

Evaluating the Effectiveness of Disaster Response in India: Identifying Areas for Improvement

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Abstract

Considering the large geographical landmass of India along with cultural diversity, an exercise to understand issues impacting disaster response apparatus in India is very necessary. Listing out these issues and understanding the root cause of these issues, disasters, both natural and man-made, have been a recurrent phenomenon in India. The country has been experiencing floods, earthquakes, cyclones and other disasters for years and each event has posed new challenges and issues to the Nation's disaster response system. Even though India has made strides in the management of natural disasters, there are still many substantial obstacles and problems that need to be resolved. One of the main challenges is the lack of coordination and communication between different agencies involved in disaster response. There is a pressing need for a disaster management strategy that is more integrated and combines all stakeholders and leverages technology to improve communication and coordination.

Another challenge is the limited availability of resources and funding for disaster response. Many people are not aware of the risks they face and are not prepared to respond to emergencies. To enhance preparedness and reaction times, there is a pressing need for more education and awareness initiatives. The present study is primarily focused on finding out the response available within the system and its impact. suggestions, if any to improvise the system.

Keywords: Disaster management, Incident Response System, Emergency operation, Natural hazard, Mock drill

Introduction

Disaster Incident Response System is a crucial element of disaster management and its effectiveness depends on the preparedness, coordination and response of all stakeholders involved. It involves a set of processes, procedures and resources that are put in place to respond to and manage the effects of a disaster. The incident response system (IRS) is an effective instrument for reducing the need for ad-hoc responses.

The plan calls for a cross-departmental team to respond to any potential emergency. The IRS allocates officers to specific tasks and provides them with sufficient instructions

to carry out their duties. IRS can be used to study past mistakes and improve on them to cope with future disasters. There are various response systems followed by many countries as per their weather, geological structure, atmospheric conditions and resources. In the USA, there are National Incident Management Systems that aim to have a standardized approach to incident management. (NIMS Homel and Security)². This guide incorporates incident management methodologies and best practices.

How to plan and execute operations during any incidents? In Russia, the Ministry for Civil Defense, Emergency Situations and Elimination of the Consequences of Natural Disasters (EMERCOM) is the organization in charge of civil emergency services. They develop plans and schemes within their framework. They organize training and have a rapid response operations force of about 30 units spread throughout various republics, regions and provinces⁶. In Japan, the Japan Disaster Relief Team (JRD) dates back to 1970. Apart from JRD teams, the Japanese Red Cross Society (JRCS) is an approved organization to deal with Disaster Countermeasures. Japan also boasts of sophisticated early warning system³.

Indonesia has National Agency for Disaster Management (BNPB). Bangladesh has National Earthquake Contingency Plan. The purpose of preparedness is to give responders more time to plan and perform emergency measures in the case of a catastrophe. Colombia has a plan called National Contingency Plan. Georgia plan is called "The Georgia Emergency Operations Plan" which considers a prediction of urgent requirements and locates the means to satisfy those demands. Tanzania has a plan called Tanzania Emergency Preparedness and Response Plan. The Disaster Incident Response System (IRS) in India is a unique and effective mechanism for reducing ad-hoc measures in disaster response in India⁴.

It has validity throughout India¹. It aims to deliver an effective, efficient and comprehensive management of disasters in India. It is a structured response synchronizing various stakeholders into teams and delivering a coordinated response when needed the most.

Material and Methods

India is one of the most disaster-prone nations on the planet due to its geographical location and extremely high socioeconomic vulnerability. 58.6% of the territory is susceptible to earthquakes, 12% of the territory is susceptible to flooding and 5,700 kilometers of the 7516 kilometers of coastline are susceptible to cyclones.

Over the course of the past three decades, the nation has been struck by approximately 431 severe disasters, each of which has resulted in significant loss of life as well as property. The 1999 Super Cyclone of Orissa and the 2001 Bhuj earthquake are still in the memories of the people of India. Twelve out of thirteen districts in Uttarakhand got affected due to the flash floods from 16 to 17 June 2013 with a reported death toll of 1000. About 75000 pilgrims were stranded due to landslides and flash floods in Kedarnath itself and many were missing⁵. Between the end of July and the beginning of August 2015, widespread floods and the forced relocation of people were the direct results of heavy rains in a number of locations around the country. There were total 293 fatalities across the country as a result of the flooding, around a million people were forced to seek refuge in relief camps and 13.7 million people were affected by the flooding. Assam, Gujarat, Madhya Pradesh, Manipur, Odisha, Rajasthan and West Bengal are some of the States that have been most severely impacted.

India has a National Disaster Management Authority (NDMA)⁴ and State Disaster Management Authorities (SDMAs) to coordinate disaster response. The NDMA⁴ provides policy guidelines and resources to the SDMAs which are responsible for implementing disaster management plans at the State level. India also has a network of specialized disaster response teams, including the National Disaster Response Force (NDRF) and State Disaster Response Forces (SDRFs), which are trained and

equipped to respond to disasters. The current NDRF force is 16 Battalions (12 in operation and 4 in Training). Each NDRF Bn contains 1149 personnel. Each of the 12 operational battalions is dispersed throughout India. The NDRF has conducted over 73 operations across the nation's territory and saved approximately 1,300,000 lives.

In addition, the NDRF can respond to nuclear, biological and chemical emergencies. Over the past 20 years, the NDRF has carried out numerous rescue missions across the country. The details of rescue missions by NDRF for different disasters are presented in figure 1. Hazard maps play a crucial role in deploying disaster response forces in suitable locations. They provide essential information about potential hazards, areas that are at risk and help in planning and preparation for disasters. By using hazard maps, response forces can be more effective and efficient in their efforts to mitigate the impact of disasters and protect the affected population. The present study aimed to review and analyze the existing disaster response issues and challenges in India.

The details on various hazard maps like earthquake hazard, landslide hazard, cyclone hazard, flood hazard, thunderstorm incidence etc. were collected and collated to understand the hazard proneness of the Country in connection with incident response system. The details on location of National Disaster Response Force and its recent activities on response to various disasters are collected and analyzed for the response time and shortest route etc.

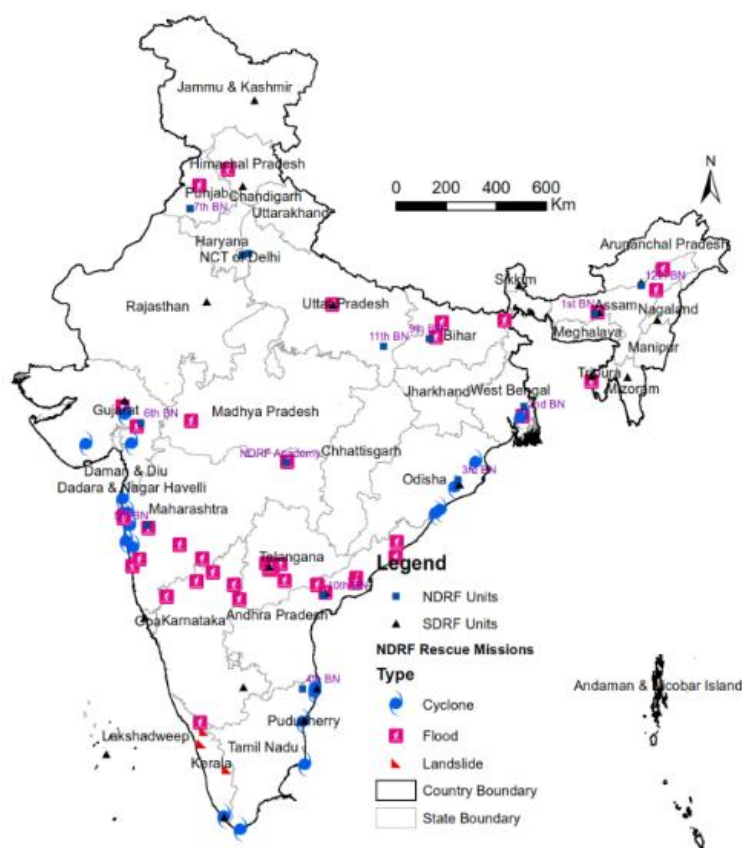


Figure 1: Map showing the NDRF rescue mission in India for different disasters

The present study will be a useful tool to enhance the response time for a multi hazard approach for India using scientific study. This study can be utilized as firsthand information to the different National Disaster Response Force (NDRF) battalions and State Disaster Response Force (SDRF) officials in connection with a quick decision on making on planning their future camps in disaster prone areas of India.

Results and Discussion

National Disaster Response Force team provided medical aid, rescue missions and logistical support in the affected areas. Even while earthquakes and tsunamis do not happen very often, they can have a significant effect when they do. Looking back, we may identify floods, cyclones, landslides, earthquakes, tsunamis and abnormal weather as India's most devastating natural calamities. Considering the conditions, priority survey areas were selected to identify gaps and analyze the present conditions of disaster management at the India level shown in table 1 and figure 2.

Over the last 100 years, the Indian subcontinent has experienced numerous cyclones with varying intensities and impacts. The Indian subcontinent is highly vulnerable to cyclones, with an average of five cyclones per year. The frequency of cyclones has been consistent over the last 100 years, with some years experiencing more cyclones than

others. Cyclones that have impacted the Indian subcontinent in the last century have ranged from mild to extremely severe. The intensity of cyclones has been increasing in recent years, with severe cyclones such as Cyclone Fani and Cyclone Amphan causing significant damage and loss of life. These have a significant impact on the economy of the Indian subcontinent, particularly in the coastal areas. The damage caused by cyclones can lead to loss of infrastructure, crops and property affecting the livelihoods of people in the affected regions.

Table 1
Natural disaster events in India

Year	No. of Events
2011	10
2012	5
2013	10
2014	8
2015	6
2016	10
2017	10
2018	14
2019	12
2020	9
2021	10

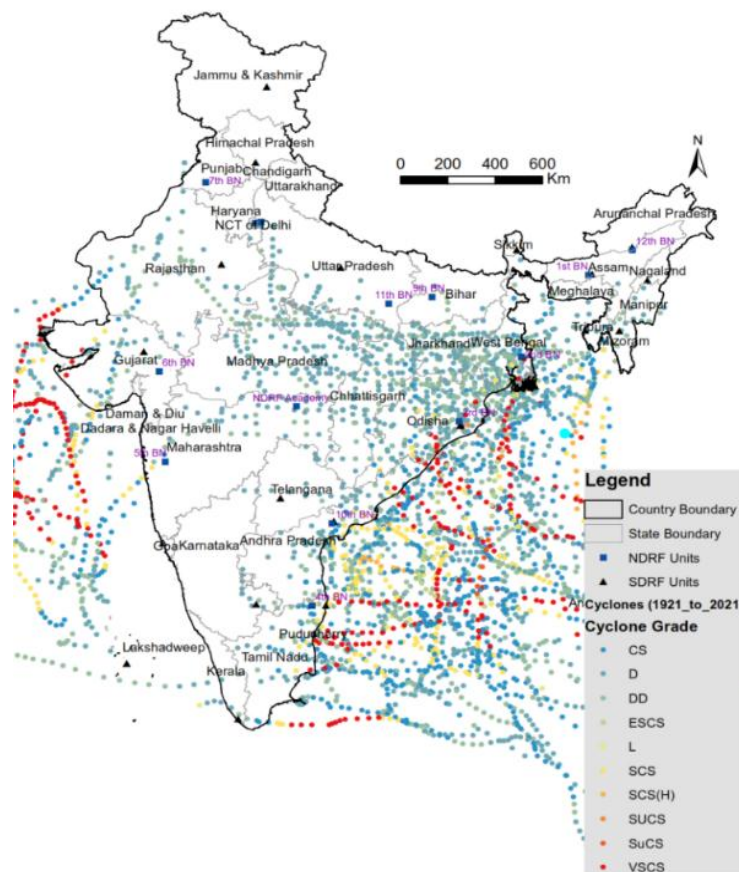


Figure 2: Map Showing occurrence of earthquakes, landslide incidences and 100 years aggregated flood areas of India

Over the last century, the Indian government and various organizations have worked to improve their preparedness and response to cyclones. The early warning systems, evacuation procedures and relief measures have significantly improved, reducing the loss of life and damage caused by cyclones. Also there is evidence to suggest that climate change is contributing to the increased frequency and intensity of cyclones in the Indian subcontinent.

The warming of the Indian Ocean is thought to be a contributing factor, which can lead to the formation of more powerful cyclones. The track of cyclones and their severity from the year 1921 to 2021 are presented in figure 3. Cyclones were identified once during the period of 2011 to 2021. Consideration of the above-mentioned disaster as table 1 gives the details of the nature of disaster around India. Numbers of cyclones were counted all around the Bay of Bengal and the Arabian Sea shown in table 2.

The different categories of cyclones that occurred in total between 2011 to 2021 in India are presented in figure 3. Maximum number of Cyclone 10 was present in the year of 2017 and 2018 in the Bay of Bengal. Maximum number of cyclone 8 was present in the year of 2019 in Arabian Sea (Figure 4).

Deploying a disaster response force based on a multi-hazard map requires careful planning, coordination and training. By

following these steps, the response force can be better prepared to respond to disasters and minimize the impact on the affected population. A multi-hazard map is a map that shows the areas that are vulnerable to different types of hazards such as floods, earthquakes, landslides etc. This map can be developed using data from various sources such as satellite imagery, weather forecasts and geological surveys.

Once the multi-hazard map is developed, it is important to determine the level of risk in each area. This can be done by considering factors such as the likelihood of a hazard occurring, the severity of the hazard and the vulnerability of the population.

Based on the level of risk, determine the type and number of response forces that will be needed to respond to the hazard. For example, if an area is at high risk of flooding, a team of rescue workers, boats and other necessary equipment may be required. An emergency response plan is a detailed plan that outlines the steps that will be taken in the event of a disaster. This plan should include information on how the response force will be deployed, how the affected population will be evacuated and how the response force will coordinate with other agencies and organizations.

Once the emergency response plan is developed, the response force must be trained to ensure that they are prepared to respond to the hazard.

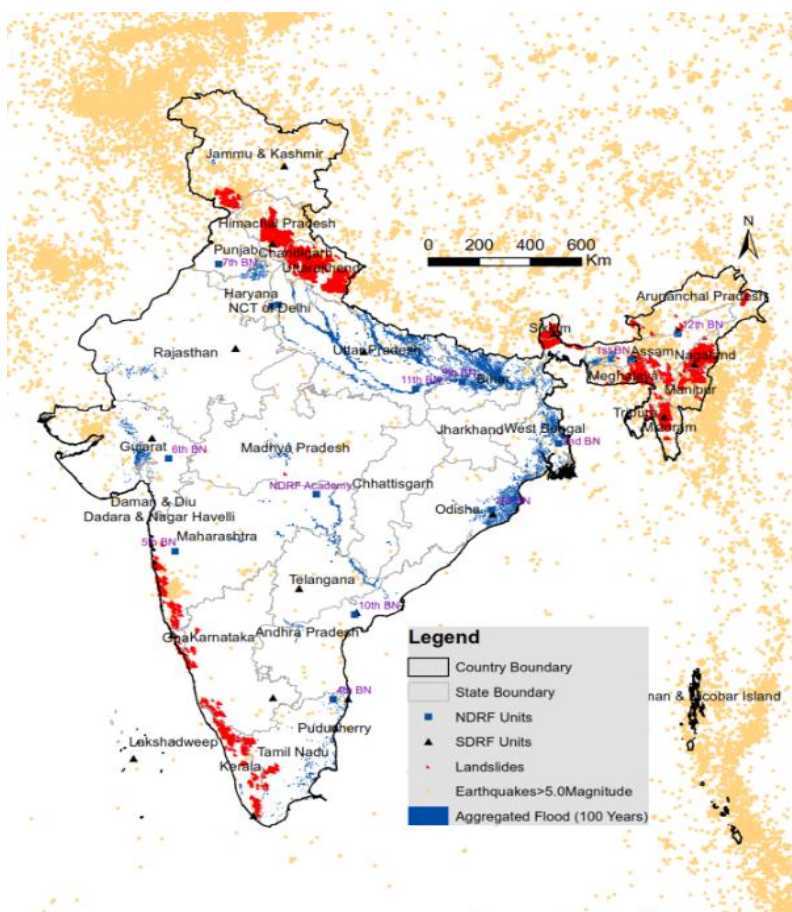


Figure 3: Map showing the track of cyclones and their severity from the year 1921 to 2021

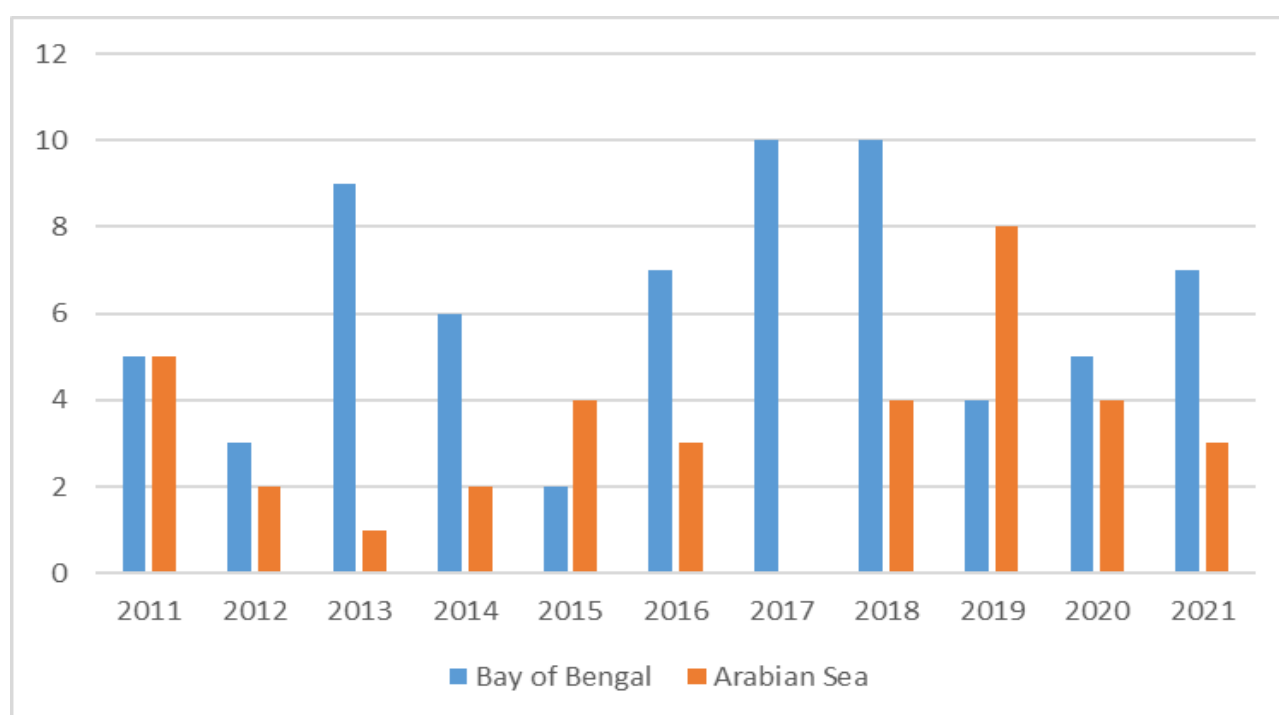


Figure 4: Comparison of number of cyclones occurrences in Bay of Bengal and Arabian Sea

Table 2
No of cyclones in Bay of Bengal and Arabian Sea

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Bay of Bengal	5	3	9	6	2	7	10	10	4	5	7
Arabian Sea	5	2	1	2	4	3	0	4	8	4	3

This training should include drills and simulations to help the response force practice their skills and improve their readiness. After the response force is deployed, it is important to monitor their activities and evaluate the effectiveness of the response. This will help to identify areas for improvement and ensure that the response force is better prepared for future disasters.

Conclusion

The present study discusses the challenges faced by India's disaster response system including the lack of coordination and communication between different agencies, limited resources and funding, lack of public awareness and preparedness and socio-economic and political issues. These challenges have been caused by factors such as urbanization, population growth and climate change. Deploying a disaster response force without hazard maps can be challenging and risky. Hazard maps are critical in identifying areas that are vulnerable to natural disasters such as cyclones, floods, earthquakes and landslides. Without hazard maps, it is difficult to determine the areas that require immediate attention during a disaster.

Disaster response forces may be deployed in areas that are not vulnerable, while areas that require urgent assistance, may be left unattended. This can result in a delay in providing relief and rescue operations, leading to increased

loss of life and property. In addition, without hazard maps, it is challenging to plan and prepare for potential disasters, making it difficult to allocate resources and develop effective response strategies. Therefore, it is essential to have accurate and up-to-date hazard maps to guide disaster response efforts and to minimize the impact of natural disasters.

Improving India's disaster response system requires a multi-faceted approach. Here are some suggestions to enhance the system:

1. Strengthen coordination and communication: (i) Develop an integrated approach to disaster management that involves all stakeholders (ii) Establish effective communication channels between different agencies involved in disaster response and (iii) Use technology to improve communication and coordination, such as developing a common platform for sharing information and real-time data.

2. Enhance public awareness and education: (i) Develop and implement public awareness campaigns to improve disaster preparedness (ii) Integrate disaster management education into school curriculums and (iii) Utilize social media and other communication channels to reach a wider audience.

3. Focus on prevention and mitigation strategies: (i) Develop and implement early warning systems for natural disasters (ii) Conduct vulnerability assessments to identify areas at high risk of disasters and (iii) Implement measures to reduce vulnerability such as building codes and land-use planning.

The key to improving India's disaster response system is to adopt a comprehensive and multi-disciplinary approach. It needs the help of everyone including the Government, the business world, civil society and surrounding areas. By addressing the challenges and issues faced by the current system, India can build a more effective disaster response system that can protect its citizens and minimize the impact of disasters.

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References

1. DM Act 2005, The Disaster Management Act, New Delhi, 30 (2005)
2. FIAPG, Federal Emergency Management Authority (FEMA) Incident Action Planning Guide 2012, 68 (2012)
3. JICA, <http://www.jica.go.jp>, accessed on 18th April 2023 (2023)
4. NDMA, <https://ndma.gov.in/en/vulnerability-profile.html>, accessed on 28.03.2019 (2019)
5. Relief Web, <https://reliefweb.int/disaster/fl-2013-000070-ind>, accessed on 28.03.2019 (2019)
6. Timothy and Thomas, EMERCOM: Russia's Emergency Response Team, *Low Intensity Conflict and Law Enforcement*, 4(2), 227-236 (1995).

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