and clean water provision to 20,000 people, in conjunction with the state water board. In addition 1,030 temporary bathing facilities were constructed in Bhachau and Rapar, Kachchh District.

The Red Cross and Red Crescent Movement- Immediately after the disaster struck, the International Federation launched an appeal for £10 million to help 300,000 people for up to four months and support the Indian Red Cross' emergency relief activities. Due to the widespread devastation, the main objective was to provide people with essential shelter, safe water and medical assistance. Special units were flown into the region to provide essential services, including a 350-bed hospital, water and sanitation units, a telecommunications team, a primary health care unit and a British Red Cross logistics team.

WHO responded rapidly to the earthquake by placing experts in emergency and humanitarian action in Ahmedabad and Bhuj on the morning after the earthquake. The World Health Organization mobilized approximately US \$ 1.2 Million through its own contribution, OFDA and DFID, to meet immediate public health needs of the affected population in Kutch district of the state. Since several national and international agencies were taking care of immediate trauma and medical needs, the focus of WHO input was to avoid duplication of efforts. WHO input was majorly on the following aspects in this direction:

- (a) Redressal of immediate public health needs
- (b) Post-earthquake Health Sector coordination
- (c) Containment of disease outbreaks and enhancement of capacity/ capability of disease surveillance practices
- (d) Water Quality Assurance

A large number of NGOs, national and international, participated in the relief operations. Many of these NGOs gradually withdrew after the relief phase closed, as they did not have sufficient resources to participate in the reconstruction program, or a long-term plan for local involvement. However, a number of larger NGOs continued and contributed to the rehabilitation program. The government actively sought for NGOs to adopt villages for rehabilitation. It had announced a contribution of 50 per cent of the cost of rehabilitation, if an NGO adopted a particular village for rehabilitation.

Recovery / Reconstruction / Relief Activities

The UN System through its response to previous disasters in the past tens years has acquired invaluable experience in disaster relief, recovery and coordination. These natural disasters include the Orissa Super Cyclone, the Latur Earthquake, the West Bengal Floods and the recurring drought crisis in several Indian states. The ongoing programmes of the UN Family have provided the organizations with an extensive presence and engagement in a broad variety of activities in India. Each UN organization

has built up networks of NGO partners with a strong field presence, trust and credibility in local communities.

The World Bank and the Asian Development Bank had estimated that improved reconstruction in the Indian state of Gujarat devastated by the January 26, 2001 earthquake would cost about Rs 10,600 crore (US\$2.3 billion). In their joint Gujarat Earthquake Recovery Program Assessment Report presented to the government of Gujarat, the two multilateral banks had put the total loss of assets, including private assets, at Rs 9,900 crore (US\$2.1 billion). The bulk of these losses were in the housing sector (Rs 5,200 crore /US\$1.1 billion). Among the other severely affected sectors were education, health, rural water supply, irrigation, transport, and public buildings and monuments. The impact on Gujarat's fiscal deficit was expected to be Rs 10,100 crore (US\$2.2 billion) over three years. The report represented the best assessment possible as of end-February 2001. It was based on field visits by a joint World Bank-ADB team to the affected areas in February.

Gujarat Emergency Earthquake Reconstruction Project (GEERP) was initiated by the Government of Gujarat, with the support of World Bank and ADB. The Government of Gujarat reconstructed and repaired affected houses in a record time of 2 years. It took 5 years for Japan to reconstruct 134,000 houses after the Kobe earthquake and it took 2 years for Maharashtra to rebuild 8,702 houses after the Latur earthquake. It is estimated that Turkey will take 6 years to reconstruct the damaged 14,000 houses and it took Mexico 2 years to complete 48,000 houses.

For its highly successful implementation of the programme, the GSDMA was awarded the UN SASAKAWA Award.

7.2. Super Cyclone Orissa (1999)

Background

The inscriptions of Hathigumpha, in Orissa from the era of King Kharavela (1 B.C.) indicate the type, frequency and intensity of various disasters. The historical

data shows that cyclones usually strike in April-May, and again, in October-December. Cyclonic disturbances of different magnitude, which originate in the Bay of Bengal in these transition months, are of great intensity (Shiva and Emani 2000). Orissa, situated between 18 North Latitude to 22 North Longitude has experienced almost 952 small and big cyclones, and 451 tornadoes from 1891 to 1990. It has also been prone to other kinds of disasters.

The *Great Bengal Famine* of 1770, the *Naanka Durbikhya* of 1866 (a severe drought that affected all the districts of the State), the *Sunia Batasa* of 1885 (a hurricane which severely affected undivided Cuttack district, claiming 2,973 human lives and damaging 50,000 houses), the *Naga Chaturthi Batasa* of 1892 (a hurricane which severely affected the coastal districts of Orissa) and the cyclone of 1971 are some of the natural calamities, which are still in the minds of the people.

The intensity of different cyclones in the eastern coast of India are such that the average speed of the storm is around 160 km per hour in West Bengal, it is 183 to 260 km per hour in Orissa, around 150 km per hour in Andhra Pradesh and 167 km per hour in Tamil Nadu. The intensity of the recent super cyclone in Orissa in 1999 was almost 260 km per hour. It was not a mere natural disaster, it is a part of the emerging crisis of unpredictable climate change, resulting from atmospheric pollution that has disturbed the climatic balance and is leading to an increasing frequency and increasing scale of droughts, floods, hurricanes and cyclones.

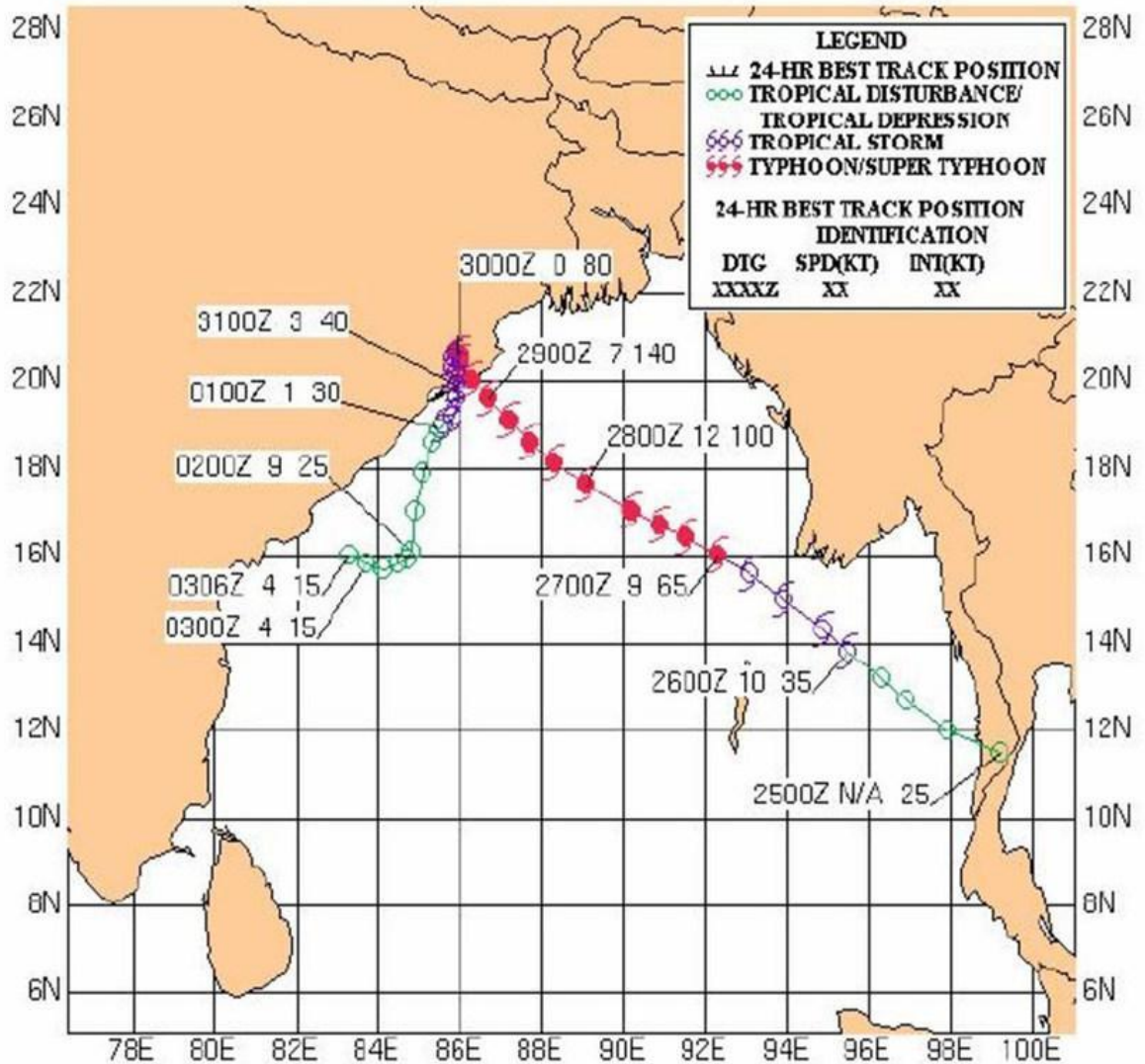


Fig:7.2. The Super Cyclone Movement Chart

The Super Cyclone

On 17th October 1999, low pressure in the Bay of Bengal generated heavy wind in Gopalpur port, Ganjam district, severely affecting the semi pucca and *kutchha* house structures of the entire district and adjacent districts, and causing the deaths of 205 people. A second low-pressure formation off the coast of Orissa occurred in the Bay of Bengal on 28 October 1999. This generated heavy wind in the east of the Andaman Island on 25 and 26 of October 1999 and created the conditions for a full-blown cyclone of rare severity, of 220 to 300 km per hour in the following two days, i.e. on 28th & 29th. This

super cyclone of catastrophic intensity brought 3 to 7 meters of high sea waves into the mainland and caused severe damage in Jagatsinghpur and Puri districts. While the intensity of the first cyclone in Ganjam district was 4.5, the second low pressure formation generated a cyclone with an intensity of 7.0, popularly known as Super Cyclone. The Super Cyclone came after 10 days of the first. It brought devastation over a larger geographical area, caused fatal loss of more human lives, and damaged both the natural and man-made resources of the region.

The death wind of the Super Cyclone was detected in the Meteorological Office at Bhubaneswar on 25th, and warnings were given to district authorities by October 27, 1999 through fax, wireless, and broadcasts over All India Radio and local T.V. networks. A forcible evacuation of 1.5 lakh people to 21 cyclone shelters and other *pucca* buildings followed on October 28, 1999. However, millions were left to face the death trap. Many people used their own judgment and did not follow the instructions given by the government. Since the government's warnings of the impact of the Ganjam cyclone turned out to be considerably overstated, they took very lightly the Government of Orissa's warning about the Super Cyclone.

They became complacent and stayed on in their own mud and thatched houses instead of searching for private accommodation in and around their villages. Apart from that, people did not have many safe alternatives within their reach. Infrastructure facilities available were inadequate- there were only 21 shelter houses at the time in the coastal districts of Orissa as compared to 1041 in Andhra Pradesh, communication networks were poor, and police personnel ill-equipped and untrained.

Damage & Loss

Soon after the Super Cyclone, the entire seacoast of Orissa had been affected by high tides. This is largely linked to the long effects of massive shrimp cultivation in the Ganjam, Jagatsinghpur, Puri, Balasore, Bhadrak districts of the State. The invitation for setting up such industries by the Govt. of Orissa in the coastal regions since 1995 has resulted in havoc in the ecological setup of the coastal belt; it has not only destroyed

mangrove forests, but also damaged the entire vegetation in and around this zone (ISRO 1999). The havoc of the Super Cyclone in Orissa could have been reduced had the mangrove along the coastline not been destroyed by shrimp farming, which has made this zone more prone to cyclones (NEERI, 1999 Gazetteers of Cuttack and Balasore). Mangrove trees have specifically adopted aerial and salt filtering roots and salt-excreting leaves that enable them to occupy the saline wetlands where other plant life cannot survive. The mangrove forest in the region was not only minimizing the tidal waves, storms and hurricanes, but also treating the effluents.

The Super Cyclone devastated almost all the coastal districts of Orissa, and a few inland regions. It affected 1827 *gram panchayats* and 28 Urban Centers in 12 districts, 30 lakh families comprising 125 (approx) lakh people in 15,676 villages were affected (White Paper, Revenue Dept, Govt. of Orissa 1999). In the post cyclone period, the entire communication networks by road, railway, air and telecommunications got disrupted. The State administration was paralyzed and supplies of essential commodities could not get through to the affected regions. The cyclone destroyed the entire standing as well as prospective crops, and severely impacted on plants, livestock and human lives. While in cities like Cuttack and Bhubaneswar, essential services were not restored for a week or more (in certain pockets), it took more than six months to restore electricity, water supply and the communication system in rural and semi urban areas of the cyclone hit zone. People struggled to survive without access to cooked food and safe water in the first week of the cyclone. The death toll went up to as much as 9885, according to government sources (Government of Orissa Report 1999). However, non-government sources assert that the toll was more than 30,000 (ODMM 2000). The details of loss and its magnitude have been shown in Table 8.1.

TABLE 1
Damage and loss caused by the Super Cyclone of Orissa

Indicators (in Nos.)	Loss
Human deaths	9885
Human injuries	2507
Cattle death	315886
Small animals death	316372
Poultry death	1883468
<i>Assets damaged</i>	
Power supply affected villages	17032
Primary schools	14901
High schools	3425
Colleges	66
Trees uprooted	9000000
PWD buildings	10059
R.D dept. buildings	7020
P.R dept. buildings	7326
Fishing boats	9085
Nets	22143
Lift irrigation points (Govt.)	5636
Crop damaged (Hect):-	
Paddy crops	130000
Vegetable crop	176000
Other crop land	257000
Potential <i>rabi</i> crop	64900
Flood embankment breached (Nos)	2005
Canal embankment breached	8647
Minor irrigation dam partially breached	31
Minor irrigation tanks affected	6967
Prime Minister Rozgar Yojana (Pmry)	1339
Units affected	
District roads damaged (km)	7500
Rural roads damaged (km)	444
Drinking water wells	6391

Source: *White Paper on Super Cyclone in Orissa, Revenue Dept., Govt. of Orissa, December 1999.*

Table 7.1 Damage and loss caused by the super cyclone of orissa

Various State and Union Territory Governments came forward to render their support, both in the form of cash and kind. The disaster could mobilize large-scale support from various comers of the country and beyond. The Chief Ministers' Relief Fund had received a total financial assistance of Rs.26.61 crore from 16 States and two Union Territories (*White Paper on Super Cyclone, Government of Orissa 1999*). Different States provided various kinds of food, medicines, and equipment. 2047 truck-loads of relief material from different State-governments and 72 trucks of relief materials from the NGO sector were accounted for (Govt. of Orissa 1999).

Around 17 of the Central Public Sector Units (PSU) of India have also rendered their assistance by distribution of relief in 17 blocks of seven districts of cyclone-affected

areas. A few of those PSUs are M/s Hindustan Zinc, IRCON, ONGC, BHEL, IPCL, NTPC, Bharat Earth Movers, M/S Andrew Yule, Cement Corporation of India, National Textile, Bridge and Roof Company of India Ltd, Mahanadi Coal Field Ltd etc. Details of relief collected from different States are given in Table below.

Assistance received from different States and UTs of India in the wake of the Orissa Super Cyclone

Sl. No.	Status/ UT	Financial assistance received from CM Relief Fund (000)	Assistance in kind (No. of trucks)			Source	
			Food	Medicine	Equipment	Govt.	NGO
1	Andhra Pradesh	2504	111	9	2	115	7
2	Assam	10000	2	-	-	2	-
3	Bihar	100000	17	-	-	17	-
4	Gujarat	20000	21	-	-	21	-
5	Haryana	-	420	5	8	433	-
6	Himachal Pradesh	5000	1	-	-	1	-
7	Karnataka	20000	12	4	11	15	2
8	Kerala	-	2	-	-	3	-
9	M.P. (Old)	13251	34	-	-	33	1
10	Maharashtra	50000	11	-	1	11	1
11	New Delhi	10000	372	-	7	376	3
12	Orissa	-	597	7	38	613	29
13	Punjab	-	9	-	-	9	-
14	Rajasthan	10000	1	-	-	1	-
15	T. Nadu	50000	156	1	1	157	1
15	U.P. (Old)	-	44	-	-	31	13
17	W. Bengal	5000	213	1	6	205	15
18	Tripura	3000	-	-	-	-	-
19	Pondichery	2500	-	-	-	-	-
20	J& K	10000	-	-	-	-	-
21	Manipur	500	-	-	-	-	-
22	Arunachal Pradesh	6500	-	-	-	-	-
	Total	266105	2027	27	68	2047	72

Source: *White Paper On Super Cyclone In Orissa, Revenue Dept., Govt. Of Orissa, December 1999, Annexture-1.*

Table :7.2 Assistance received from different states and UT's of India in the wake of Orissa super cyclone

Relief by NGOs

The effects of the Super Cyclone on the people of Orissa and on their resources was so devastating that it was beyond the capacity of one State or one Nation to handle the situation. Even before any request for help was made, the Non-Government Organisations came forward and rendered their help through the distribution of relief. An accounting of assistance provided by the Non-Government sectors shows that there were 20 International NGOs, 20 National/ Regional NGOs and 101 local NGOs in the field. The services of the NGOs may be categorized as disposal of carcasses and corpses (97,379 and 5478 were disposed off respectively), organizing free community kitchens, distribution of relief, provision of health and sanitation services, and undertaking various programmes for reconstruction and rehabilitation.

Free community kitchens

Distribution of food through community kitchen centers in super cyclone areas during the first two weeks was a major relief programme of the NGOs, funding agencies and charitable organizations. A few of these organizations agencies engaged in this activity were: the Red Cross, ISCON, Utkal Bipanna Sahayata Samiti (UBSS), Gita Press, Orissa Disaster Mitigation Mission (ODMM) and 21 other NGOs. It has been calculated that UBSS provided 12,00,000 free meals and ODMM distributed 4,80,000 meals in the cyclone-affected areas. Around 1059 metric tons of BPL rice and 25 metric tons of wheat were distributed through 110 centers by 21 NGOs in 30 blocks of eight districts (White Paper on Super Cyclone in Orissa 1999)

Distribution of relief

There were 9 International NGOs and **35** local NGOs engaged in distributing relief in the cyclone affected areas in the form of raw food, clothes, and household articles. Food items distributed included 4100 pails of oils, 1400 packets of bread and nutrimix, 6 truck loads of eggs, 3 180 cartons of biscuits, 120 metric tons of cooked food and 5601 metric tons of food materials like rice, dried rice, pulses, potato, salt, flour, milk powder, sugar and cooked food.

The International NGOs engaged in providing relief were Lutheran World Services, OXFAM, Action Aid, IFRC, IGSSS, CONCERN, ISKON, World Vision.

32. The national level NGOs were: Voluntary Health Association of India (VHAI) and its State branch, Catholic Relief Service (CRS), YMCA, Ramakrishna Mission, DVC Kolkata, CARITAS Kolkata, NABARD etc.

The relief and rehabilitation activities undertaken by these agencies, however, seem to be dispersed and many times overlapping. For example, Action Aid India has implemented the Food for Work programmes in few villages of Erasama block, where EFICOR, a national level agency has also implemented similar programmes in the same villages. This has not only confused people but also made them dependent on outside agencies. At a certain level, this reflects the lack of any need-based plan followed by many of these DEC members, and lack of coordination among them at the implementation level.

Apart from food items, NGOs have also distributed 3,50,000 pieces of clothes, 20,60,000 candle sticks, **1,67,000** match boxes, 3,36,000 polythene sheets, 2,02,145 pieces of light blankets, 6,697 sets of utensils, 11,000 pieces of floor mats, 10,000 water bottles, 10,000 water pouches, 15,669 jerry cans (20 Lt. each), 5500 buckets, 25,300 tarpaulin mats etc.

Air dropping by the government had been started from 4th day in accessible pockets; however, the free community kitchen organized by the NGOs in many areas were the only centers for many to get one square meal a day. These centers provided food and psychological consolation to the affected people. They helped people reorganize themselves and revitalise their strength to overcome the consequences of the SuperCyclone. In the common kitchens for a few days, people forgot their caste boundaries and ritual, purity and pollution.

Emergency health and sanitation services

The need for emergency health services in the cyclone-affected areas was felt within a few days of the cyclone, when the carcasses, corpses and trees decomposed and polluted the water and the air. Almost 391 doctors, 64 para-medical staff, and 1500 health volunteers worked untiringly day and night. They served 7,50,000 affected persons in 1,50,000 families. NGOs also distributed medicines, which include halogen tablets, chlorine tablets, ORS packets, antacid, bleaching powder, chloroquine tablets, saline water etc. International NGOs engaged in providing health services in the affected regions were: Doctors without Borders, UNICEF, WHO, and CARE India. The national level NGOs engaged were Ramakrishna Mission, CARITAS Kolkata, Help the Aged in India, Chinmaya Mission, Emanuel Hospital, and VHAI New Delhi. If the NGOs had not come forward to shoulder the responsibilities of providing services in the affected areas in the post-cyclone period, many more people would have died for want of basic health services.

Emergency Rehabilitation activities of the government

The total package for the rehabilitation of the affected areas proposed by the Government of Orissa to the government of India was to the extent of Rs. 6,227.59 crores. The State government has been sanctioned a total amount of Rs.693.72 crores from the National Fund for Calamity Relief (NFCR) as grant of the Government of India, and Rs.826.01 crores from various Central Ministries directly to different departments of the Government of Orissa (Table 4).

The Government of Orissa, with the assistance of Central Government, neighboring States and International agencies, undertook restoration work on a war footing and progress in respect of educational institutions ,roads, public buildings, power supply, irrigation sources and that of livelihood resources like agriculture, dairy and fishing, is remarkable.

The educational institutions in the cyclone-affected areas have suffered a lot. The restoration of these damaged institutions has been done by various neighboring States, by

the central government under OBB (Operation Black Board), and also with the assistance of the Prime Ministers' Relief Fund and Donor agencies like DFID (Department of Foreign Investment for Development), MPLAD (Member of Parliament for Local Area Development Fund) of the members of parliament., and Paradeep Phosphate Limited. Out of 11,690 damaged primary buildings, almost 4420 units have been repaired and 3866 units have been constructed under the OBB scheme. Similarly, 509 units have been completed with the assistance of the PMRF (Prime Minister's Relief Fund). Neighboring State governments have also constructed a total of 11 1 units (OSDMA, 2002). Different Public Sector Units (PSU) like NALCO, Paradeep Phosphate Ltd., Paradeep Port Trust, Mahanadi Coal Field, Rourkela Steel Plant, NIDS and NPCC have also rendered help.

The Rural Development Department has repaired 1 139 roads for which it spent Rs. 11.71 crores, while the Public Works Department spent Rs.15.60 crores to repair 373 out of 536 roads.

IIT Kharagpur provided help by identifying 512 locations within 10 km of the entire coastline where cyclone shelters should be constructed. Apart from 23 cyclone shelters constructed by the Red-Cross (in the pre-Super Cyclone period), the Orissa State Disaster Mitigation Mission (OSDMA) has built 40 such centers with the help of the Rural Development Department and 60 more centers out of Chief Minister Relief Fund (CMRF). The governments of Maharashtra and Karnataka have built 49 and 20 school-cum-cyclone shelters respectively. Many other public and private agencies have undertaken the construction of around 50 more cyclone shelters.

Rehabilitation activities by NGOs & INGOs.

Different NGOs have adopted different strategies to revive the resource base of the people. The livelihood-focused activities of these agencies either aim at immediate rehabilitation or long term rehabilitation. The immediate rehabilitation programme so far implemented by these organizations includes the supply of paddy and vegetable seeds, farming tools, food for work programme for rebuilding community assets like roads and ponds, support to fishermen communities by replacing nets and boats etc. The long term rehabilitation programmes so far implemented in the affected areas emphasizes more on

livelihood replenishment, generation of new community forests, irrigation infrastructures for diversifying agriculture production, construction of dwellings both for human and livestock, and construction of multi-purpose cyclone shelters. A few agencies have adopted region specific strategies and provided support to women for mat weaving, making dry fish preparations, broom making, support to artisans for bamboo basket making, toy making, smithy and carpentry, renovation of salt canals and salt ponds, support to weavers and betel vine owners, and assistance for poultry and goat rearing.

The NGOs have undertaken the construction of buildings for primary schools (63 units completed and 50 units under progress), and for high school (36 units completed and 32 units under progress). The NGOs and PSUs have also proposed to construct 63 10 dwelling houses, of which by the end of 2001, 1800 units have been completed. For example, in Erasama block alone, the Government of Maharashtra has built up 645 units, TATA has built up 435 units, Swami Narayan Organisation has built up 240 units, Ramkrishna Mission has built up 230 units and Bharat Seva Sangha has built up 88 dwelling units.

7.3. The Kashmir Floods 2014

Background

Floods cause damage to houses, properties, public infrastructure and industries resulting in huge physical and financial losses, apart from loss of lives. The after effects of floods such as the agony of survivors, spread of epidemics, non-availability of drinking water, essential commodities and medicines and loss of the dwellings make floods the most feared among the natural disasters. This can be attributed to many reasons including increase in population, rapid urbanization, increasing developmental activities in flood plains and with global warming.

The State of Jammu and Kashmir (J&K), experienced heavy monsoon rains that began on 2 September 2014 and led to unprecedented widespread flooding across the state. The river banks of Jhelum, Tawi, Chenab and several other streams were overflowed. The districts including capital of the state Srinagar, Anantnag, Baramulla,

Pulwama, Ganderbal, Kulgam, Budgam, Rajouri, Poonch, Udhampur and Reasi were worst affected. Links of Kashmir Valley were disrupted and the National Highway was closed for vehicular traffic as a result of landslides and floods. Several major and minor roads were cut off and about 30 bridges were broken, hindering the relief and rescue operations. Except for connectivity between Srinagar and North Kashmir's Ganderbal district, all other districts of the valley were cut off. Thousands of villages and many urban areas were submerged into 10 to 30 feet of water causing loss of life, cattle and destruction of collapsed houses, public infrastructure, life-line structures and loss of business. Many people in Srinagar valley and Jammu division remained stranded for a few days together without food and water. Their belongings, including warm clothes, beddings, furniture and utensils were submerged and destroyed. It was the fierce sense of survival of the people which sustained them and valiant efforts were made by Army, Air Force, National Disaster Response Force (NDRF), State Government and local community volunteers.

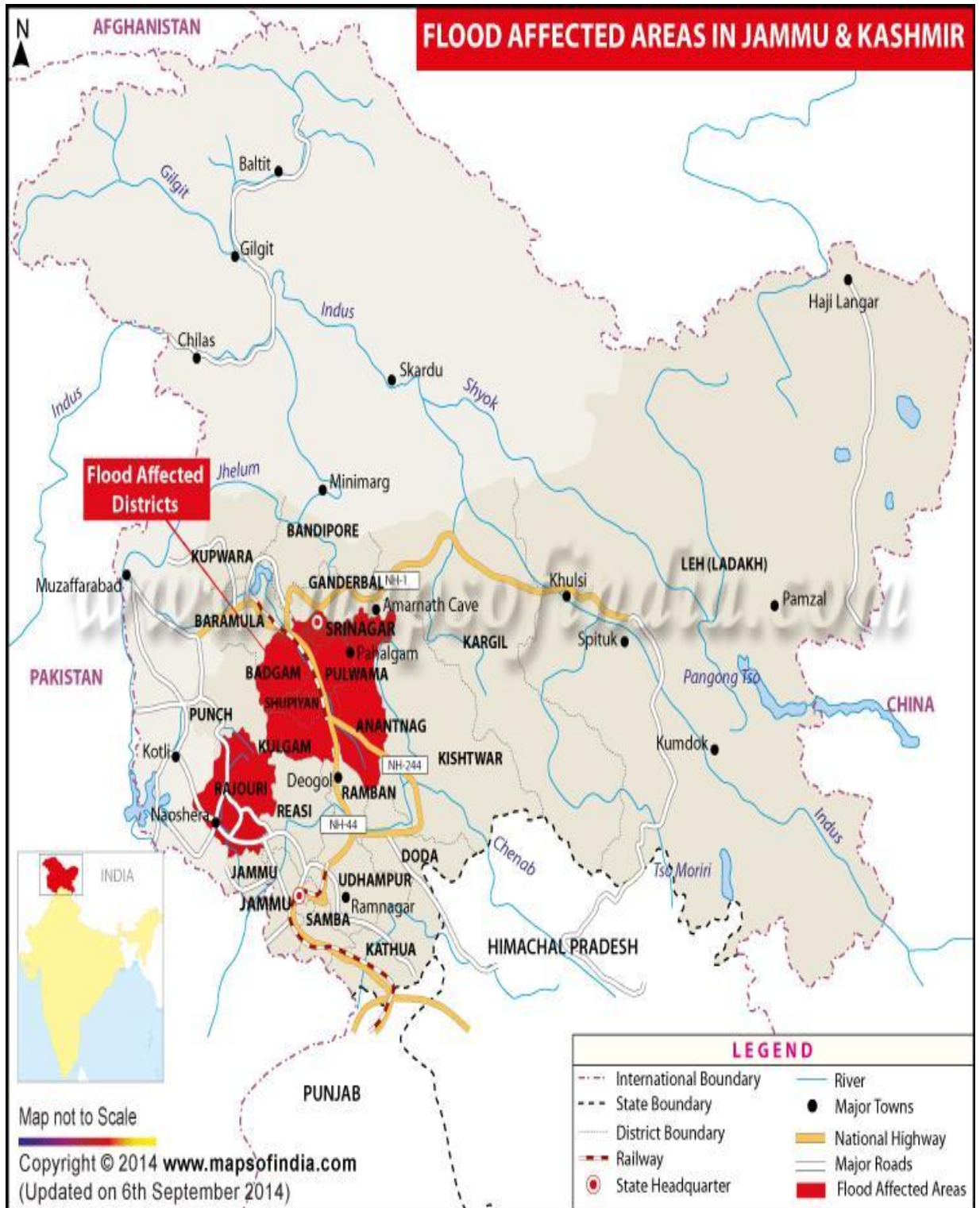


Fig: 7.3 Flood affected areas in Jammu & Kashmir

The Government of J&K though provided relief and rescue measures in many areas of the state, but could not respond to the event in the first 24 hours in these massive

humanitarian crises. The national channels and newspapers highlighted that the help could not reach even up to the sixth day of the floods. The chief minister of the state explained that the entire secretariat, police headquarters, fire services, hospitals, control rooms and infrastructure were under water. Not even cell phones and telephones were operational. The ministers and officers were too swept in the flood. With great difficulty, the rescue operation could be started by the State Government, which faced a lot of criticism and anger from the local people. They were dissatisfied with the relief and rehabilitation work done by the State Government.

Assessment of the Relief Measures

The Supreme Court of India constituted a Committee on 24 September 2014, for assessing the condition of severely affected areas in J&K. The Committee visited several places in the State to assess the situation existing on the ground by interacting with the local communities, doctors and officials of government departments, with regard to different areas of concerns. An interim report submitted by the Committee indicates several issues in the area of evacuation, relief and rehabilitation as under:

Relief Distribution

The free ration had not been properly distributed in some districts, particularly Srinagar and Udhampur. The distribution machinery at the district level was required to be geared up and revamped. Blankets and warm clothing were required to be distributed in order to survive in the harsh winter.

Health Services

Flood incident badly affected the essential services of the State. Several hospitals, clinics and pharmacies submerged into water for a number of days. Major hospitals of the city including other hospitals reported damage to the X-ray and ultrasound machines which were installed at the ground floor of the hospital. The Bone and Joint Hospital required free implants to the patients at least for a period of six months by the time people become self-reliant. The team of doctors was arranged from the Centre for providing medical assistance in different hospitals of Srinagar.

Post-Traumatic Stress Disorder

It is well-known that such tragedies leave their imprints on the minds of a large number of vulnerable communities, especially children and elderly. Sometimes they suffer from post traumatic stress disorders. Some of the survivors of this nature's fury, who remained stranded in water for a few days without houses, food and water, were required doctors and psychiatrists for counseling and treatment over several months.

Sanitation

Critical infrastructure and basic services witnessed damage and needs to be restored like water supply and electricity. The flood situation left herculean task to dewater and clean the Srinagar city from silt and garbage, where markets, houses, government offices, secretariat and roads were submerged. The roads and public places were stinking due to the non-disposal of garbage and carcasses. There was a requirement to properly sanitize the same so as to make the place habitable.

Damage Assessment & Payment of Ex-gratia

Another common issue highlighted in the report was delay in damage assessment of the properties and payment of ex-gratia. The process of damage assessment was still underway resulting in delay in re-building and restoring normal life in the affected areas. Many houses had collapsed and been damaged due to stranded water, which required appropriate and adequate response from the State. Since, flood had caused extensive damage to the farms, crops and horticulture land, the completion of damage assessment and payment of ex-gratia were required to be disbursed expeditiously.

Relief Measures by the Government of India

The Army, Air force, Navy and NDRF personnel were engaged in rescue and relief operations. The Indian Army deployed about 30,000 troops with 224 boats. About 30 transport aircrafts and 70 helicopters were deployed by the Indian Air Force. Three teams of marine commando forces (MARCOS) of the Indian Navy were deployed. 15 Engineer Task forces of the Indian Army were deployed with necessary engineer stores and equipments. 22 teams of NDRF consisting of 955 personnel along with the necessary equipment were deployed for assistance to the State Government in search and rescue operations.

As a result, more than 0.29 million persons were rescued to safer places. Essential commodities including food packets, baby food, drinking water and medicines were sent to the affected areas. Relief camps were organized at different places. Thousands of blankets and tents were sent to the flood victims. Dewatering pumps were dispatched to Srinagar for use by the state. Water purification plants were sent to the State. Oxygen cylinders, medicines, chlorine tablets, doses of measles and vaccines for newborn were sent to the affected areas. Doctors, specialists, physicians, pediatricians, Gynecologists and paramedical staff were deployed in different hospitals in order to restore the health facilities. Telecommunication was restored, free access of calls were arranged for stranded people. Power supply was largely restored in all the hospitals, water supply stations and relief camps. Damaged sub-stations were repaired. Adequate fuel stock including LPG cylinders was sent to Srinagar. The Border Roads Organization deployed their personnel for restoration and repair of important roads. Banks were made functional and ATMs were restored.

Damage and Loss

About 1.5 million families spread over 5794 villages were affected. As per the initial assessment received, around 0.35 million structures had suffered damages, 90,000 cattle/sheep perished, crop loss reported in 0.65 million hectares of land besides huge loss to the public and private infrastructure. Around 191 people in Jammu region and 91 people in Kashmir valley have been reported dead. The details of physical losses caused due to floods in J&K are as under.

In addition, extensive damage of the infrastructure including roads, telecommunication, power, health, fuel distribution and drinking water supply system were reportedly affected.

Items	Numbers
Number of districts affected	20
Number of villages affected	5794
Number of families/households	1.53 million
Number of structures damaged	0.34 million
Loss of livestock (sheep /cattle)	90000
Loss of crops	0.65 million
Number of human lives lost	287
Number of houses fully damaged (<i>permanent</i>)	45862
Number of houses fully damaged (<i>temporary</i>)	21635
Number of houses partially damaged (<i>permanent/temporary</i>)	187756
Number of cow sheds damaged	89354

Table 7.3 Physical Losses by the floods occurred in J&K in 2014

Flood Relief and Rehabilitation Measures

The floods in September 2014 caused havoc across many districts of the State in which over 1.5 million families spread over 5794 villages were affected. The Prime Minister during his visit to Srinagar on 7 September 2014 and 23 October 2014 announced financial assistance from the GoI as well as from Prime Minister’s National Relief Fund (PMNRF).⁹ It was decided to provide \$3175.60 to the next of kin of the deceased and \$794 to each person who is grievously injured. An amount of \$0.80 million was provided for purchase of 100,000 blankets for the victims. Assistance of \$90.48 million was announced for restoration of houses damaged. Provision of \$27.78 million was made for the hospitals in Srinagar, Jammu and Leh. Free replacements of course

books to all the children up to primary and upper primary level schools were also announced.

The central government released \$158.73 million exclusively for use of flood relief and rehabilitation. In addition to the funds provided from PMNRF, financial assistance was provided from the National Disaster Response Fund. Financial assistance of \$2381 were given for the next of kin of each person who died, \$1190.50 for each fully damaged permanent house and assistance for loss of agriculture and horticulture crop and loss of animals and poultry were announced. The State Government had also been advised to use 10 percent flexi funds from centrally sponsored schemes for disaster mitigation and restoration without delay.

Gaps and Issues in Management of Jammu & Kashmir Floods

Nature's fury has time and again exposed the deep rooted lacuna in the disaster management system in India. Lack of preparedness, mitigation, response and recovery planning make us even more prone to damage in such an eventuality. For prevention and mitigation effects of disasters including flood disasters and for undertaking a holistic, coordinated and prompt response to any disaster situation, the States are required to act through their SDMA. Though the data indicates that several states have their institutional setup in place, such situations actually reveal the real-time gaps which still need the attention of local administration in order to reduce disaster risk. In the flood of J&K also, certain gaps and issues have been observed, which are as under:

Lack of Proper Flood Forecasting System

Despite several events of floods in India including a major flood in Uttarakhand last year in which almost 5,000 lives were lost, installation of flood forecasting and early warning systems at appropriate locations and their regular monitoring has been a challenge. The State of J&K has three hydrological stations viz. Sangam, Ram Munshi Bagh and Saffora installed by Central Water Commission (CWC) on Jhelum River which runs through the valley. These had detected the rise of water levels from 5.3 meter on 3 September, 2014 to 10.13 meters on 4 September 2014, which is more than the height of a single storey house. However, local authorities did not read the signals of

alarming rise in water level as these stations were not flood forecasting stations but merely to monitor the flow of water from India to Pakistan. Had the information by these stations provided flood forecasts to the state authorities, it would have prepared for flood recovery by providing an early window to evacuate people from low lying areas, deployment of special teams and arrangement of relief supplies. The situation could have been controlled through having a proper communication network and last mile connectivity.

Lack of Preparedness Planning

Despite the fact that the region had observed multiple flash floods and two severe floods in the past (during 1959 and 1992), the State has not been identified as flood prone. The tendency for Federal, State and Local governments to be overwhelmed is dangerous, given the multitude of tasks before them, many of which have not been planned for, or have not been effectively assigned to other members of the disaster assistance network beforehand. The SDMA and DDMA, which are responsible for disaster management in the state, are yet to prepare disaster management and response plans. The state government has approved disaster management policy in 2012, the institutional system and allocation of responsibilities to the departments during natural disasters is still underway.¹² The untimely and inequitable distribution of assistance is a major issue. Only after the recent flood, the CWC has planned to install a flood forecasting system and monitoring mechanism, which will take almost two years to implement.¹³ Proper community awareness, last mile connectivity and response and recovery planning are still at preliminary stage.

Lack of Coordination

Disasters cannot be managed unless the stakeholders from the governmental departments, non-government organizations, international agencies and private sectors are working together in a well-coordinated manner. One of the reasons why the flood disaster could not be managed during initial hours was that the state administration could not coordinate with its own departments. It was a total collapse of communication facilities. The teams for disaster response could not be identified and sent to the affected

places. Effective advisory could not reach the communities so that they could shift from the low-lying areas. Lack of coordination hampered identification of affected villages, numbers of beneficiaries, assessment of damages and relief distribution process. The community volunteers, NGOs and humanitarian agencies were working independently to help the communities, without much involvement of the government.

Lack of Adoption of Prevention and Mitigation

Measures of Flood prevention and mitigation are generally used by the regions where floods are recurrent phenomena. People living in such areas are habitual of taking certain precautions such as shifting from low-lying areas, crops grown in the undulated areas, creation of embankments/banks, construction of dams and reservoirs, channel improvement, desilting of rivers, land use planning and diversion of flood waters in order to reduce the damage. However, in the case of J&K, such measures were not much implemented by the communities and officials, resulting in acute destruction.

Weak Recovery Planning

The response operation of J&K exposed several shortcomings related to immediate response, distribution of relief supplies, rescue, damage assessment, restoration and rehabilitation, which had affected the entire rehabilitation process badly. A lot of vital time was lost in developing repair and reconstruction mechanisms within government and resource management. If the post-disaster recovery mechanism is identified, the process of response, resettlement and rehabilitation could start timely, better coordinated and planned.

7.4. Conclusion Summary of findings

Nature's fury has time and again exposed the deep rooted lacuna in our disaster management system. Lack of preparedness, mitigation, response and recovery planning make us even more prone to damage in such an eventuality. For prevention and mitigation effects of disasters including flood disasters and for undertaking a holistic, coordinated and prompt response to any disaster situation, the States are required to act through their SDMA.

Lack of Proper Forecasting System. Most of the disasters like Cyclone and Floods could have been predicted with more accuracy to be prepared in advance and save

lives . Improper/ inadequate attention to Govt communications by the locals ,esp in the case of Orissa cyclones.

Lack of Preparedness Planning. Despite the fact that the regions like Orissa and Gujarat both being well known disaster prone areas did not cater for relief accommodation or quake resistant buildings or even creation of disaster relief material storage areas.

Lack of Adoption of Prevention and Mitigation . Measures of Flood or quake prevention and mitigation are generally used by the regions where floods or quakes are recurrent phenomena. However in all the cases examined, People living in such areas were casual and not taking certain precautions such as shifting from low-lying areas, crops grown in the undulated areas, creation of embankments/banks, , channel improvement, desilting of rivers, land use planning and diversion of flood waters or adoption of quake resilient technologies, in order to reduce the damage.

Lack of coordination between the relief agencies, governmental and non-governmental. As a result, the flow of relief materials and rehabilitation assistance of these agencies was largely irregular, insufficient and also not timely esp during Golden Hour.

Poor Recovery Planning. A lot of vital time was lost in developing alternate routes, repair and reconstruction mechanisms within government and resource management. If the post-disaster recovery mechanism is planned and rehearsed then the process of response, resettlement and rehabilitation could have started timely, better coordinated and planned.

Contribution of Armed Forces. Armed forces continue to play a significant role in rescue and material relief even during the period of Kashmir floods (2014). The Army, Air force, Navy and NDRF personnel were engaged in rescue and relief operations. The Indian Army deployed about 30,000 troops with 224 boats. About 30 transport aircrafts and 70 helicopters were deployed by the Indian Air Force consuming the Armed forces operational reserves.

Damage Assessment & Payment of Ex-gratia . Another common issue highlighted in the report was delay in damage assessment of the properties and payment of ex-gratia.

Health Services

- (a) **Hospitals.** Disaster incidents badly affected the essential Hospital services of the State. Several hospitals, clinics and pharmacies are either submerged or damaged and inaccessible for a number of days
- (b) **Sanitation.** Critical infrastructure and basic services witnessed damage and needs to be restored like water supply and electricity esp to meet medical emergencies.
- (c) **Post-Traumatic Stress Disorder.** Tragedies leave their imprints on the minds of a large number of vulnerable communities, especially children and elderly.
- (d) **Disposal of Dead and Carcasses of Livestock.** This posed a major challenge in initial phases of relief, at times leading to outbreak of epidemic

Relief Distribution. The Relief ration and commodities had not been properly distributed in some districts, in all cases. The distribution machinery at the district level required to be geared up and revamped. Both in terms of non availability in the initial phases of relief and excess or not required items in the later stages.

Importance of HAM radios. As regards emergency relief, the Government of Andhra Pradesh established Ham Radio Centers in different towns and the capital city, restored power supply, and helped the State to out-flow information about the affected situations.

Management of NGOs.

- (a) **Connect to grass root** During Orissa Cyclone it was observed that the welfare agencies, even the international agencies, by and large were not prepared to face a disaster of such magnitude. Not a single local NGO operating at the grassroots level in Orissa was found to have the expertise to face such a disaster.

(b) **Partnering with PRI.** The relief operations wherever carried out with the help of the members of *Panchayati Raj Institutions* (PRI), were by and large smooth. It has been observed that NGOs who have distributed assistance directly or by ignoring the *Panchayati Raj Institutions*, more or less could not manage the distribution properly.

(c) **Community Kitchens.** Run by the NGOs did a commendable job in bringing significant relief to the victims, however in most cases they took 3 to 4 days to be effective.

CHAPTER 8

ANALYSIS OF FEEDBACKS AND DATA COLLECTED

8.1 Primary Survey

Primary survey was based on a set of questions derived after exhaustive literature review and examination of case studies pertaining to major National Calamities. Stakeholder opinions were gathered using a structured questionnaire through a survey. The survey had a total of 15 questions in addition to 3 questions which were related to respondent's service and experience profile. The survey included respondents from all the segments of the government servants, who are directly or indirectly involved in disaster related works. There were a total of 284 respondents to the questionnaire.

Analysis of Primary Survey

The survey covered all segments of society and all the stakeholders playing direct or indirect role in Policy formulation(NDMA officials), Policy implementation (NDRF/SDRF Officials), execution of disaster relief operations(Armed forces, NGOs) and also was shared with civilians residing in different disaster prone geographies.

Service Profile of Respondents

The respondents pertained to the following categories;-

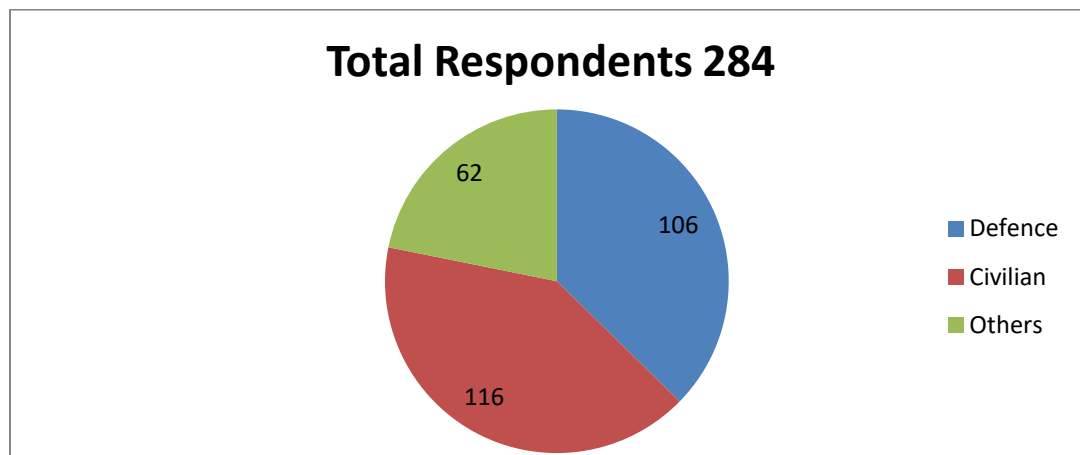


Fig 8.1: Service profile of Respondents

Length of Service

3. The respondents length of service of Defence and Civil Officials (excl Civilians) is as under :-

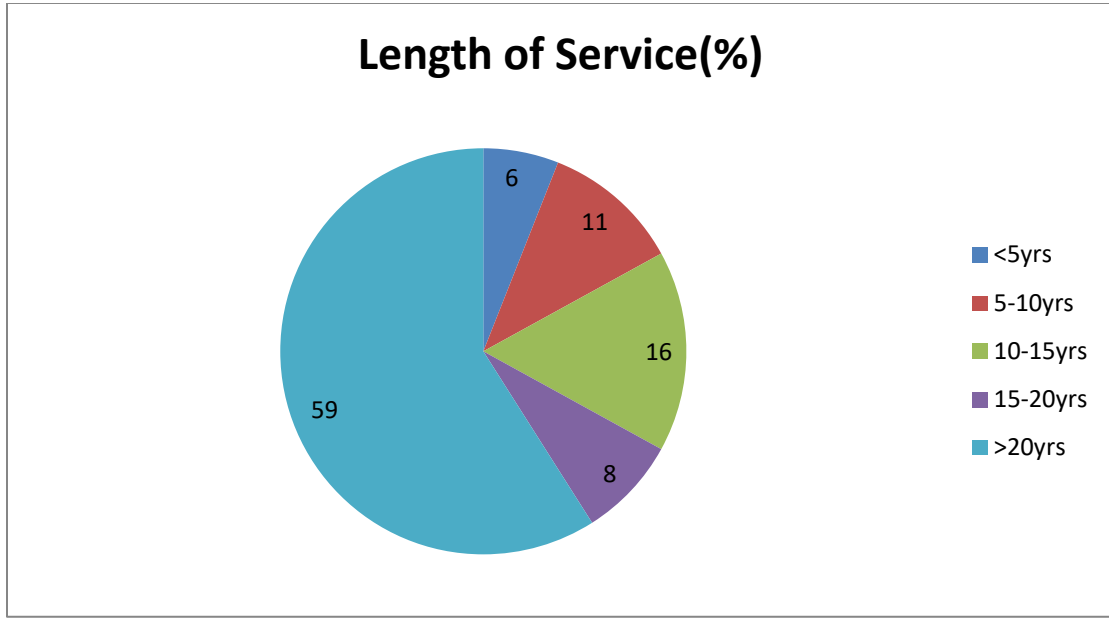


Fig 8.2: Length of Service of Respondents

8.2. Analysis of Responses

A set of fifteen Questions were circulated to all respondents via Google Form on 27 Dec 22. Out of these Thirteen were direct questions and two were Ranking order based responses. These have been compiled and the inferences drawn have been summarized as under:-

Q1. In response to the question that “ **Existing National resources allocation is sufficient to meet the material requirements needed to combat disasters.**” Majority of the respondents (51%) felt inadequacy , while a mere (13%) respondents agreed to adequate resource allocation at National Level.

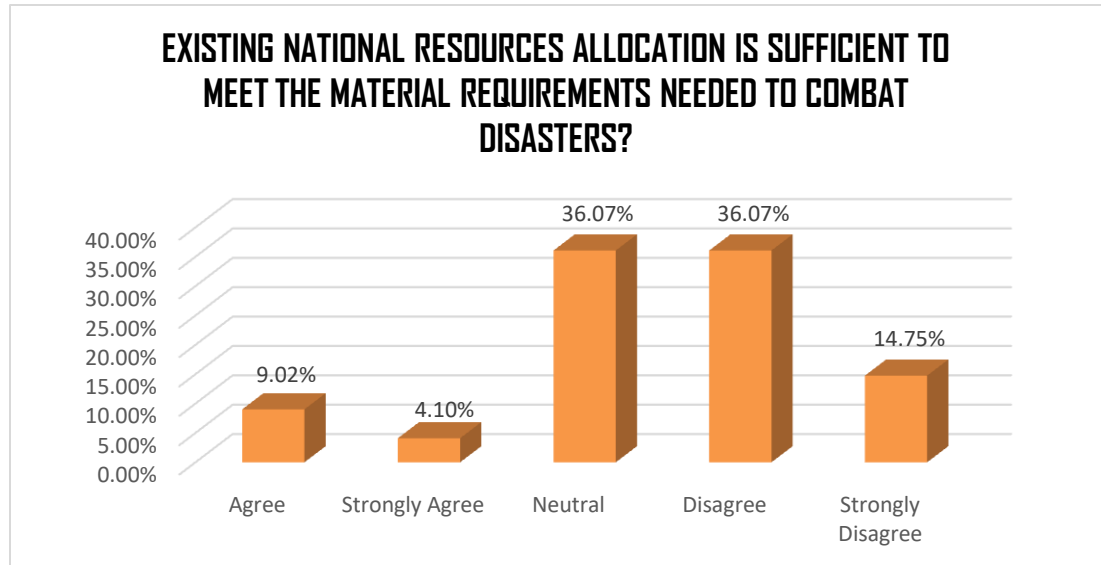


Fig 8.3: Adequacy of Existing National Resources Allocation

Q2. In response to the question that “**Current policy frameworks/strategies adequately accommodate all the needs of material management during natural disasters.**” The respondents were Majorly (89%)agreeing , while (11%) disagreeing that the existing policy framework/strategies of material management during natural disaster are adequate.

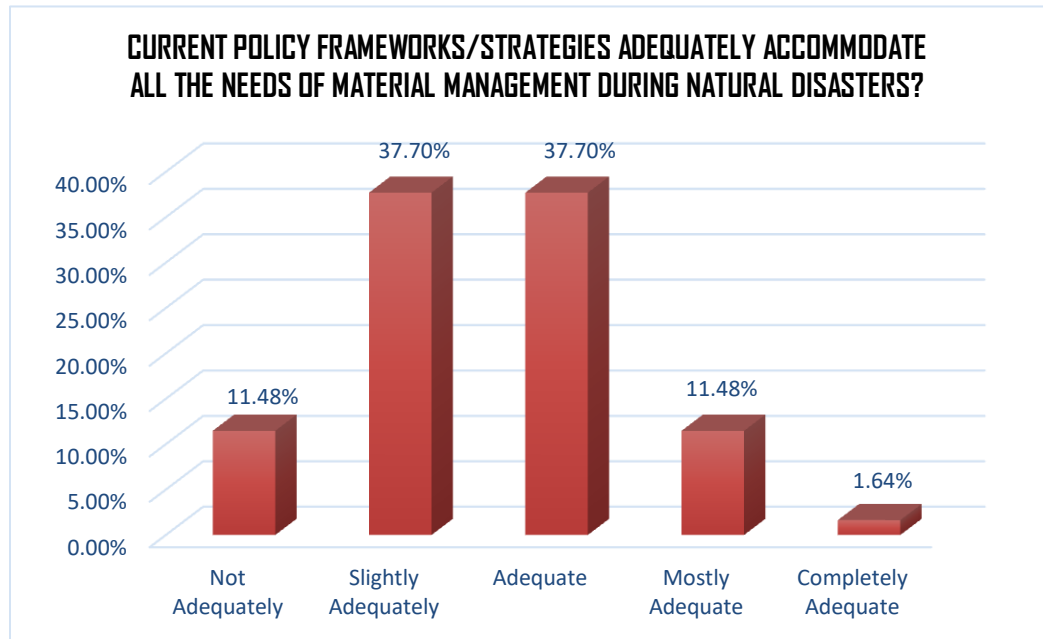


Fig 8.4: Current Policy Frameworks/ Strategies

Q3. In response to the question that “**The organizational characteristics of NDMA/NDRF enable them to effectively and efficiently handle the rescue /relief materials in the event of a natural disaster.**” 33% respondent felt NDRF /NDMA are well organized institutions, where as 33% felt otherwise and balance 34% maintained a Neutral stance

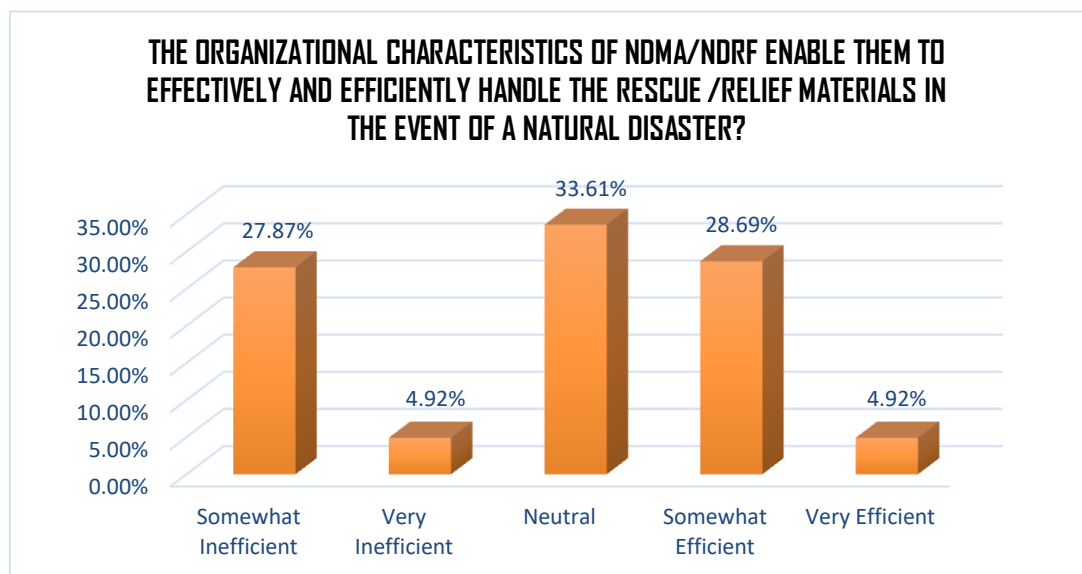


Fig 8.5: Organizational Characteristics of NDMA/NDRF

Q4. In response to the question that “**Our National Disaster Emergency Response framework is at par with other developed nations in terms of Disaster relief material management.**” Majority of respondents agreed to our current response framework to be at par with the developed nations.

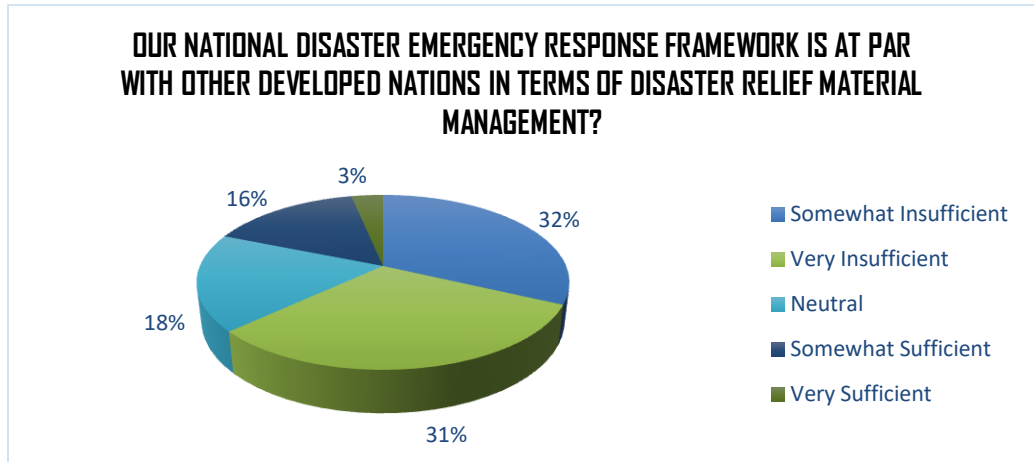


Fig 8.6: *Our National Disaster Emergency Response framework vis a vis other developed nations*

Q5. In response to the question that “**What is the level of awareness of disaster risk factors and disaster store handling at the community level?**” Over 77% respondent feel that the level of awareness of disaster risk factors and disaster store handling at the community level is quite poor.

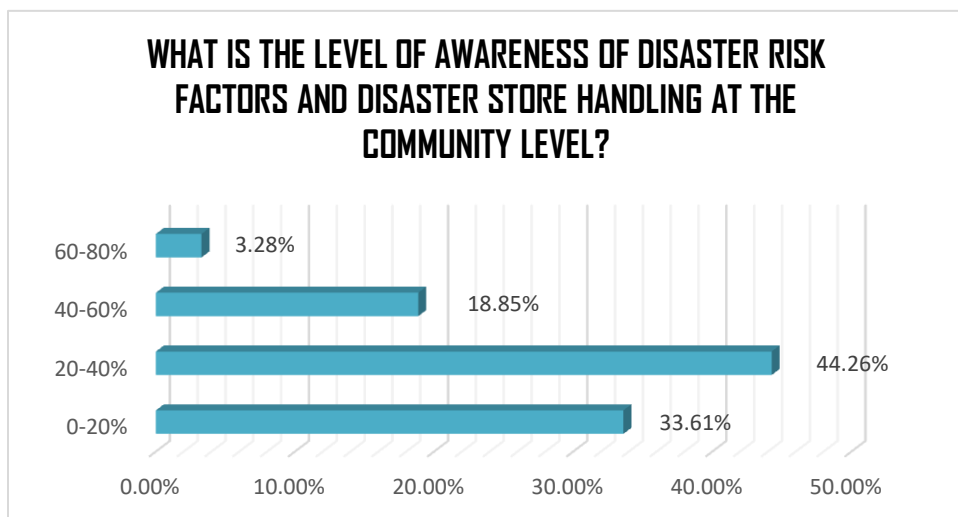


Fig 8.7: *Disaster Awareness and Store Handling at the Community Level*

Q6. In response to the question “**What percentages of vulnerable areas have relief material storage or replenishment route plans identified / rehearsed?**” Maximum respondents (76%) opined that most of the vulnerable areas do not have sufficient relief material storage, or replenishment route plans either identified/ rehearsed.

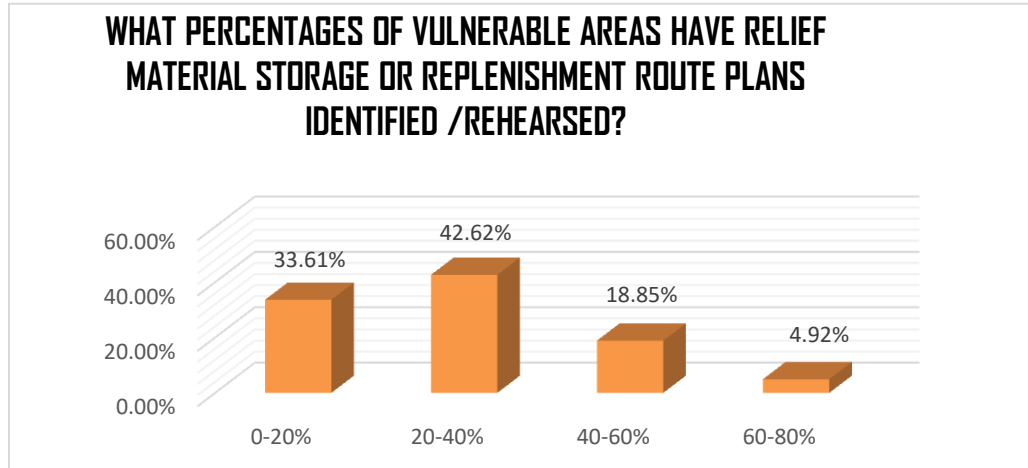


Fig 8.8: Replenishment Routes Identified/ Rehearsed

Q7. In response to the question that “**Citizen disaster awareness and public information projects with respect to disaster relief stores management are being efficiently undertaken in the country?**” Barely 15% of the respondents felt that necessary impetus is being given to citizen disaster awareness and public information projects with respect to disaster relief stores management.

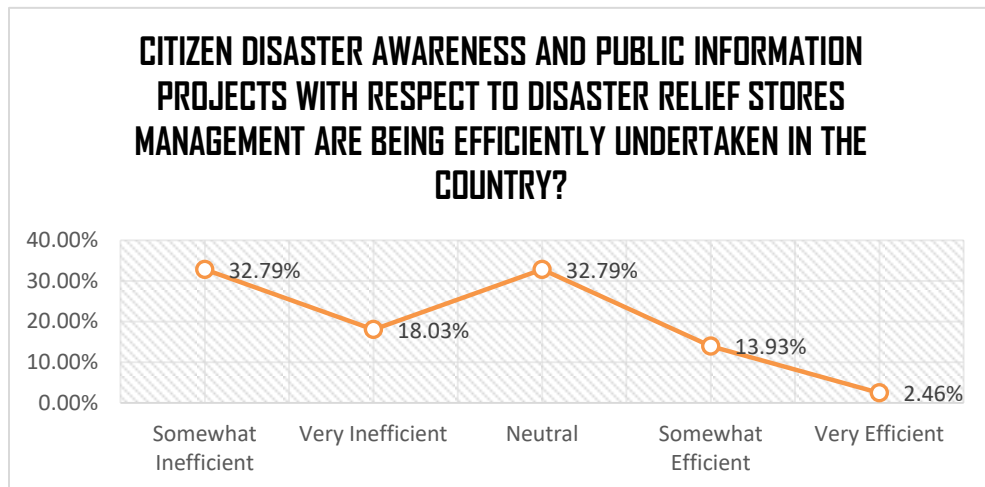


Fig 8.9: Citizen Disaster Awareness wrt Relief Stores Management

Q8. In response to the question that “**Is adequate disaster stores handling /management training is being undertaken for NDRF/ Para mil/Armed forces in the country?**” Majority of the respondents (58%) felt that necessary impetus is being given wrt stores handling/ management training for NDRF/ Para Mil/ Armed forces , while 42% felt more needs to be done in this direction.

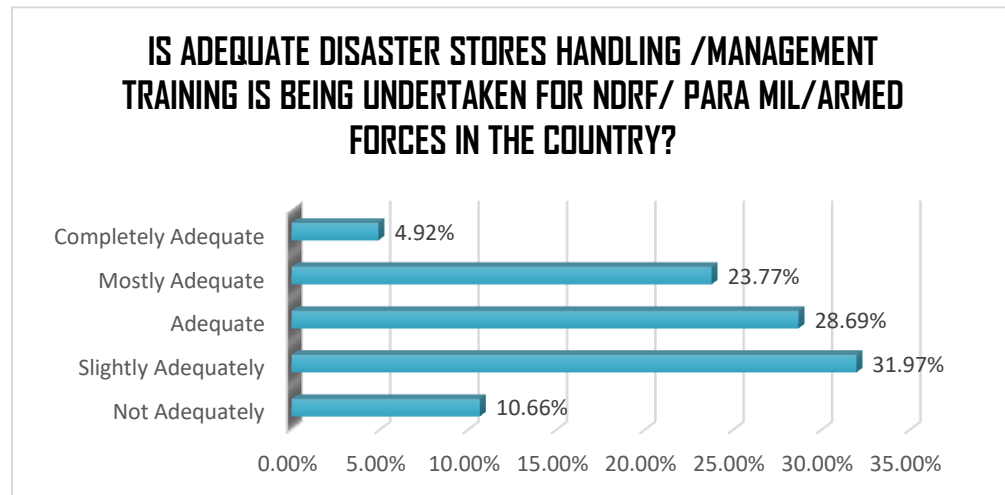


Fig 8.10: Stores Handling Training of NDRF/ Armed Forces

Q9. In response to the question that **Adequate disaster stores handling /management training is being imparted to the citizens /SHGs / NGOs in the country?** Majority of the respondents (68%) felt that necessary impetus is being given wrt stores handling/ management training for the Citizens/ SHGs/ NGOs in the country, while 32% felt more needs to be done in this direction.

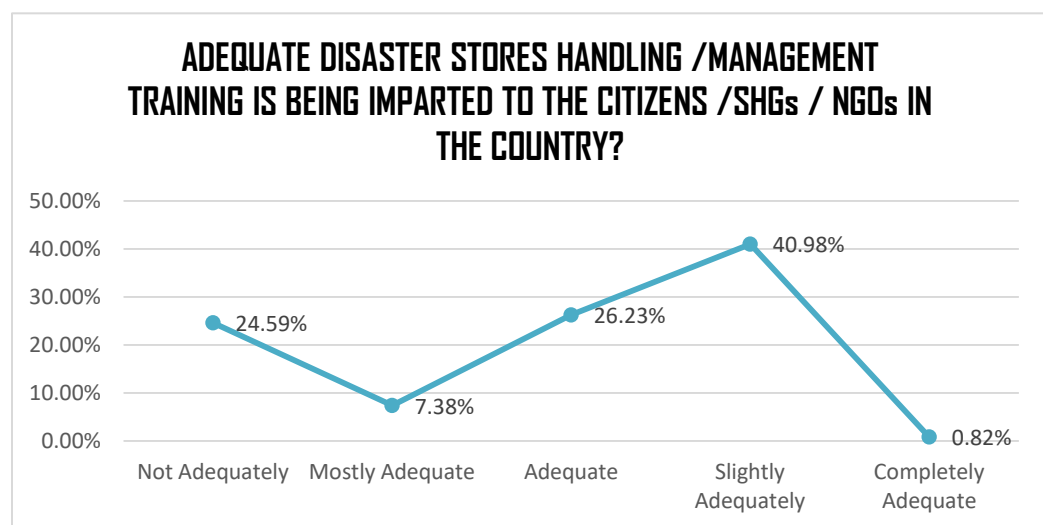


Fig 8.11: Stores Handling Training of Citizens/ SHGs/ NGOs

Q10. In response to the question that **Adequate funds are available to NDRF/ SDRF to meet the full material requirement in the Preparatory stage of any disaster?** only 12% of the respondents felt funds are not adequately available during the Preparatory stage of the Disaster.

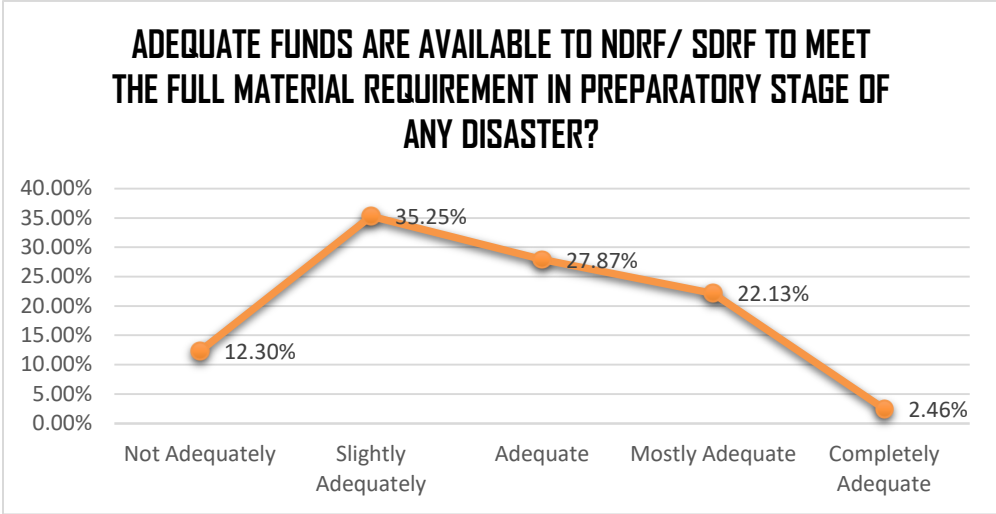


Fig 8.12: Funds Adequacy During Preparatory Stage

Q11. In response to the question that **Adequate funds are available to NDRF/ SDRF to meet the full material requirement in the Response stage of any disaster?**, Only 13% of the respondents felt funds are not adequately available during the Response stage of the Disaster.

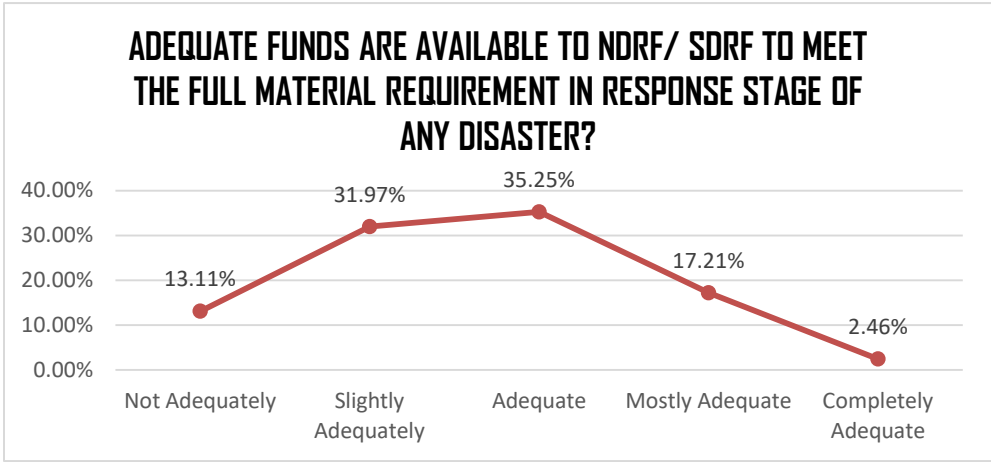


Fig 8.13: Funds Adequacy During Response Stage

Q12. In response to the question that “**Along with rapid urbanization & infrastructure expansion in vulnerable areas, the center and State Government have also constructed adequate Disaster resistant/ relief storage spaces**”. Majority (62%) of the respondent opined that the center and states have Not adequately constructed Disaster resistant/ relief storage infrastructure in vulnerable areas.

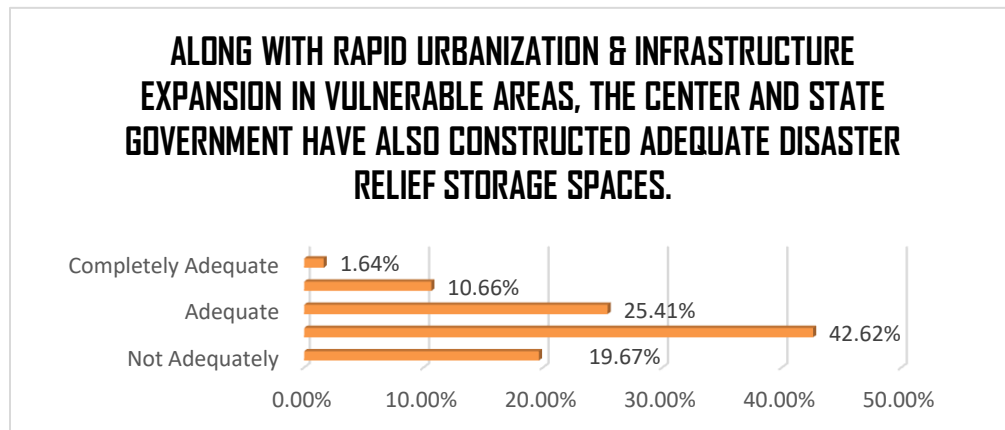


Fig 8.14: Construction of Disaster Relief Storage Spaces

Q13. response to the question that “**Is NDRF/ SDRF Capable of handling the entire Disaster Material requirements, without the assistance of Armed forces?**” Majority of respondents(75%) felt that assistance of Armed Forces is essential for NDRF and SDRF to be able to handle the entire disaster material requirements.

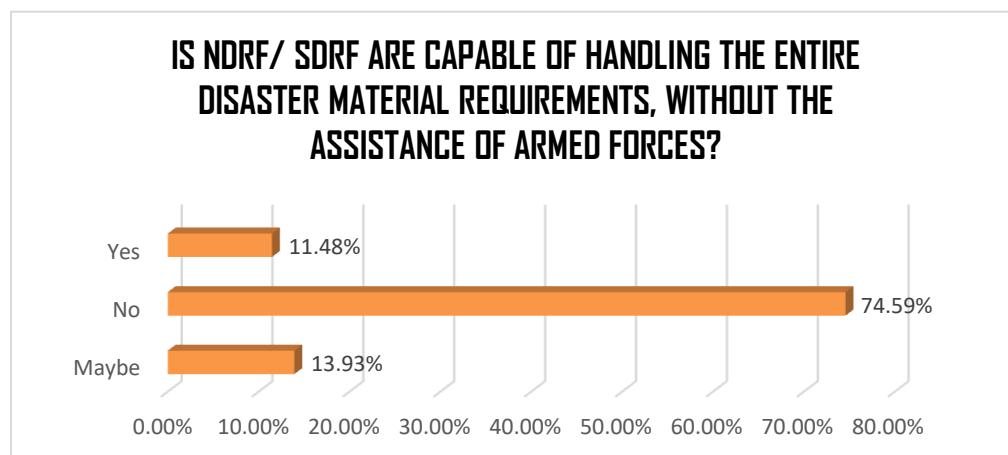


Fig 8.15: Capability of NDRF/SDRF to Handle Disasters

Q14. In response to the question to “ **Rate various agencies, in order of their contribution in providing the material support during Disaster Relief Operations.**” Respondents rated contribution of Armed Forces and NDRF/SDRF as significant while contribution of Media and NGOs was also acknowledged.

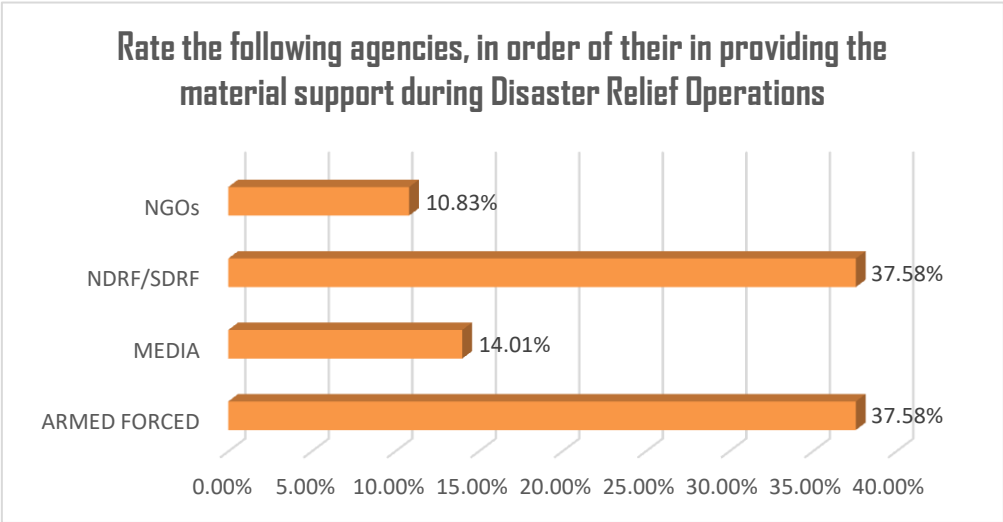


Fig 8.16: Contribution of Various Agencies in Disaster

Q15. In response to the question to “**Rate the order of importance of stores for their necessity during Disaster Relief Operations.**” **Maximum Respondents** (30.19%) opined Medical stores as most important during disaster relief operations followed by Food Material (29.25%), Rescue stores (20.75%) and Shelter stores(19.81%).

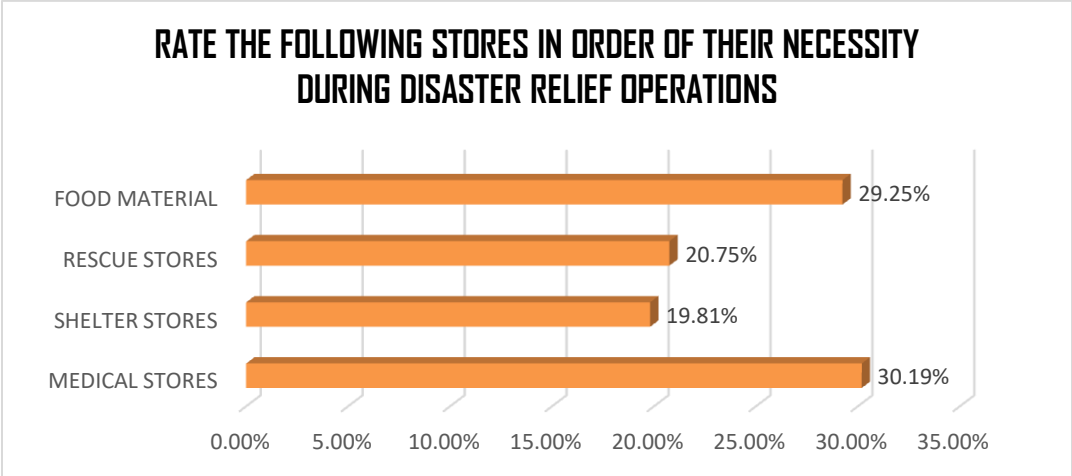


Fig 8.17: Inter Se Importance of Disaster Relief Stores

8.3. Summary of Findings

Most of the respondents felt Inadequacy / Insufficiency in resource allocation at National Level to meet the challenges of Natural Disaster effectively.

While there is unanimous agreement amongst respondents that our Current policy frameworks/ strategies do adequately accommodate all the needs of material management during natural disasters , however they were divided when it comes to “on ground” organizational effectiveness of NDMA/NDRF/ SDRF to handle the Disasters.

Most respondents feel that the level of awareness of disaster risk factors and disaster store handling at the community level is quite poor. Notwithstanding, emphasis is being paid on training people at community level, NGOs and SHGs.

Maximum respondents opined that most of the vulnerable areas do not have sufficient relief material storage, or replenishment route plans identified/ rehearsed.

Majority of the respondents (58%) felt that necessary impetus is being given wrt stores handling/ management training for NDRF/ Para Mil/ Armed forces , while 42% felt more needs to be done in this direction.

Majority of the respondent felt adequate funds are available during the Preparatory stage as well as Relief stage of the Disaster.

Most of the respondents opined that Center and States have Not adequately developed or constructed Disaster resistant / relief storage infrastructure in vulnerable areas as part of their planned Development Strategy.

Majority of respondents felt that assistance from the Armed Forces was essential for the NDRF and SDRF to be able to effectively handle the entire material requirements during the disaster.

Respondents rated contribution of Armed Forces and NDRF/SDRF as equally significant in combating disasters, while contribution of Media and NGOs was also acknowledged to a lesser degree.

Maximum Respondents opined Medical stores as most important during disaster relief operations followed by Food Material, Rescue stores and Shelter stores in this order.

8.4. Case study findings

Lack of Preparedness

The preparedness programmes undertaken by the government in the disaster prone areas are neither sufficient, nor timely. Not a single local NGO was operating at the grassroots level in Orissa when the disaster struck in 1999. In Jagatsinghpur district, 43NGOs and VOs were registered under the Registration Act of 1860, and if 50% of them would have acted in time, perhaps the lives of many thousand people could have been saved. In the post-cyclone period many NGOs functioning in other districts (in-land areas), which had either less or no acquaintance with the area and the people, came into these regions, which shows that many of the voluntary organizations and NGOs registered with the government are not functional.

Inadequate Coordination amongst Relief Agencies

There was a lack of coordination between the relief agencies, governmental and non-governmental. As a result, the flow of relief materials and rehabilitation assistance of these agencies was largely irregular, insufficient and also not timely. In many blocks and villages, the quantity of relief and rehabilitation support supplied has been in excess of need.

People Participation

Training and education of local communities to facilitate their role in mitigating the damages of any disaster should be a part of the disaster preparedness programme. This is evident in the case of Gujarat and Orissa wherein post rehabilitation the buildings and Structures were disaster resilient.

Health Services

Any disaster incident badly affected the essential services of the State. In Kashmir, several hospitals, clinics and pharmacies submerged into water for a number of

days. Major hospitals of the city including other hospitals report damage to the critical diagnostic instruments like X-ray and ultrasound machines which are installed at the hospital.

Sanitation

Critical infrastructure and basic services witnessed damage and needs to be restored like water supply and electricity in all three cases. The flood situation left herculean task to dewater and clean the Srinagar city from silt and garbage, where markets, houses, government offices, secretariat and roads were submerged. Immediate remedial measures are essential to prevent epidemic-like situations.

Lack of Disaster Resilient Infrastructures

Non adherence to Multi-hazard resistant construction capable of withstanding cyclones, earthquake and other natural disasters. In all three cases, most houses /structures were without incorporating any modern technology or technology advancements.

Contribution of NGOs

A large number of NGOs, national and international, participated in the relief operations. Many of these NGOs gradually withdrew after the relief phase closed, as they did not have sufficient resources to participate in the reconstruction program, or a long-term plan for local involvement. However, a number of Bigger NGOs continued and contributed to the rehabilitation program. The government actively sought for NGOs to adopt villages for rehabilitation.

Indian Red Cross Society(ICRS)

Interaction was held with Indian Red Cross Society officials, including the office of Secretary General on 02 Feb 23 , to get an insight into their Material support structure . The following were the highlights :-

- (a) The Indian Red Cross is a voluntary humanitarian organization having a network of over 1100 branches throughout the country, providing relief in times of disasters/emergencies and promoting health & care of the vulnerable people and communities. It is a leading member of the largest independent humanitarian organization in the world, the International Red Cross & Red Crescent

Movement. The movement has three main components, the International Committee of Red Cross (ICRC), National Societies and International Federation of Red Cross and Red Crescent Societies.

(b) The Mission of the Indian Red Cross is to inspire, encourage and initiate at all times all forms of humanitarian activities so that human suffering can be minimized and even prevented and thus contribute to creating a more congenial climate for peace.

(i) Indian Red Cross Society (IRCS) was established in 1920 under the Indian Red Cross Society Act and incorporated under Parliament Act XV of 1920. The act was last amended in 1992 and rules were formed in 1994.

(ii) The IRCS has 36 State / Union Territories Branches with their more than 1100 districts and sub district branches.

(iii) The Honourable President of India is the President and Hon'ble Union Health Minister is the Chairman of the Society.

(iv) The Vice Chairman is elected by the members of the Managing Body.

(v) The National Managing Body consists of 18 members.

(vi) The Chairman and 6 members are nominated by the President. The remaining 12 are elected by the state and union territory branches through an electoral college.

(c) IRCS has six Zonal warehousing complexes spread over geographically dispersed locations namely at Bahadurgarh, Haryana , Noonmati Guwahati ,Salt Lake Sector-V, Kolkata , Sokral Viramgam Distt. Ahmedabad, Gujarat , Ekhu Nagar, Arakkonam , Vikhroli (West) Mumbai. These are manned and stocks verified at yearly periodicity to enable quick response their latest stock positions during annual stocktaking is as under:-

DP STOCK POSITIONS OF IRCS VARIOUS WAREHOUSES AS ON						
SEP 22						
<u>NAME OF</u> <u>WAREHOUSES</u>						
	<u>ARK</u>	<u>BHW</u>	<u>KOL</u>	<u>VIRAM</u>	<u>GUW</u>	<u>VIKH</u>
BED SHEETS	0	58	877	0	0	0
COTTON BLANKET	0	0	544	0		0
WOOLEN BLANKET	0	42632	5060	5110	10000	0
LADIES CLOTHING	0	0	0	0	0	10
GENTS CLOTHING	35	0	0	210	0	0
MOSQUITO NET	0	8	3137	0	0	0
KITCHEN SETS	29	10800	631	0	200	0
TOWEL	0	0	2447	0	0	0
PLASTIC BUCKETS	0	2849	6604	3561	0	310
TARPAULIN	4070	15586	16805	5000	0	0
FAMILY TENTS	1814	1446	1408	1056	0	0
SHELTER TOOL KITS	300	480	95	0	0	0

CHAPTER 9

FINDINGS AND RECOMMENDATION

9.1. Background

Materials and finances are essential to meet the needs and aspirations of affected people for repairing devastated infrastructure and development of new housing complexes, schools, and hospitals. Though Materials and finances start pouring in at initial stages from a large number of organizations-national as well as international, It has been seen that all the resources are not used prudently and judiciously because of some unethical practices. There are several methods that can be implemented to improve material management in natural disasters

- (a) Advance planning and preparation: Having a pre-disaster plan in place for material management can help ensure that the right resources are in the right place at the right time. This includes identifying potential sources of materials, establishing relationships with suppliers and logistics providers, and developing procedures for ordering and distributing materials.
- (b) Use of technology: Technology can be used to improve the efficiency of material management during a disaster. For example, using drones and other unmanned aerial vehicles for delivery of materials in hard-to-reach areas, using GIS mapping for real-time tracking of resources, and using predictive analytics to anticipate the materials needed during a disaster. The list of Stores / Equipments recommended under Medical, Relief / rescue and Food stores is placed at Appendix A to C. Nodal Ministry responsible for monitoring their storage and availability is placed at Appendix D.
- (c) Supply Chain Management: supply chain resilience can be improved by identifying critical nodes, suppliers, and customers in the supply chain, and developing plans to mitigate disruptions and maintain continuity of operations.
- (d) Inventory Management: keeping accurate records of inventory and monitoring stock levels can help ensure that materials are available when needed. This includes developing procedures for ordering and receiving materials, as well as for tracking their use and location.

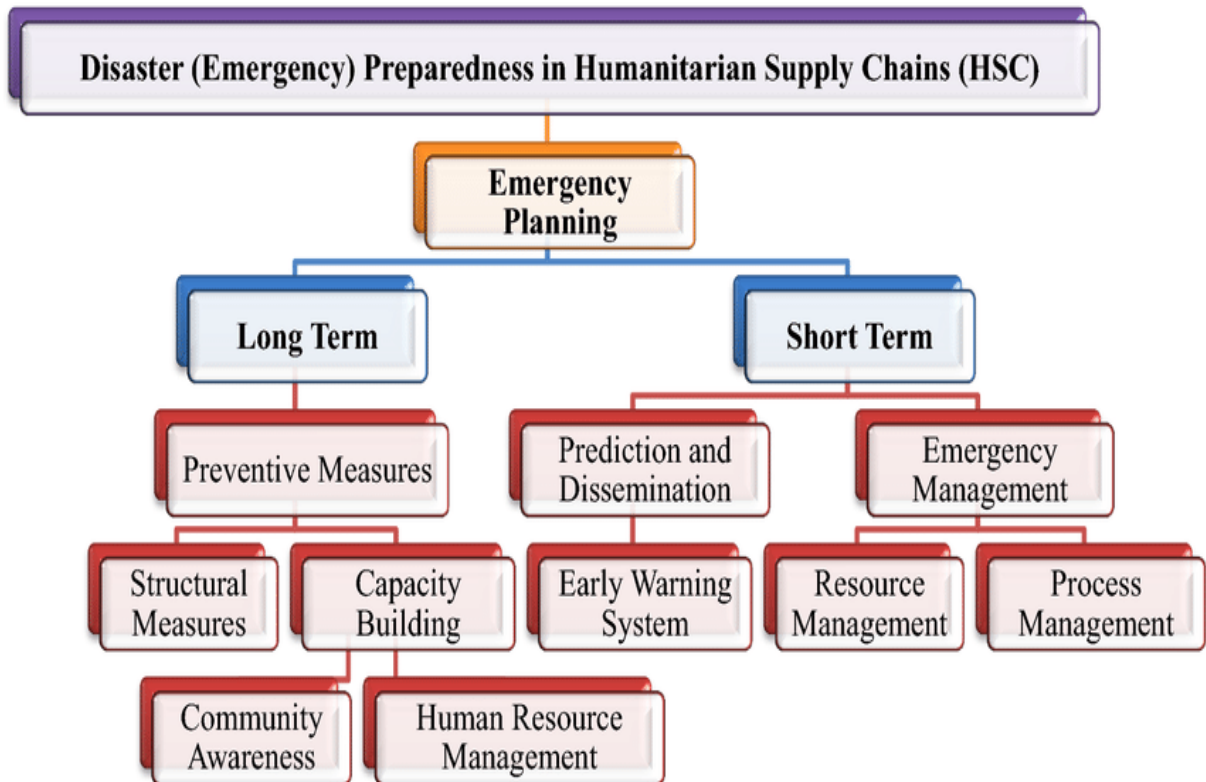
(e) Capacity Building: Building capacity of local communities and organizations to respond to natural disasters can help to improve the overall resilience of affected areas and improve the effectiveness of material management during a disaster.

(f) Community Involvement: Involving community groups in the planning and execution of material management can help ensure that resources are distributed equitably and in a way that meets the specific needs of affected communities

(g) Partnering with NGOs and other organizations: partnering with NGOs and other organizations can help to leverage the resources and expertise of these groups to support the distribution and management of materials during a disaster.

We have to take an immediate and long-term view of materials and finances for lessening the sufferings of people affected by disaster management. This responsibility must be taken seriously by the administrative apparatus specially set-up right from Union Government to local levels. In this context, the following points merit great significance:

- (a) Identifying the source from where finances and materials can be tapped.
- (b) Ascertaining the immediate, short term and long-term needs of the people affected by disasters.
- (c) Developing Transparent System of accounting, expenditure and auditing.
- (d) Prompt and efficient supply chain (transportation) system so that materials and finances reach at the right time to the affected people, otherwise these may not serve any purpose.
- (e) Administrative ethics must be practiced in these difficult hours of the people.



9.2. Emergency Management

The main objective of a humanitarian assistance Emergency management system is to strengthen national capacity so that material supplies are effectively managed from the moment donors offer assistance and through their arrival and distribution in the disaster affected areas. As in other aspects of disaster management, managing of disaster supplies cannot be improvised at the last moment. A standing committee should be designated to:

- (a) Establish national policy regarding donations and receipt of emergency supplies.
- (b) When a disaster occurs, rapid damage assessment must be carried out in order to identify needs and resources.
- (c) If external assistance is necessary, requests should be strictly limited to resources not available in the affected zone.

- (d) When requesting supplies, the time required for shipment and distribution must be considered, and there must be planning for needs that will remain unmet after supplies arrive.
- (e) No supplies or other forms of relief should be sent without first verifying the need for such assistance. It is essential to assign priorities for each container shipped.

9.3. The Principles of Effective Material Management in Disasters

Following are the principal components in managing effective Material Management in any disaster relief operation:-

- (a) **Acquisition and mobilization of Resources**

This requires determining what items are necessary, to acquire them, and how to use them to meet identified needs. This also entails an accurate assessment of readily available and alternative means of transportation to promptly and safely deliver supplies at Storage or distribution areas.

- (b) **Storage**

An organized storage system safeguards supplies until they can be delivered to their final destination. The system also assists in anticipating amounts of supplies in reserve for later needs. A Three tier system at National, state / Regional and District level storage space is desirable.

- (c) **Distribution**

The ultimate objective of the logistic supply chain is to deliver assistance to the persons affected by the disaster or to the organizations in charge of their use. Balanced and controlled distribution must be ensured to avoid abuses, waste, or damage to the supplies. These components are linked and complementary, and require very careful coordination to ensure that there are no interruptions in the logistic chain.

Some of the proposals to improve upon each principle of Material Management are amplified as under :-

(a) **Advance / Early Warning and Monitoring Systems**

Preparedness measures means activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely early warnings and temporary evacuation of people, livestock and assets from threatened locations. This may be fostered through information sharing, mock-drills, community based disaster preparedness planning, family preparedness planning and capacity building/training for communities, officials and other stakeholders. With accurate and timely information and preparedness, everyone who may suffer from the consequences of disaster events should be able to take precautions and thus limit the damages. Hence procuring and maintaining functionality of Early Warning and Monitoring Equipment is one of the most essential aspects of Material Management.

(b) **Advance List of Essential Items required According to Calamity Vulnerability**

The first important step is that all the agencies that are MHA, the State Governments, District authorities, local bodies should join together in 'advance' identification of materials required under different types of calamities. Precaution may be taken to enlist according to priority, i.e. vital item may be put in category A, essential in B and desirable in C. The list so prepared may This would avoid hit and trial method, which leads to a lot of confusion. be circulated to all and may be made available on the internet as well.

There can be a mechanism for permanent **materials management planning** which may last for a sufficiently long time. This requires thorough preparation and continuous updating. It was found that the people, voluntary organizations, State Governments, foreign countries rushed with materials, whatever they thought were

desirable. This created confusion and a lot of problems for the administration. It was, however, unavoidable due to the suddenness and seriousness of the situation. Notwithstanding, we must keep the following principles in mind:

- (a) Right item
- (b) Right quantity
- (c) Right price
- (d) Right source
- (e) Right delivery
- (f) Right methods
- (g) Right people

Need for appropriate building technology

The buildings come down in quakes when they are heavy and rigid and unable to accommodate seismic movements. Adequate design must minimize the possibility of relative displacement between parts of the foundations and between foundation and superstructure. Quake vibrations and floods can cause consolidation or liquefactions of soils, resulting in uneven settlement. Either the stabilization of soil prior to construction or the use of piles or deep piers bearing on deep structure is the solution to this problem.

The damage caused to most of the buildings during the earthquake was on account of the building not being resistant to the earthquake. The Institute of Building Technology attached to the Ministry of Urban Development and CDRI(Coalition of Disaster Resilient Infrastructure) has done extensive research on this subject. It is essential to spread awareness of their proposed interventions and bring them into practice , especially in disaster prone areas.

Use of Information/Communication Technology

The communication channels generally get uprooted after the earthquake or floods/ slides. The place gets cut-off from the outside world. The absence of telephone connections creates tremendous chaos and confusion due to blockage of flow of information. Utilization of HAM technology proves to be extremely useful to build up the communication network during such calamity in addition to satellite or wireless based systems. Thus, the disaster management teams should not only have access to the appropriate tools and equipment for use of Information Technology but also have adequate training in making use of the same.

Linking disaster recovery with sustainable development

The recovery plan should be developed by integrating disaster risk reduction (DRR) measures to the recovery programme. Sectors such as education, health, transportation, water and sanitation should be given equal attention along with housing reconstruction so as to link safety of communities with the long-term sustainability. Mitigation measures tend to be potentially more efficient and long-term sustainable solutions . Structural measures will remain important elements and should primarily focus on the protection of human safety, valuable goods and property. Some of the measures are:

- (a) Building codes and regulations shall be designed to construct disaster resistant constructions to include measures for disasters such as earthquakes, floods and landslides etc.
- (b) Discourage development from disaster prone areas/ river corridors and encourage new development at safe areas, relocation of vulnerable populations, restructure buildings to face the multiple disasters and mapping of vulnerable areas to assess risk and utilize the outcomes in rehabilitation and development planning.
- (c) Incorporate Mitigation steps for eg, In order to achieve control over floods, it is essential to construct dams, reservoirs on streams or tributaries,

construction of levees, watershed treatment and channel improvements by removing undesirable bends; deepening and widening of channels to increase size of waterways; removal of obstructions and concrete lining to increase efficiency.

Identification of Sources for Stores

We may prepare the list of sources, dealing in those goods. Besides, we may take the help of the Press in requesting the people to donate the required items and not the items, which may increase the unnecessary botheration of storage, handling, etc. Even the foreign countries who contact for help may be intimated about these requirements. It has been reported that in Gujarat, materials kept lying at the airport/ railway station, causing the problem of storage, pollution thefts, etc. for a few days.

Ordering the Equipment Directly from the Sources

Without entering into complicated and complex purchase procedures, goods may be purchased directly from the identified supplier and supply may be received at the needed site while getting it recorded at the central office with the help of a suitable Information System or Technology. Centralization of policy function but decentralization of operations is the key to success. It has been observed that things either do not reach or reach very late at remote places. This can be corrected by directly asking the vehicles to take the delivery of items under intimation to the central office.

Tiered Storage Infrastructure

Supply chain interruptions caused by external events can have a significant financial and operational impact on Disaster preparedness. Therefore, improving disaster preparedness in supply chains is critical. One critical component of disaster management planning in supply chains was the storage of emergency supplies, equipment, and vital documents that would be needed in times of crisis. The aim is to propose an efficient decision process for establishing an effective network of secure storage facilities that could support multiple supply chain facilities. Storing emergency supplies at every supply chain facility could be cost-prohibitive. In addition, gaining access to emergency

supplies that were stored at each facility may be prevented by some external events, such as fires or hurricanes, because items stored on-site are destroyed or may become inaccessible. Therefore, the proposed secure site selection process could balance operational effectiveness and cost-efficiency by identifying the minimum number and possible locations of off-site storage facilities.

Report at the Central Office /Disaster Recovery Centre

The state government should develop a recovery center which has a network of partners, including government officials, not-to-profit organizations, consulting firms, and other experts engaged in diverse sectors such as housing, urban planning, livelihood, public infrastructure development, procurement, financial management, disaster risk management, environment, waste management, transportation and Health, Education and Agriculture. The state may identify these professionals and pool them as experts to assist in recovery starting with identification of recovery issues and taking decisions on recovery goals.

To achieve transparency, responsiveness and availability of the materials, the Central office should keep track of items- Where needed? How much? Central office can also ensure the movement from surplus to non-surplus areas. Central office should function round the clock. This would avoid the pilferage of materials which reportedly happened in Gujarat.

Recording in each Area

Each area should also maintain the record of materials received and distributed. In this way, the Central reporting system can be strengthened and updated in an ongoing manner.

Systematic Distribution

In the field, it is essential to identify the beneficiaries so that the materials reach the right people.

Need for Periodical Controls

Every district disaster management plan should be updated at the end of year periodically and the review of the contingency action plans at levels L0 to L3, in increasing order of intensity, be carried out on a quarterly or half yearly basis. This effort to update and to be in a state of readiness, is extremely critical for the disaster prone areas.

India boasts of its democratic success over the past 50 years. The most critical component of democracy has been successful holding of the elections from time to time. The exercise of holding elections has been so methodical and systematic due to the compulsory rehearsals and the training programmes, so should be our preparedness for disasters.

Transparency ,Accountability and Penalty for Misuse of Funds

There should be transparency and accountability in the process of relief and rehabilitation. The record-keeping coupled with concurrent audit should be monitored. The penalty for misuse of funds should be so high that persons involved in the activities are deterred from indulging in such an Act. The State Disaster Management Act has a provision for imposing these penalties. It is necessary for each State to enact such legislation to prevent misuse of funds under such calamities.

Involving Religious Institutions in the Area

Religious institutions have a mass appeal and reach, which would help in generating awareness about various calamity management practices as well as help mobilize community efforts for mitigating the problem. In the event of a calamity, religious institutions can play a role of the counselor assuaging the emotional trauma of the victims.

High Moral Values of the Functionaries

All that we require is honest leadership at all levels of public and bureaucratic life. The time has come to put the nation before self. This alone can make a substantial

difference to our overall performance, the growth rate included. Moral values are indispensable for good governance. An efficient and technologically sound administrative machinery, unless it stands on a high moral pedestal, does not serve the public, but it serves a perpetuating and exploitative system.

People Participation

Peoples' participation in regulatory and development administration is very crucial not only in bridging the gap between the administration and the public but also by way of reducing corruption and complaints against the system. Further it helps the people to understand limitations of the administration at different levels.

Greater role of NGOs

Many voluntary organizations and the people, bilateral and multilateral agencies contribute financial and material resources generously as well as take interest in the welfare of victims so that they can be integrated in normal life in the shortest possible time. The victims need some essential items like food, clothing, shelter, health, sanitation, etc., since most of them have lost most of their belongings during the calamity. These supplies have to be made immediately during the period of operations relief, otherwise many more lives can be lost. While making these arrangements, there is a need for various types of materials required for rehabilitation of the affected people. To procure the required material and reach it to the needy, well in time, poses a major challenge before the administration. Many NGOs are registered with state authorities to assist during such periods of calamity. Some essential aspect of these are:-

- (a) NGO must have men/women of integrity, to handle materials management.
- (b) Maintaining transparency and accountability in the delivery system.
- (c) Constant mechanism for ascertaining the need for material area wise
- (d) Making stores at different areas to ensure need based and promptness of delivery.
- (e) Establishing contact with foreign countries if they are interested in helpings, as per the need of the area.

- (f) Checking against donation of sub-standard, time barred or contaminated goods.
- (g) Political leaders especially should show positive concern in providing the materials to the affected people in a responsible manner. They should avoid politics in such issues.

9.4. Conclusion

Natural disasters like floods, earthquakes and cyclones cause havoc in more than one geography simultaneously. It underlines the necessity for coordinated regional action in order to strengthen all aspects of disaster management wherever possible by learning from one another and by sharing experiences and physical as well as financial resources, Regional co-operation for effective disaster management system is needed for hazard and vulnerability analysis and human resource development as well as materials and financial planning.

The State / Local Government has to be the main stakeholder in the implementation strategy for effective execution of the overall disaster recovery plan. The institutional setup, which works on a temporary basis, should be capable of handling specialized tasks within a well-defined framework. The State and district level disaster management authorities shall be provided personnel from the recovery center to meet the requirements of staff and expertise. The programme management units at district, state and central level shall be constituted for regular monitoring of the recovery and rehabilitation programme. A window for mid-term / regular evaluation by third parties should be kept for evaluating the implementation of the programmes, and continuous improvements be undertaken to ensure robust and reliable material support plan to combat disasters.

APPENDIX 'A'

LIST OF RECOMMENDED MEDICINE/MEDICAL STORES

<u>S.No</u>	<u>Antibiotics & Antimicrobials</u>
1.	Metronidazole in for IV use containing 500 mg per bottle of 100 ml
2.	Amikacin 250mg/vial
3.	Ceftriaxone 1gm/vial
4.	Amoxicillin 500mg+ Clavulanic acid 125mg Tab
5.	Tab Norfloxacin 400mg+ Tinidazole 600mg
6.	Azithromycin dihydrate 250 mg Tab/Cap
7.	Chloroquine phosphate 250mg Tab
8.	Amoxicillin 200mg/5ml + Clavulanic acid 28 5mg/5ml syp in 30 ml
9.	Metronidazole susp 200mg/5ml bott of 60 ml
10.	Syp Ciprofloxacin 125mg per 5ml bott of 60ml
	<u>Analgesics, Antipyretics, Antispasmodics</u>
11.	Diclofenac 25mg/ml. IP. 3ml Inj
12.	Tramadol HC 50mg/ml Inj
13.	Paracetamol 150mg/ml, 3ml inj
14.	Hyoscine Bromide inj 20mg/ml, 1ml inj
15.	Pentazocine 30mg/1ml inj
16.	Antispasmodic cap containing dicyclomine HCL 20mg.
17.	Paracetamol 500mg Paracetamol 500mg Tab
18.	Diclofenic Sodium 50mg, enteric coated Tab
19.	Paracetamol syp 125mg/5ml bott of 60ml
20.	Dicyclomine 10mg.
21.	Simethicone 40mg/5ml bottle of 30ml
22.	Paracetamol 100ml infusion 10mg/ml

<u>Antihistaminics</u>	
23.	Common Cold Tab (Antihistaminics + Paracetamol 500mg without pseudoephedrine)
24.	Levo-Cetirizine 5mg Tab
25.	Cetirizine Syrup 5mg/5ml bott of 60ml
26.	Cough Expectorant syp 5ml containing Diphenhydramine Hcl 14.08mg ammonium chloride 0.138gm, sodium citrate 57.03mg chloroform 22.08mg, menthol 1.14mg & alcohol 0.2625ml (5% v/v) in flavoured syrup base bott of 100ml Bronchodilators
27.	Levo-Salbutamol aerosol inhalation pack of 200 metered dose (each metered dose supplies 100mcg of salbutamol)
28.	Levo-Salbutamol 1.25mcg Ipratropium 500 mcg respule, in 2.5ml ampoule
29.	Inj Deriphyllin (Etiophyllin 85.7mg + Theophylline 24.3mg)
30.	MDI Levo-Salbutamol 50mcg+ Ipratropium 20mcg Budesonide respuls 1mg/2ml
31.	Prokinetics & Aantiemetics, Antiulcer Drugs
32.	Inj Pantoprazole 40mg
33.	Ondansetron 8mg inj
34.	Cap Omeprazole 40mg
35.	Ondansetron 8mg Tab
<u>Antihypertensives</u>	
36.	Isosorbide Dinitrate 10mg Tab
37.	Aspirin 150mg Tab
Antidiabetic Drugs	
38.	Metformin 0.5g Tab
Eye/ Ear Drops	
39.	Eye drops Flurbiprofen (0.03% in a bott of 5 ml)
40.	Ciprofloxacin 0.3% eye drop of 3mg/ml bott of 5ml
41.	Xylometazotine HCL 0.05% w/v nasal solutuoin bott of 10ml
42.	Waxil/Cerokin Ear drops
43.	Clotrimazole cream 1% Tube of 15gm
Syringes and IV Fluids	
44.	Cannula IV Size 16G, 18G, 20G

45.	Peripherally inserted central catheter
46.	Normal Saline 500ml
47.	Ringer lactate 500ml FFS
48.	Glucose saline isotonic solution in self-collapsible flexible dextrose 5% with 0.9% Sod chloride non-toxic disposable plastic bott of 500ml FFS or equivalent technology.
49.	Syringe disposable, plastic, sterile, with needles
50.	Syringe disposable 50ml
51.	Mannitol 20% Inj bott of 350 ml Inj
	Suturing & Dressing material
52.	Bandage Triangular
53.	Cotton wool, absorbent Pkt of 500gm
54.	Cotton wool, absorbent Pkt of 50gm
55.	Lignocaine HCL Jelly 2% Tube of 30gm with plastic nozzle
56.	Liquid Antiseptic (Chlorhexidine Solution) with Activator Containing Gluconate BP 7.5% v/v Cetrimide BP 15% w/v sufficient quantity of Tab sodium Nitrite 1g to make 0.4% Soln with each 1 liter cont in air tight pack
57.	Povidone Iodine solution 5% bottle of 100ml
58.	Framycetin Sulphate cream BP 1% cream 20gms
59.	Dressing Medicated Gauze paraffin, 10cm x 10cm tin of 24
60.	Framycetin sulphate gauzed box of 10
61.	Adhesive Plaster Micro porous tape
62.	Pre packed abdominal swabs sterile
63.	Pre packed sterile gauze pieces
64.	Sterile Hand gloves
65.	Silk Braided size 2/0, 70-76 cm, RB 3/8 circle needle 45
66.	Vicryl rapid, undyed 70cm, 26mm, R cutting size 3/0
67.	2-Propanol 45 gm 1-propanol 30 gm Ethyl hexadecyl dimethyl ammonium ethyl sulphate 0.2 gm with skin protecting substance
68.	500 ml bott with dispenser

69.	Mask operation surgeon
70.	Cap operation
71.	Disposable gown
72.	Band-Aid
73.	Gumzee Pack
74.	Universal gloves Disposable
75.	Bandage open woove uncompressed 10 cm x 4 Mtrs
	<u>Emergency Drugs</u>
76.	Adrenaline Tartrate (1:1000), 1ml Inj Atropine Sulphate 0.6mg, 1ml Inj
77.	Hydrocortisone Sodium Succinate 100mg Inj
78.	Dopamine HCL 40mg/ml, 5ml Inj
79.	Sodium Bicarbonate 7.5% amp of 10ml
80.	Calcium gluconate 10%, 10ml Inj
81.	Tranexamic acid 500mg/5ml Inj
82.	Dextrose 50%, 25ml Inj
83.	Pheniramine Maleate Inj 22.75mg per ml amp of 2ml
84.	Anti venom, serum polyvalent, dry amp of 10ml
85.	Permethrin 5% Tube of 30gm
86.	Artesunate 60mg Inj
87.	Nor adrenaline bitartrate 2mg/ml, 2ml Inj
88.	Diazepam 10mg, 2ml Inj Phanytoin Sodium 150mg per ml, 10ml Vial Inj
89.	Lignocaine HCL solution 2% for IV use, 50ml Inj
90.	Tetanus Toxoid, Purified Absorbed rubber capped Vial of 5ml (10 Doses)
91.	Frusemide 20mg, 2ml Inj
	<u>Basic Surgical Instruments</u>
92.	Forceps, Artery Straight
93.	Needle Holder, 19cm Box joint
94.	Forceps Straight
95.	Forceps, dissecting, toothed, 12.5cm.
96.	Suture cutting scissor
97.	Kidney tray disposable plastic

98.	Bowl Small/large Disposable plastic
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	<u>Misc Items</u>
99.	Glucometer with strips
100.	IV Stand Compact/folding
101.	Tape, Measure, linen 1.5 meter
102.	Electronic Adult Weighing Machine
103.	Apparatus suction foot action complete apparatus suction portable, 230 V, AC
104.	Pulse Oximeter Hand Held
105.	Percussor (Babinski)
106.	Apparatus oxygen portable light weight set 200 ltr complete
107.	Cylinder Oxygen Key spanner
108.	Scissor straight 19cm
109.	Laryngoscope Audit (complete) with battery
110.	Thermometer Digital
111.	Nebulizer
112.	Auroscope complete
113.	Infusion Pump
114.	Chest Drainage System/ Intercostal Chest drain (ICD)
115.	Ambu Bag
116.	Emergency Kit Medical Officers (1998 pattern) complete
117.	Sphygmomanometer, aneroid type 300mm scale with bandage cuff Complete
118.	Airway, Guedal, all rubber, with PVC, all size 9 infant and adult
119.	Tube Endo-tracheal nasal size 8.0 with cuff
120.	Tube Endo-tracheal nasal size 4.0
121.	Stethoscope folding with diaphragm type chest piece 139 Torch hand chromium plated brass standard cells fitted with a bulb of 6.2 without cell
122.	Tube feeding smooth plastic infant 38 cm long
123.	Alprazolam 0.25mg tab
124.	Urine collection Bag with Volume meter
125.	Nasogastric tube size 12 and 16

126.	Catheter Foleys silicon 2 way 5ml size 16FG
127.	Catheter Foleys silicon 2 way size 20 FG 5ml retention balloon
128.	Foleys-Paediatric size (8)
129.	Oral Rehydration powder sachet of 20.5g each containing sodium chloride IP 2.6g Anhydrous Dextrose IP 13.5g.
130.	Potassium Chloride IP 1.5g & Sodium Citrate IP 2.99 to make 1ltr Mixture
131.	Apparatus Oxygen inhalation Portable facemask disposable
132.	Suction tubing with yankaur tip
133.	Catheter suction Endobronchial with terminal transparent non toxic PVC tubing size FG 14 length 50cm
134.	Sharps disposable container-BD (White with blue lid)
135.	Tongue depressor disposable wooden
136.	Disposable bed sheets
137.	Liquid Hand wash Soap
138.	Sodium Perborate monohydrate 50% bott of 810 gms
139.	1% w/v iodine in nonoxynol iodine Solvent ether 500ml bottle
140.	Emergency Kit Para Medical staff (1998 pattern) complete
141.	Dextrose monohydrate for oral use in pack of 100 gm with or without vitamin and mineral
142.	Infant Feed 500gms (lactogen-I & II)
143.	Vomit Bags disposable
144.	Patient identification wrist band
145.	Self sealing pouches size 5 inch with sticker
146.	Plastic dispensing bott 100ml

<u>Part II: Surgical Stores</u>	
<u>Antibiotics & Antimicrobials</u>	
147.	Caftriaxone 1gm/vial
148.	Amikacin sulphate 250mg/2 ml inj
149.	Amoxycillin 500mg + Cakvulanic acid 125mg Tab Metronidazole inj for IV use containing 500mg per bottle of 100ml
150.	Norfloxacin 400mg Tab
151.	Amoxycillin 200mg/5ml+ Clavulanic acid 28.5mg/5ml syp in 30 ml
152.	Metronidazole syp 200mg/5ml bott of 60 ml
153.	Norflox syp 100mg/5ml bott of 30ml)
	Analgesics & Antipyretics
154.	Tramadol HC 50mg/ml inj
155.	Pentazocine 30mg/1ml inj
156.	Paracetamol 500mg Tab
157.	Diclofenac Sodium 50mg, enteric coated Tab
158.	Paracetamol syp 125mg/5ml bott of 60/ml
159.	Paracetamol 100ml infusion 10mg/ml
160.	Dicyclomine 10mg, simethicone 40mg/5ml
161.	Diclofencac gel 1% Tube of 20gm
	Antihistaminics
162.	Levo-Cetirizine 5mg Tab
163.	Cetirizine Syp 5mg/5ml bott of 60 ml
164.	Cough expectorant syp 5 ml containing Diphenhydramine Hcl 14.08mg Ammonium chloride 0.138 gm, sodium citrate 57.03mg chloroform 22.08 mg methol 1.14 mg & Alochal 0.2625 ml (5% v/v) in flavoured sype base bott of 100ml

	<u>Prokinetics & Antiemetics, Antiulcer Drugs</u>
165.	Inj Pentaprazole 40 mg
166.	Ondansetron 8mg Inj
167.	Ondansetron 8mg Tab
	Eye/Ear drops
168.	Ciprofloxacin 0.3% eye drops of 3mg/ml bott of 5ml
169.	Xylometazoline HCL 0.05% w/v nasal solution bott of 10ml
170.	Flubiprofen Eye Drops 0.03% Syringes and IV Fluids
171.	Cannula IV Size 16G
172.	IV Infusion set
173.	Normal Saline 500ml
174.	Ringer lactate 500ml FSS
175.	Syringe disposable, plastic, sterile 2ml with needle
176.	Mannitol 20% Ink bott of 350ml Inj
177.	Syringe disposable, plastic, sterile 5ml with needle
178.	Syringe disposable 20 ml
179.	Glucose saline isotonic solution in self collapsible flexible dextrose 5% with 0.9% Sod chloride non-toxic disposable plastic bott of 500ml FFS or equivalent technology Dressings
180.	Adhesive plaster zinc oxide 7.5cm x 5 mtr
181.	Bandage open wove uncompressed 10cm x 4 meters Dressings
182.	Bandage, plaster for paris 10cm x 3meters
183.	Cotton wool, Absorbent pkt of 500gm
184.	Bandage open wove uncompressed 6cm x 4 meters 207. Bandage crepe 10cm
	<u>Emergency Drugs</u>
185.	Adrenaline Tartrate (1:1000) 1ml Inj

186.	Atropine sulphate 0.6mg 1ml Inj
187.	Hydrocortisone sodium succinate 100mg Inj
188.	Dopamine HCL 40mg/ml, 5ml Inj
189.	Sodium Bicarbonate 7.5% amp to 10ml
190.	Calcium gluconate 10%. 10ml Inj
191.	Tranexamine acid 500mg/5ml Inj
192.	Pheniramine Maleate Inj 22.75mg per ml amp of 2ml
193.	Dextrose 50%, 25 ml Inj
194.	Nor adrenaline bitartrate 2mg/ml Inj
195.	Diazepam 10mg, 2ml Inj
196.	Phenytoin Sodium 100mg Inj
197.	Lignocaine HCL solution 2% for IV use 50 ml Inj
198.	Frusamide 20mg, 2ml inj
199.	Inj Midazolam 5mg 1ml Inj
200.	Needle Holder, 19 cm box joint
201.	Forceps, Artery straight
202.	Forceps, dissecting, toothed, 12.5 cm
203.	Suture cutting scissors
204.	Surgical blade size 3 fitting (Commercial No 10)
205.	Disposable scalpel with No 23 Blade
	<u>Emergency Drugs</u>
206.	Scissor straight 19 cm
207.	Suprapubic set complete
208.	Cricothyroidocotomy set
209.	Hard Cervical collar (small, med, large) 02 each
210.	Splint Knee Thomas 58.5cm complete
211.	Long arm "U" Splint
212.	Short arm splint
213.	Long leg "U" Splint

214.	Short leg Splint
215.	Arm Sling pouch
216.	Lumbar Belt (small, large, medium) 02 each
217.	Flex Finger Splint
218.	Knee Immobiliser
219.	Wrist Immobilizer
	<u>Misc Items</u>
220.	Hydrogen peroxide solution
221.	Lignocaine 1% Local Anaesthetic without adrenaline
222.	Lignocaine HCL Jelly 2% Tube of 30 gm with plastic nozzle Liquid Antiseptic (Chlorhexidine Solution) with activator containing chlorhexidine gluconate BP 7.5% v/v Cetrimide BP 15% w/v sufficient quality of tab sodium nitrite 1g to make 0.4% Soln with each 1 litre cont in air tight pack
223.	Povidone Iodine solution 5% bottle of 100ml.
224.	Framycetin Sulphate cream BP 1% cream 20gm
	<u>Misc Items</u>
225.	Dressing Medicated Gauze paraffin 10cm x 10cm tin of 24
226.	Framycetin sulphate gauze box of 10
227.	Adhesive Plaster Micro porous tape 3 inch box of 4
228.	Adhesive Plaster Micro porous tape 1 inch box of 12
229.	Pre packed abdominal swabs sterile
232.	Mask operation surgeon
233.	Cap operation
234.	Disposable gown (Sterile)
235.	Band-Aid
236.	Gumzee Pads Sterile-pre-packed
237.	Universal gloves Disposable
238.	Sterile drapes for procedure medium
239.	Synthetic Absorbable polygalactin 910/ polyglycolic acid coated with polycaprolate size 2/0. 70-90 cm, ½ circle reverse cutting 30-40mm

APPENDIX B

LIST OF RECOMMENDED RESCUE/ RELIEF EQUIPMENTS

1.	Teletector
2.	Gm Survey Meter
3.	Contamination Monitor
4.	Mini Rad Meter
5.	Portable Alpha Contamination Monitor
6.	Electronic Dosimeter
7.	Beta Gamma Counting System
8.	Alpha Counting System
9.	Battery Operated Air Sampler With Filter Paper
10.	Micro Survey Meter
11.	Breathing Apparatus Set With Spare Cylinder
12.	Integrated Hood Mask Respirator (gas mask) with 2 canisters
13.	Butyl Rubber Gloves (Inner & Outer) 14
14.	NBC Over boots
15.	Thermo Luminescent Dosimeter (TLD)
16.	Resuscitator
17.	Residual Vapour Detection Kit
18.	Water Poison Detector Kit
19.	Three Colour Detection Paper
20.	Personal Decontamination Kit
21.	Auto Injector Set
22.	NBC First Aid Kit Type-A
23.	NBC First Aid Kit Type-B
24.	CW Sampling Kit
25.	Portable Decontamination Apparatus NBC Suits Decontamination
26.	NBC Permeable Suit MK-IV Portable Gama Spectrometer

27.	Decontamination Kit (Set)
28.	Naps Tablet (60mg/20 tablet packs)
29.	Hazmat Vehicle
30.	Life Detector Type-I & II
31.	Victim Location Equipment and Breaching System
32.	Multigas Detector
33.	Video Camera with Accessories Hand Held Gas Detector
34.	Angle Cutter (electric) 14" Dia
35.	Circular Saw (electric) 16" Dia
36.	Replacement Diamond Tipped Blades for Angle Cutter
37.	Replacement Composite Blades for Angle Cutter
38.	Replacement Carbide Tipped Blades for Circular Saw
39.	Air Lifting Bag Set with Air Cylinder Come Along 1.5 Tons
40.	Combination Cutter and Spreader
41.	Multi Cable Winch
42.	Bullet Chain Saw
43.	Diamond Chain Saw
44.	Hammer Drill Concrete
45.	Gas Cutter 450mm
46.	Rubber Pipe Duplon 100m Rolls
47.	Oxygen Cylinder
48.	Acetylene Cylinder
49.	Rotary (Circular) Rescue Saw 12" with Diamond Tipped Blade
50.	Ramset with Matching Foot Pump
51.	Hydraulic Jack 20 Ton Electric Drill
52.	Electric Drill bit Set 63 Chipping Hammer
53.	Chipping Hammer bit Flat

54.	Chipping Hammer bit Pointed
55.	Rotary Hammer Drill Bit
56.	Keyhole saw complete with set of four saws
57.	Reciprocating Saw
58.	Reciprocating Saw Blade Wood'
59.	Cordless Hammer Drill bit set
60.	Spare Battery for Cordless Hammer Drill
61.	Fire Extinguisher Portable
62.	Breathing Apparatus set with Spare Cylinders
63.	Leak Tester for Testing Respiratory Equipment
64.	Distress Signal Unit
65.	Fire Proximity Suit Fire Entry Suit
66.	Inflatable Light Tower Portable Generator 10 5 KVA
67.	Portable Generator 2.5 KVA
68.	Oxygen Concentrator
69.	Pulse Oxymeter
70.	Nebuliser
71.	Portable Anesthesia Kit
72.	Portable Ultra Sound Machine
73.	Automatic Blood Analyzer
74.	Multi Parameter Monitor
75.	Portable Defibrillator with recorder
76.	Portable Suction Equipment
77.	ECG Machine with Analyzer
78.	Walkie Talkie Set
79.	Satellite Phone Base Station 25 Watts
80.	Portable Radio Set
81.	Personal Diving Kit (Weight Belt Gloves Dive Fins)

82.	High Pressure Breathing Air Compressor
83.	Under Water Torch.
84.	Under Water Communication Set
85.	Under Water Video Camera
86.	Floating Pump
87.	Inflatable Boat With OBM (FRP)
88.	Rescue Boat
89.	Inflatable Motor Rescue Boat Small (10 Seated)
90.	Inflatable Motor Rescue Boat Bigs (20 Seated) Boat Assault Universal Type With OBM 50 HP
91.	Synthetic Life Jacket
92.	Pliers 8 Inches
93.	Vise Grip 10 Inches
94.	Bolt Cutter 14 Inches
95.	Bolt Cutter 30 Inch
96.	Chisel for Concrete Inch
97.	Chisel for Concrete ½ Inch to 1 Inch
98.	Framing square 22 Inch
99.	Screw Driver Set
100.	Hacksaw 12 Inch Tubular
101.	Hacksaw Replacement Blade 12 Inch Long
102.	Sledge Hammer 7 Kg
103.	Sledge Hammer 10 Kg
104.	Carpenter Hammer 3 inch
105.	Round Shovel 8 Inch
106.	Spade Shovel 12 Inch x 10 Inch
107.	Spades

108.	Fire Axe 2% Feet
109.	Crow Bar 2 Feet
110.	Pick Mattock
111.	Pry Bar 6 Feet 1
112.	Axe Mate Kit
113.	Hand Saw 600 mm
114.	Brick Hammer
115.	8 Penny Nail in Kgs 2, 3, 4 Inch Assorted
116.	Water Jell Blanket Exhaust Fan 12 Inch
117.	Ventilator and Air Tube 7 Meter Long
118.	Reflective Jackets Water proof
119.	Safety Helmets
120.	Boots Hard Toe Steel Shank
121.	Safety Torches
122.	Water Bottle (Light weight with protective carrier)
123.	Disaster Management Kit
124.	MRF Box 48 Inch
125.	Tarpaulin 4m x 4m
126.	Tarpaulin 6m x 6m
127.	Mega Phone
128.	Steel Tube 6% Dia
129.	Bucket Small
130.	Racks Plastic
131.	Spray Bottles 1 Liter
132.	Spray Paint Orange 400 CC
133.	Scene tape 100m Rolls
134.	Wooden Planks Various sizes in Cubic Feet

136.	Full Body Harness
137.	Eveready Batteries 1.5 V
138.	PVC Suit
139.	Safety Vest Florescent Waterproof
140.	Heavy Duty Work Gloves
141.	Face Shield
142.	Safety Goggles
143.	Head Light
144.	Nose Mask
145.	Dust Mask
146.	Earplug (Corded)
147.	Knee Pad Cushion 1 Inch
148.	Bite Sticks
149.	Blood Pressure Cuff Audit with Dial
150.	Collar Stiff Neck Regular
151.	Case Stiff Neck Collar
152.	Traffic Cones
153.	Rope Manila 100m Rolls
154.	Rope Nylon 100m Rolls
155.	Collar Stiff No Neck
156.	Collar Stiff Neck Pediatrics
157.	Pocket Masks (CPR)
158.	Dressing Abdominal 7 ½
159.	Gauze Dressing Vaseline
160.	Glasses Eye Protection
161.	Scissors Paramedical

162.	Stethoscope
163.	Dressing Multi Trauma 12"x3"
164.	Band Aid 1" x 3" (Pkts)
165.	Bandage Roller 6" (5m Roll)
166.	Gloves Sterile Latex XL
167.	Mask Oxygen Adult Non re-breather Universal Size
168.	Oxygen Cannula Nasal
169.	Flexible Splints (Large/Medium/Small)
170.	Airway Oral Set 60mm/80mm/90mm/100mm
171.	Emergency Rescue Stretcher
172.	Emergency Accident Kit
173.	Trachlight Wand Disposable 10 per Pack Infant Infantry Pack (CPR Mannequin) 05 Pieces Pack with Lungs
174.	Squadron Plus (CPR Mannequin) 05 Pieces Pack with Lungs
175.	Manual Suction Unit
176.	Bag Valve Mask Infant (Silicon)
177.	Tents Various Sizes
178.	Tin Sheets
179.	Wooden Ballies
180.	Hessian Cloth
181.	Blankets
182.	Durries
183.	Tarpauline
184.	Woollen and Cotton Clothing
185.	Towels

186.	Plastic Sheets
187.	Net Mosquito

APPENDIX C

LIST OF RECOMMENDED FOOD ITEMS

1.	Baby food
2.	Food grains and spices;
3.	Cooking oil
4.	Ready to eat food items
5.	Drinking water,
6.	Water purifying tablets
7.	Nutrition packs for children
8.	Rice
9.	Mix pulse
10.	Sugar
11.	Flour
12.	Vegetable oil
13.	Salt
14.	Milk Powder
15.	Tea
16.	Maggie noodles

APPENDIX D

LIST OF RECOMMENDED STORES BY RESPECTIVE DEPTT

<u>S.No</u>	<u>Name of Ministry/Org./ Department</u>	<u>Relief items to be arranged</u>
1.	Ministry of Food Processing Industries	Meals Ready to Eat, Baby Food, Milk, Powder, Tea, Sugar, Biscuits, Noodles
2.	Ministry of Drinking Water Sanitation	Bottled Drinking Water, Water Purifiers, Portable RO Machines, Dewatering Pumps
3.	Ministry of Textiles	Blankets, Cotton Woolen Garments, Towels, Mosquito Nets, Bed Sheets
4.	Ministry of Health and Family Welfare	Basic First Aid Kits, life Saving Animal, Vaccination, Face Masks, Gloves, Water Sterilization Tablets, Body Bags, Bleaching Powder, Dignity/Sanitary Kits, Soaps/Sanitizers, Repellents, Stretchers
5.	CII, ASSOCHAM, ORCS, FICCI	Solar Lantern, Solar Mobile Phone Battery Chargers, Solar Resources Torches
6.	Indian Red Cross Society	Ground Sheet / Durrie, Plastic Sheets, Rain Capes
7.	NDRF and FICCI	Tents, Tarpaulin

BIBLIOGRAPHY

- Aichi Prefecture Website. (2013). Prefecture's Supports to the 2011 Great East Japan Earthquake and Tsunami <<http://www.pref.aichi.jp/saigaijoho/>>.
- AK Singh, 1 (2016). Disaster and Tsunami Management ISBN.
- Alessandra Cozzolino (2012). Humanitarian Logistics: Cross- Sector Cooperation in Disaster Relief Management
- Animesh Prakash: Distribution Network Design in Relief Chain Management Learnings from the 2008 Kosi Floods, Bihar, India
- Arminas D (2005) Supply lessons of tsunami aid, Supply Management, Vol. 10, No. 2, p. 14.
- Arshad Mehmood Malik: Integrated Logistics Systems in Disasters
- Arun Sahdeo: Government Response System and Challenges of Managing Disaster Logistics in India
- Bahan, N. (2016). Disaster Management and the Role of Armed Forces. Research paper, Lucknow university
- Beamon B and Kotleba S. (2006) Inventory management support systems for emergency humanitarian relief operations in South Sudani, International Journal of Logistics Management, Vol. 17. No. 2, pp. 187-212.
- Benini A, Conley C, Dittimore B, Waksman Z. (2006) Survivor needs or logistical convenience? Factors shaping decisions to deliver relief to earthquake-affected communities. Pakistan, 2005- 06.
- Bilham. The 1737 Calcutta Earthquake and Cyclone Evaluated, Bull. Seism. Soc. Amer. 84(5), 1650-1657, 1994
- Bonney J (2003). The ultimate logistics challengell, The Journal of Commerce, December 8, p.1
- Brig K S Gulia (2004). Geneses of Disaster: Ramifications and Ameliorations (Delhi: Kalpaz Publications)
- CAG (2013). Report No. 5 of 2013- Performance Audit of Civil Disaster Preparedness in India of Union Government. Ministry of Home Affairs New Delhi: CAG.

- CAG (2017). Disaster Management of Report No 4 of 2017 Performance Audit of Flood Management and Response New Delhi: CAG. Chand, D. (2010). Armed Forces Response Plan to Disaster. [CENTRE FOR LAND WARFARE S STUDIES](#), 117.
- Chaikin D. (2003) Towards improved logistics challenges and questions for logisticians and managers!, Forced Migration Review, No. 18, p. 10.
- Charudatta Pendse: Challenges in Procurement, Packaging, Stocking: A Case Study form Kosi Floods - 2008
- Christopher M. (2005). Logistics and supply chain management Creating value adding networks. London: Prentice Hall
- Christoplos I. (2006) Links between relief, rehabilitation and development in the tsunami response. Tsunami Evaluation Coalition, London.
- Church's Auxiliary for Social Action. 2000. Report on Orissa Cyclone: Relief and Rehabilitation Intervention, Occasional paper presented in a meeting at Bhubaneswar organized on 13.4.2000 by SDC, New Delhi.
- CLAWS (2014) DISASTER MANAGEMENT: INTEGRATED RESPONSE STRATEGIES New Delhi: CLAWS.
- Commision, P. (2006). Report on Working Group on Disaster Management for the Eleventh Five Year Plan (2007-12). New Delhi: Gol
- CWC. (2007). Water Data Complete 2005 and Central Water Commission New Delhi: Central Water Commission.
- CWC. (2018) STUDY REPORT Kerala Floods 2018 New Delhi: Central WaterCommission Hydrology Directorate.
- [the cycloneeyelone](#) affected Fishermen, F & ARD, Govt. of Orissa.
- Dagur, C. O. (2008). Armed Forces in Disaster Management. New Delhi: Centre for Land Warfare Studies.
- Dangi, H. (2014). Disaster Management: Humanitarian Logistics in Relief Operations. Index International.
- Davesar, R. (2018, December 11). The Pioneer. Retrieved February 04, 2023, from The daily pioneer: <https://www.dailypioneer.com/2018/columnists/disaster-management-a-distant-dream.html>

- Defence Staff.
- Dhara, S. 2000. Death ~~Foretold~~~~Foretolds~~. Down to Earth. April 30,2000
- Disaster Management Status Report 2004, Ministry of Home Affairs, Govt of India, New Delhi.
- Disasters, C. f. (2018). 2018 EXTREME WEATHER EVENTS AFFECTED 60 MILLION PEOPLE Geneva: UNISDR
- Dr R J Yadav (2011) Disaster Management in India: Acts, Policies and Guidelines-vol I
- Dr S L Goel (2007) Disaster Administration and Management Test and case studies (New Delhi: Deep and Deep Publications Pvt Ltd).
- Dr VK Sethi (2006) Disaster Management.
- EM-DAT (2011) - The OFDA/CRED international disaster database, <http://www.emdat.be/database>.
- Federal earthquake Management authority (FEMA) Strategic Plan 2008-2013 <http://www.fema.gov/about/strategicplanfy08.shtm>
- FEMA. (2019, January 30), FEMA About the Agency Retrieved February 22, 2023, from www.fema.gov: <https://www.fema.gov/about-agency>
- Gandhi, P. J. (2007). Disaster Mitigation and Management New Delhi. Deep and Deep Publications.
- Gaurav Tyagi & Ankit Kaushal: Integrated Logistics Systems for Disasters-Strategic Planning and Lessons to Learn
- Gautam, S. H. (2012). Reassessing India's Disaster Management Preparedness and Role of Armed Forces New Delhi: IDSA.
- George Waber (1998). World Disaster Report (Oxford University Press-1998)
- Ghalavand, A. P. ((2014)). Disaster Management and Strategies. ISBN
- Gol. (2001). Manual of Disaster Management in India. New Delhi: NDM Division Ministry of Agriculture.
- Govt. of India. 1980. Report of the National Commission on Floods, Ministry of Irrigation & Energy, Govt. of India.
- Govt. of Orissa. 1980. Orissa Relief Code: Cyclone Plan for a Coastal Area in Orissa, Appendix - XIV, 215-225.

- -1995, Statistical Hand-Book of the cyclone affected districts, P&C Department, Govt. of Orissa.
- -1999. Memorandum on Damage caused by the Super Cyclone of Rare Severity in Orissa, Revenue Department, Govt. of Orissa.
- --2000, Memorandum on Damage caused by the Super Cyclone of Rare Severity in Orissa, Revenue Department, Annex-VIII & IX, Govt. of Orissa
- --2000. Relief and Rehabilitation in Orissa. Presented ~~in a meeting~~ [in a meeting](#) on Orissa Rehabilitation, organized by SDC New Delhi, on 13.4.2000, at Bhubaneswar.
- -2001. A Note on the Disbursement of Financial Assistance on Boats and Nets to the
- -2002. Disaster Management with special reference to Super Cyclone, Drought and Flood in Orissa State Development Report, published by Government of Orissa and NKC Center for Development Studies, Bhubaneswar.
- Goyet CV and Morinière L C. (2006) The role of needs assessment in the tsunami response. Published by the Tsunami Evaluation Coalition (TEC)- July 2006.
- Gujarat Earthquake Recovery Program- Assessment Report, A Joint Report by the World Bank and the Asian Development Bank to the Governments of Gujarat and India, March 14, 2001
- Gujarat Emergency Earthquake Reconstruction Project- After 700 Days- December 2002, Gujarat State Disaster Management Authority, Government of Gujarat
- Gujarat Emergency Earthquake Reconstruction Project Quarterly Progress Report, July-September 2003, Gujarat State Disaster Management Authority, Government of Gujarat
- Hamedi M, Haghani A and Yang S. (2012) Reliable transportation of humanitarian supplies in disaster response: model and heuristic, Procedia-Social and Behavioral Sciences, 54, 1205- 1219.
- Hanaoka S. (2013) Literature Review of Humanitarian Logistics Problems and Issues in the Great East Japan Earthquake. Japan Logistics Society, No. 21, pp. 373-376
- Hari Krishna Organizational Contingency Planning: for Efficient Supply Chain Management in Disasters Oxfam International Experience

- Healslip G, Mangan J & Lalwani C. (2010) Modeling a Humanitarian Supply Chain Using the Structured Analysis and Design Technique (SADT). University of Hull Logistics Institute.UK.
- Holguin-Veras J. (2011) Humanitarian Logistics Structures: Field Investigation on their Comparative Performance and Implications for the US.
- Home Affairs MHA. (2017). Disaster Management [Division](#) MHA. Retrieved February 04, 2023, from Disaster Management [Division](#) MHA: <http://www.ndmindia.nic.in/constitution>
- IDS, H. (2009). Armed Forces Response Plan New Delhi: Headquartes Integrated
- IFRC-Choreographer of Disaster Management-The Gujarat Earthquake
- INSARAG (2017, July 01), NATIONAL ACCREDITATION PROCESS. Retrieved February 22, 2023, from www.insarag.org: <https://www.insarag.org/capacity-building/national-guidelines>
- International Seminar on "Disaster Preparedness and Mitigation", 21-23 November 2002, JOINTLY ORGANISED BY Government of India (GoI) and United Nations Development Programme (UNDP) and Confederation of Indian Industry [CII]-A Concept Note
- J Radhakrishnan: Experiences in Logistics in the Aftermath of Tsunami in Nagapattinam District
- James H. Henderson (2007) Logistics In Support Of Disaster Relief
- Japan Institute of Logistics System. (2012) Logistics System, Vol. 21.
- Japan, C. O. (2015). White Paper on Disaster Management in Japan Tokyo: Japan Governement
- Japan, C. O. (Disaster Management in Japan). Disaster Management Tokyo: Cabinet Office.
- John Hannigan (2012) Disaster without Borders: The International Politics of Natural Disaster (Cambridge UK: Polity Press, Main Street Cambridge)
- John Hannigan (2012). Disasters with Borders-The international politics of natural disasters.
- Juha 1 Uitto, R. S. (2016). Sustainable Development and Disaster Risk Reduction, Kyoto.Springer.

- Kapur, A. (2010). *Vulnerable India 4 Geographical Study of Disasters*. New Delhi: Sage Publications.
- Keelery, S. (2018, August 28). The Statistics Portal. Retrieved February 05, 2023, from [www.statista.com: https://www.statista.com/chart/15242/key-data-regarding-the-severe-flooding-in-the-indian-state-of-kerala](https://www.statista.com/chart/15242/key-data-regarding-the-severe-flooding-in-the-indian-state-of-kerala)
- Kovacs G & Spens K M. (2009) Identifying challenges in humanitarian logistics. *International Journal of Physical Distribution & Logistics Management*, 39(6), 506-528
- Kovacs G and Spens K (2007) Humanitarian Logistics in Disaster Relief Operations. *International Journal of Physical Distribution & Logistics Management* 2007, 37(2): 99-114.
- Krishna S. Vatsa, The Bhuj Earthquake, District of Kutch, State of Gujarat (India), January 26, 2001-A Reconnaissance Report - Identification of Priority Issues, Prepared for DRM-World Institute for Disaster Risk Management, March 16, 2001
- Kristianto Y, Gunasekaran A., Helo, P and Hao Y. (2014), A model of resilient supply chain network design: a two-stage programming with fuzzy shortest path. *Expert Systems with Applications*, 41(1),39-49.
- Lessons from Recent Indian Earthquakes- Editorial as Guest Editor of Special Issue on Earthquakes in India, *Indian Concrete Journal* Vol. 72, No. 11 November 1998 Sudhir K. Jain, Department of Civil Engineering, Indian Institute of Technology Kanpur
- Lt. Gen. S S Sengupta: Forging Synergy between Armed Forces, Civil and Commercial Organisations for Humanitarian Logistics
- M. Perry, Natural disaster management planning: A study of logistics managers responding to the tsunami, *International Journal of Physical Distribution & Logistics Management*, 37, 5. (2007), 409-433.
- Maon, F Lindgreen A & Vanhamme J (2009). Developing supply chains in disaster relief operations through cross-sector socially oriented collaborations: a theoretical model. *Supply Chain Management: An International Journal*, 14(2), 149-164.
- MHA. (2005). *National Disaster Management Act 2005* New Delhi: MHA.
- MHA. (2011). *Disaster Management in India* new Delhi: MHA Gol
- MHA. (2013). *Task Force Report on Review of DM Act 2005*. New Delhi: Ministry of

- Mohanty, M. 1999, Declare Orissa Super Cyclone as a National Calamity of Rare Severity. Occasional Note. presented at a Seminar on the Super Cyclone in Orissa organised by Orissa Gaveshana Chakra, 22.11.99, Bhubaneswar.
- Moore, D M and Antill P D (2000) Contractor Logistic Support Privatising the tail to pay for the tooth: Global Logistics for the New Millennium, 272-278.
- Najafi M, Eshghi K and Dullaert W (2013). A n robust optimization model for logistics planning in the earthquake response phase, Transportation Research Part E: Logistics and Transportation Review, 49(1), 217-249.
- Nano Seeber et al, Field observations bearing on the genesis of the January 26, 2001 Republic Day Earthquake of India resulting from a field survey of the epicentral region by NSF-SCEC Team
- NDMA (2009) National Policy on Disaster Management 2009 New Delhi: Ministry of Home Affairs
- NDMA (2016) National Disaster Management Plan New Delhi: NDMA
- NDMA (2018) Kerala Floods. Aapda Samad September is, 10.
- NDMA. (2018) NDMP-2018-Revised-Draft New Delhi: NDMA
- NDRE (2018, Aug 211 NDRF Retrieved February 25, 2023, from ndrf.gov.in: <http://ndrf.gov.in/pressrelease/ndef-saved-535-lives-and-evacuated-more-24600-marooned-people-flood-hit-kerala>
- NDRF (2018) Message from DG NDRF. The Saviour Jul-Sep 2018, 32
- NDRF (2018, November 05). National Disaster Response Force, Retrieved February 15, 2023, from ndrf gov.in: <http://www.ndef.gov.in/operations/kerala-floods-2018>
- NDRF (2019, February (2), nf gov in. Retrieved February 02, 2023, from National disaster Response Force: <http://www.ndrf.gov.in/about-us> OGATA, T. (2016). Disaster Management in Japan. Japanes Medical Association Journal, 30
- NEERI, 1999. Report on Acquaculture, Submitted to Supreme Court.
- ODMM, 2000. Super Cyclone and Rehabilitation, Occasional paper presented in 'Orissa Rehabilitation organised by SDC, New Delhi, at Bhubaneswar on 13.04.2000.
- Oloruntoba R. and Gray R. (2006) Humanitarian aid: an agile supply chain? Supply Chain Management, Vol. 11 No. 2, pp. 115- 20.

- Panda, R. (2012), Japan's Disaster Response Management: Lessons for the World. *Journal of Defence Studies*, 18 PIB. (2017) *Seismic Zones* New Delhi: Ministry of Earth Science.
- Panigrahi, N. 2000. Super Cyclone of Orissa: Role of Welfare Agencies in Relief, Rehabilitation and Reconstruction. Occasional Paper No-51, NKC Center for Development Studies, Bhubaneswar.
- Peter Tatham and Martin Christopher (2014) *Humanitarian Logistics: Meeting the Challenge of Preparing for and Responding to Disasters*
- PIB. (2018, August 18) Press Information Bureau Retrieved February 20, 2023, from <http://pib.nic.in/newsite/PrintRelease.aspx?relid=181944>
- PIB. (2018, August 23), Press Bureau of India Retrieved February 24, 2023, from <http://pib.nic.in/newsite/PrintRelease.aspx?relid=182031>
- PIB. (2018, August 24). Press Information Bureau Retrieved February 20, 2023, from <http://pib.nic.in/PressReleaselframePage.aspx?PRID=1543908>
- PIB. (2019, February 04). Press Bureau of India Retrieved February 05, 2023, from <http://www.pib.nic.in/Pressreleaseshare.aspx?PRID=1562584>
- Prasad, K. 1999. Orissa Cyclone and Disaster Management. *Mainstream*, Annual Number, 1999.
- Raj, A. (2008). ARMED FORCES IN DISASTER RESPONSE: ROLE REAPPRAISAL *CLAWS Journal*, 182
- Rajya Sabha 1998. Question No- 1242, Dt.10.12.1998.
- Reliefweb.(2011. April 13) *Japan Earthquake and Tsunami Update Wednesday Assistance, Center for Excellence in Disaster Management and Humanitarian*, (reliefweb) <https://reliefweb.int/report/japan/japan-earthquake-and-tsunami-update-wednesday-april-13-2011>
- S. Pettit & A Beresford: Critical success factors in the context of humanitarian aid supply chains, *International Journal of Physical Distribution & Logistics Management*, 39, 6, (2009), 450-468.
- Sahani, P. (2003). *Disaster Risk Reduction in South Asia*. New Delhi: Prentice Hall of India.

- Saleem. S. (2018, October 02) graphoverflow.com. Retrieved February 05, 2023, from graphoverflow.com: <https://graphoverflow.com/graphs/kerala-flood-2018.html>
- Samal, K.C., Meher, S., Panigrahi, N. 2002. Beyond Relief: Disaster Mitigation, Livelihood rehabilitation and the Post-Cyclone recovery in Orissa, Funded by ODI, London, NKC Center for Development Studies, Bhubaneswar.
- Saya, S. (2017, May 17). Japan's International Cooperation on DRR Mainstreaming DRR in International Societies Open image in new window Retrieved February 13, 2023, from pringer Link: https://link.springer.com/chapter/10.1007/978-3-319-59469-9_14
- Security, D. o. (2019, January 30). Careers at FEMA Retrieved February 22, 2023, from careers fema, gov: <https://careers.fema.gov/fema-corps>
- Sharma, V. K. (2013). Disaster Management New Delhi: Medtech.
- Sheu J B (2007b), Challenges of emergency logistics management, Transportation Research Part E Logistics and Transportation Review, 43(6), 655-659
- Shiva, V and Emani, A. 2000. Climate Change, Deforestation & The Orissa Super Cyclone, Research Foundation for Science, Technology & Ecology, New Delhi.
- Singh, D. (2016). Disaster Management in India and the Role of Armed Forces. Research Paper. Merrut University
- Singh, J. (2007). Disaster Management: Future Challenges and Opportunities. ISBN
- Sinha, P. C. (2006). Disaster Vulnerabilities and Risks New Delhi: SBS Publishers and Distributers.
- Smilowitz K & Dolinskaya I. (2011) Decision making tools for distribution networks in disaster relief. Center for the Commercialization of Innovative Transportation Technologies Northwestern University.
- Soumitra Roy (2004) Natural Disaster Management- a case study of Tornado
- Swain, M and Panigrahi, N. 2001. Impact of Super Cyclone on the Life and Livelihood of the Women: A Study in two Coastal Districts of Orissa, Internal Project. NKC Center for Development Studies, Bhubaneswar.
- Swain, S, 2000. Women in Orissa: The Pre-and-Post-Cyclone Scenario. in Health for the Millions, New Delhi. 25-6.

- Tatham P & Houghton L (2011) The wicked problem of humanitarian logistics and disaster relief aid. *Journal of Humanitarian, Logistics and Supply Chain Management*, Vol. 1 No. 1, pp. 15-31.
- Telford J and Cosgrave J. (2006) Joint evaluation of the international response to the Indian Ocean tsunami: Synthesis Report. Published by the Tsunami Evaluation Coalition (TEC) London, July 2006.
- Thakur Shailendra Nath (2012) *Environmental Disaster and Management* (New Delhi Manas Publications)
- Thomas A S. (2003) *Humanitarian Logistics: Enabling Disaster Response*. Fritz Institute.
- Thomas A S. and Kopczak L.R. (2005) *From Logistics to Supply Chain Management: The Path Forward in the Humanitarian Sector*. Fritz Institute
- Tony Wild (2001): *Best Practice in Inventory Management* (Oxford: Butterworth-Heinemann, Linacre House, Jordan Hill Oxford)
- United Nation Development Program (UNDP) 2006. *Logistics: Disaster Management training program*. 1st ed. UNDP, NY
- V Thiruppugazh: *Logistics and Supply Chain Management in Disaster Relief: Responsibilities and Challenges of Government A Case Study of Post-Earthquake. Relief in Gujarat*
- Van Wassenhove L N (2006) Blakett Memorial Lecture Humanitarian aid logistics: supply chain management in high gear. *Journal of the Operational Research Society* 57(5): 475- 489.
- Vasileios Zeimpekis, Soumia Ichoua Ioannis Minis(2013), *Humanitarian and Relief Logistics: Research Issues, Case Studies and Future Trends*
- Vivek Deolankar (2010) *Disaster Management Strategies A Global Perspective* (New Delhi Commonwealth Publishers Pvt Ltd)
- Voluntary Health Association of India, 1999. *VHAI Highlights: Aparajita, in Health for the Millions*, Nov-Dec 1999, 25-6.
- World Health Organization (2011) *The Great East Japan Earthquake: A story of a devastating natural disaster, a tale of human compassion*. 11 March 2011 WHO Western Pacific Region Publication.

