ENHANCING DISASTER RESPONSE THROUGH OPTIMISED CIVIL – INDIAN AIR FORCE COORDINATION: A FRAMEWORK

Dissertation Submitted to the Panjab University, Chandigarh for the award of degree of Master of Arts in Public Administration and Public Policy, in partial fulfillment of the requirement for the Advanced Professional Programme in Public Administration (2024-25)

Submitted by

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INDIAN INSTITUTE OF PUBLIC ADMINISTRATION

NEW DELHI

SELF DECLARATION CERTIFICATE

I, the undersigned hereby declare that the dissertation titled 'Enhancing Disaster Response Through Optimised Civil – Indian Air Force Coordination: A Framework', submitted by me for award of the Degree of **Master of Arts in Public Administration and Public Policy** is original and this work or part thereof has not been submitted for the award of any degree or diploma either in this or any other University. All the sources I have accessed or quoted have been indicated or acknowledged by means of references.

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CERTIFICATE

I have the pleasure to certify that Air Commodore Rajiv Dobhal has pursued his research work and prepared the present dissertation titled 'Enhancing Disaster Response Through Optimised Civil – Indian Air Force Coordination: A Framework' 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 Arts in Public Administration and Public Policy** in partial fulfillment of the requirement for the Advanced Professional Programme in Public Administration (APPPA) on Indian Institute of Public Administration (IIPA), New Delhi.

I recommend that the dissertation of Air Commodore Rajiv Dobhal is worthy of consideration for the award of Master of Arts degree of the Panjab University, Chandigarh.

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ACRONYMS/ABBREVIATIONS

AMCDRR	Asia Ministerial Conference on Disaster Risk Reduction
ASEAN	Association of Southeast Asian Nations
BBB	Build Back Better
CBDP	Community-Based Disaster Preparedness
CBRN	Chemical, Biological, Radiological and Nuclear
CDRI	Coalition for Disaster Resilient Infrastructure
CIMIC	Civil-Military Cooperation
DDMA	District Disaster Management Authority
DM	Disaster Management
DMC	Disaster Management Centre
DRR	Disaster Risk Reduction
EOC	Emergency Operations Centre
EWS	Early Warning System
FEMA	Federal Emergency Management Agency
GDP	Gross Domestic Product
GIS	Geographic Information Systems
GLOF	Glacier Lake Outbursts
GPS	Global Positioning System
HADR	Humanitarian Assistance and Disaster Relief
HFA	Hyogo Framework of Action
HVRA	Hazard, Vulnerability, Risk and Assessment
IFRC	International Federation of Red Cross and Red Crescent

IIPA	Indian Institute of Public Administration
MDGs	Millennium Development Goals
NCDM	National Centre for Disaster Management
NDMA	National Disaster Management Authority
NDMIS	National Disaster Management Information System
NDMP	National Disaster Management Plan
NDRF	National Disaster Response force
NIDM	National Institute of Disaster Management
NIMS	National Incident Management System
NPDM	National Policy on Disaster Management
RCG	Regional Consultative Group
RPA	Remotely Piloted Aircraft
RS	Remote Sensing
SDGs	Sustainable Development Goals
SDMA	State Disaster Management Authority
SDF	Self-Defense Forces
SDRF	State Disaster Response Force
SFDRR	Sendai Framework for Disaster Risk Reduction
SF	Sendai Framework
UDMA	Urban Disaster Management Authority
UN	United Nations
UNDP	United Nations Development Programme
UNISDR/UNDRR	United Nations Office for Disaster Risk Reduction

UNOCHA	UN Office for the Coordination of Humanitarian Affairs
UT	Union Territory
WHO	World Health Organisation

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SUMMARY

India faces frequent natural and man-made disasters that cause significant loss of life, displacement and economic damage. With a diverse geography and high population density, the complexity and scale of these events demand rapid and efficient disaster response mechanisms. The Disaster Management Act, 2005, provides the legal foundation for disaster preparedness, mitigation and response in India, establishing key institutions such as the National Disaster Management Authority (NDMA), State Disaster Management Authorities (SDMAs) and the National Disaster Response Force (NDRF). At the central level, disaster management is coordinated by the Ministry of Home Affairs (MHA), supported by bodies like the National Crisis Management Committee (NCMC) and the Defence Crisis Management Group (DCMG). The Indian Armed Forces, particularly the Indian Air Force (IAF), play a crucial role in disaster response, providing airlift capabilities, search and rescue operations, medical evacuations and logistical support. However, despite this institutional framework, coordination gaps between civil and military agencies often hinder the effectiveness of disaster response, leading to delays, resource mismanagement and operational inefficiencies, limiting the overall impact of disaster relief efforts.

This dissertation explores the critical need for enhancing civil–IAF coordination to improve disaster response in India. It employs a mixed-methods approach, combining qualitative analyses of past disaster operations with quantitative evaluation of operational metrics such as response time, resource allocation efficiency and decision-making processes. Case studies of major disasters, including the Kerala Floods (2018), Uttarakhand floods (2021) and Agartala floods (2024), are analysed to identify systemic

challenges in collaboration, such as communication breakdowns, jurisdictional ambiguities and a lack of unified command structures. In addition, best practices in civil–military coordination from disaster-prone countries such as the United States, Australia and Japan are examined to derive actionable insights.

The study develops an optimised framework for enhancing civil–IAF coordination, focusing on three core areas:-

Streamlined Communication Protocols. Establishing real time, technology driven communication channels to facilitate seamless information sharing between civil and military stakeholders.

Integrated Command Structures. Proposing a unified command model to minimise jurisdictional overlaps and accelerate decision – making during emergencies.

Joint Preparedness Initiatives. Emphasising regular joint training exercises, simulation drills and knowledge – sharing workshops to build trust and operational synergy between civil agencies and the IAF.

The feasibility and potential impact of the proposed framework are validated through interviews with disaster management experts, IAF personnel and policymakers. The framework is further contextualised within India's policy landscape, aligning with the National Disaster Management Plan, the Sendai Framework for Disaster Risk Reduction (SFDRR), the Sustainable Development Goals (SDGs) and PM's Ten Point Agenda on DRR.

The dissertation concludes by offering actionable policy recommendations to institutionalise the proposed framework within India's disaster management system. These include establishing dedicated civil–military disaster coordination cells, revising existing protocols to incorporate joint decision – making and investing in technology to support real time coordination. By addressing the systemic gaps in civil–IAF collaboration, the study seeks to enhance not only the immediate effectiveness of disaster response operations but also the long-term resilience and preparedness of India's disaster management ecosystem.

The findings contribute to the broader discourse on optimising civil–military collaboration in disaster management and offer a scalable model that can be adapted to other sectors and regions. Ultimately, this research aims to bridge the gap between civil and military agencies, ensuring faster, effective and coordinated disaster responses that save lives and mitigate damage.

CHAPTER 1

INTRODUCTION

During disasters, it is natural that our hearts go out to those who are suffering. Relief and rescue take priority and rightly so. Resilience is about how quickly systems can ensure the return of normal life. Resilience is built in the times between one disaster and another. Studying past disasters and learning lessons from them is the way.

Shri Narendra Modi, Prime Minister

Background

India is highly vulnerable to various natural calamities like floods, droughts, cyclones, tsunamis, earthquakes, urban flooding, landslides, avalanches and forest fire due to its unique geo-climatic and socio-economic conditions. As per the Annual Report (2022-23) of the NDMA, 27 out of the 36 States and Union Territories (UTs) are disaster prone. 58.6% of the landmass is prone to earthquakes of moderate to very high intensity and 12% of the land is prone to flood and river erosion. Out of 7,516 km coastline, 5,700 km is prone to cyclones and tsunamis, 68% of the cultivable land is vulnerable to drought, hilly areas are at risk from landslides and avalanches and 15% of the landmass is prone to landslides. A total of 5,161 Urban Local Bodies (ULBs) are prone to urban flooding. Fire incidents, industrial accidents and other manmade disasters involving chemical, biological and radioactive materials are additional hazards, which have underscored the need for strengthening mitigation, preparedness and response measures (NDMA, 2023).

As per the EM-DAT (2024), there were 399 major natural disasters recorded in the year 2023, with 86,473 deaths, 9.31 crore people affected and $ 20,270 crores in economic losses across the world. India was among the 10 hardest hit countries and recorded 1.76% of the total deaths and 4.72% of the total number of people affected. The economic loss was to the tune of ₹ 1 lakh crores (Indian Express, 2025). Looking at the data from 2000 to 2024, India has had 9002 disaster events, affecting nearly 460 crore people and resulting in 14.7 lakh deaths. The economic loss amounted to $ 3.45 lakh crores, which if we adjust for inflation, would be much higher. **The detailed data on various parameters regarding disasters in India during the period 2000 to 2024 is placed at the annexure to this study.**

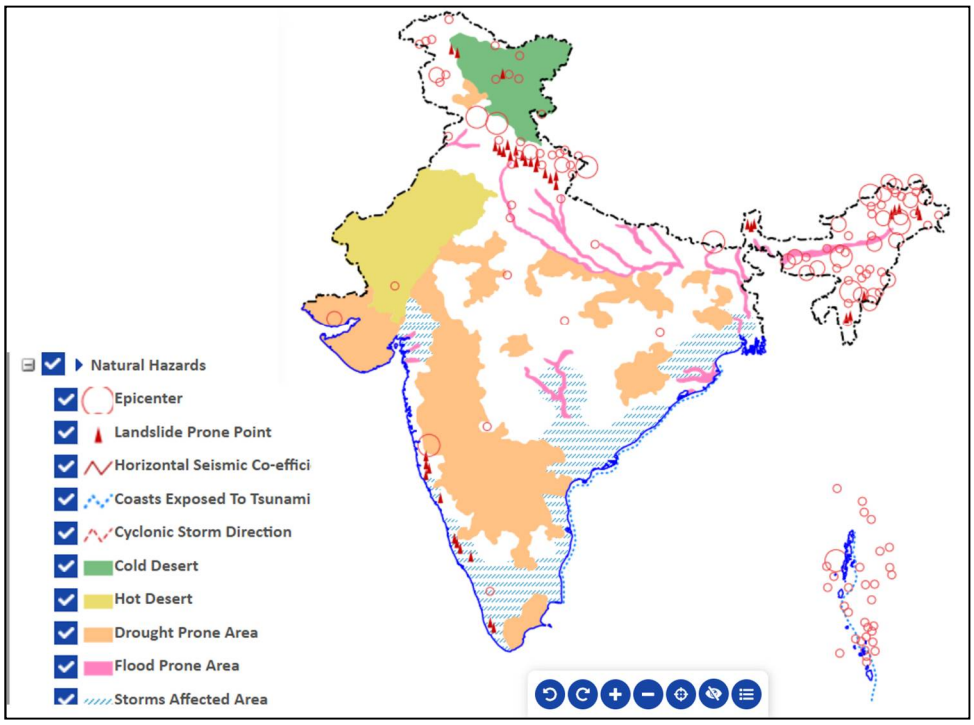

Figure 1: A Composite Hazard Map of India

(Source: National Atlas & Thematic Mapping Organisation: https://geoportal.natmo.gov.in/map.php?id=2)

The IAF has played a crucial role in disaster response operations, utilising its rapid deployment capabilities, aerial mobility and strategic reach to deliver immediate relief during crises. India's vast and varied geography often means that disasters hit remote areas where typical relief efforts struggle due to logistical hurdles. The IAF, equipped with transport aircraft, helicopters and reconnaissance tools, acts as a first responder, providing humanitarian aid, carrying out search and rescue missions and evacuating those in need.

Some notable operations include Operation Rahat for the Uttarakhand floods in 2013, Operation Karuna after Cyclone Fani in 2019 and Operation Dost during the earthquake in Turkey and Syria in 2023. However, despite the IAF's proven effectiveness, challenges remain in integrating its assets with civil disaster response systems.

Rationale for the Study

The IAF has indeed been pivotal in Humanitarian Assistance and Disaster Relief (HADR) operations, demonstrating remarkable speed and efficiency in responding to various natural disasters and emergencies. Its capability to swiftly deploy air assets for evacuation, medical aid and logistical support has significantly reduced the impact of disasters. However, challenges such as delayed tasking, inadequate structured protocols and insufficient inter-agency coordination have often hindered its effectiveness.

One of the primary issues is the absence of predefined operational guidelines that dictate real-time coordination, resource deployment and post-disaster assessment involving the IAF. This gap often results in duplicated efforts and misallocation of

resources, leading to delayed response times during critical situations. Although national policies recognise the Armed Forces' role in disaster response, clearly defined procedures that facilitate efficient collaboration between civilian agencies and military assets are lacking.

To address these challenges, this research seeks to develop a structured, technology-driven framework aimed at optimising civil-IAF coordination. The relevance of this study is underscored by the increasing frequency and intensity of climate-induced disasters in India, which demand a more agile and responsive disaster management approach. Among the objectives of this research are the establishment of standardised protocols, the implementation of real-time resource allocation mechanisms and the development of a streamlined command structure. These measures will ensure that disaster response systems transition from being merely reactive to a more proactive stance.

Additionally, the study explores how advancements in technology, such as AI-based decision support systems and predictive analytics, can play a crucial role in enhancing disaster management. By integrating these tools, the research aims to foster faster response times, improve coordination among various agencies and develop effective risk mitigation strategies, thereby enhancing the overall efficacy of India's disaster management framework.

Objectives of the Study

Key objectives of the study are as follows:-

To analyse the existing civil–IAF disaster response framework and identify critical shortcomings.

To evaluate global best practices in military-civil coordination for disaster management and explore their applicability to India.

To develop an optimised framework incorporating AI-driven decision support systems, structured training programmes and standardised communication protocols.

To validate the proposed framework through stakeholder feedback, including IAF pilots, civil administration officials and disaster management experts.

Statement of the Problem

Disasters—both natural and man-made—have become increasingly frequent and severe in India, placing immense pressure on the country's disaster management capabilities. The growing incidence of cyclones, floods, earthquakes and other emergencies necessitate a robust and coordinated response system to save lives, protect infrastructure and provide timely relief. The IAF, with its swift mobility, logistical expertise and aerial rescue capabilities, plays a crucial role in disaster relief and humanitarian assistance. However, despite these capabilities, coordination between civil administration and the IAF remains inadequate, leading to delays, inefficiencies and at times, confusion during disaster response operations.

Research Questions

This study seeks to answer the following research questions:-

What are the gaps and challenges in the existing civil-IAF disaster response framework?

How do global best practices in civil-military disaster coordination compare to India's existing system?

What technological interventions (such as AI-driven decision support systems) can improve disaster response effectiveness?

How can a structured framework for civil-IAF coordination enhance India's disaster preparedness and response capabilities?

Research Design

The study follows a multi-method research approach, incorporating:-

Literature Review. This involves examining national and international policies, case studies and best practices in civil-military coordination. The review will include an analysis of disaster management frameworks, coordination mechanisms and policy directives from agencies such as the NDMA, the Federal Emergency Management Agency (FEMA) and international military-civil partnerships. Secondary sources such as government reports, journal articles and institutional guidelines will also be reviewed to identify gaps and best practices.

Case Study Analysis. The research will include a review of disaster relief operations like the Kerala Floods (2018), Uttarakhand Floods (2021) and Agartala Floods (2024) to identify operational challenges, coordination gaps and best practices. These case studies will provide insights into real-world disaster response mechanisms, evaluating the deployment of the IAF, inter-agency collaboration and lessons for future improvements.

Stakeholder Surveys & Interviews. Primary data will be collected from IAF pilots, civil administration officials and NDMA stakeholders through in-depth interviews and structured questionnaires. The focus will be on operational challenges, inter-agency coordination issues and recommendations for improving the existing disaster response framework. A mixed-methods approach will be utilised, incorporating both qualitative and quantitative data analysis for a comprehensive understanding of stakeholder perspectives.

Comparative Analysis. The study will evaluate global models, such as FEMA's National Incident Management System (NIMS) in the USA, Japan's Self-Defense Forces (SDF) model and Australia's Civil-Military Cooperation (CIMIC) framework. The aim is to identify best practices in civil-military coordination, resource allocation and command structures, highlighting successful international strategies and assessing their applicability within the Indian disaster management framework. Furthermore, the analysis will explore how these models incorporate advanced technologies, communication protocols and training programs to enhance disaster response efficiency.

Scope

This study focuses on disaster relief coordination between civil authorities and the IAF, assessing existing policies, operational challenges and areas for improvement. The research will examine policy frameworks at the national, state and district levels while exploring technological enablers for improving disaster response efficiency.

Limitations

While this research provides a comprehensive analysis, certain limitations exist:-

Limited availability of operational data from past disaster relief missions.

Variation in disaster response strategies across states, leading to non-uniform conclusions.

Dependency on stakeholder interviews and surveys, which may introduce subjective biases.

Structure of the Dissertation

This dissertation is structured as follows:-

Chapter 1: Introduction. Statement of Problem, Justification and Methodology.

Chapter 2: Foundations and Evolution of Disaster Management in India. Provides essential background, including definitions, historical evolution, key policies and frameworks.

Chapter 3: Literature Review. Analyses existing research on disaster management frameworks and civil-military coordination.

Chapter 4: Current Coordination Framework and Challenges. Examines existing civil-IAF disaster response setups and key challenges.

Chapter 5: Case Studies and Lessons Learnt. Provides in-depth case studies of past disaster responses.

Chapter 6: Proposed Framework for Optimised Civil–IAF Coordination. Outlines structured solutions to improve inter-agency coordination.

Chapter 7: Evaluation of the Proposed Framework. Assesses the framework's effectiveness using stakeholder feedback.

Chapter 8: Analysis of Surveys and Interviews. Presents insights from stakeholder engagement.

Chapter 9: Conclusion and Recommendations. Summarises key findings and suggests future research directions.

CHAPTER 2

FOUNDATIONS AND EVOLUTION OF DISASTER MANAGEMENT IN INDIA

We cannot stop natural disasters but we can arm ourselves with knowledge: so many lives wouldn't have to be lost if there was enough disaster preparedness.

Petra Nemcova

Etymology

The word "disaster" has its origins in Middle French, where it is spelled "désastre." This, in turn, was borrowed from Old Italian "disastro," which derives from the Greek term that combines the pejorative prefix δυσ- (dus-), meaning "bad," with the word αστήρ (aster), meaning "star." Thus, the root of the term translates to "bad star," reflecting an astrological theme. In ancient beliefs, the notion of a disastrous event was often linked to the adverse influence of celestial bodies, suggesting that the misalignment or demise of a star could herald destruction or calamity on the Earth (MHA, 2011).

Definition

A disaster is defined as an event or a series of events that results in significant casualties and damage, leading to the loss of properties, infrastructure, environment, essential services, or means of livelihood. These impacts are typically beyond the capacity of the affected community to manage or cope with using their available resources and capabilities. Disasters can overwhelm the normal functioning of communities, necessitating external assistance and coordinated responses for recovery and aid. It is often described as a “catastrophic situation in which the normal pattern of

life or eco-system has been disrupted and extra-ordinary emergency interventions are required to save and preserve lives and or the environment" (MHA, 2011).

According to the Disaster Management Act, 2005 a disaster is "a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or manmade causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to and destruction of, property, or damage to, or degradation of, environment and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area".

The United Nations defines it as "the occurrence of sudden or major misfortune which disrupts the basic fabric and normal functioning of the society or community".

Disasters have been an enduring aspect of human existence, manifesting as both natural and manmade events that challenge our resilience and capability to respond. Throughout history, the impacts of these disasters have led to profound changes in society's preparedness and response strategies. For instance, while natural disasters often result in significant loss of life and property, human-made disasters can equally devastate communities. Understanding the nature of these disasters is crucial for developing effective disaster management policies and enhancing the resilience of vulnerable populations. The High Power Committee on Disaster Management, constituted in 1999, has identified 31 various disasters categorised into five major sub-groups, as shown:-

i.	Water and climate related disasters	a) b) c) d) e) f) g) h) i) j) k)	Floods and drainage management Cyclones Tornadoes and hurricanes Hailstorm Cloud burst Heat wave and cold wave Snow avalanches Droughts Sea erosion Thunder and lightening Tsunami
ii.	Geological related disasters	a) b) c) d)	Landslides and mudflows Earthquakes Dam failures/ Dam bursts Minor fires
iii.	Chemical, industrial and nuclear related disasters	a) b)	Chemical and industrial disasters Nuclear disasters
iv.	Accident related disasters	a) b) c) d) e) f) g) h) i) j) k)	Forest fires Urban fires Mine flooding Oil spills Major building collapse Serial bomb blasts Festival related disasters Electrical disasters and fires Air, road and rail accidents Boat capsizing Village fire
v.	Biological related disasters	a) b) c) d)	Biological disasters and epidemics Pest attacks Cattle epidemics Food poisoning

Figure 2: List of Disaster Sub-Groups

(Source: NDMA: Disater Management in India)

Internationally, a paradigm shift in global DRR occurred in 1994 with the adoption of the Yokohama Strategy for a Safer World. This strategy emphasised the integration of disaster prevention, preparedness and mitigation into sustainable development policies, marking a move from reactive responses to proactive measures. In alignment with the Yokohama strategy, the Government of India initiated a central sector scheme, making holistic disaster management capacity building a top priority.

Under this initiative, Disaster Management Centres (DMCs) were established in Administrative Training Institutes across all states and Union Territories (UTs). Additionally, the National Centre for Disaster Management (NCDM) was created at IIPA

and it was placed under the Union Agriculture Ministry, which was responsible for disaster management at the time. The establishment of the High Powered Committee on Disaster Management, which released its report in 2000, paved the way for a new institutional, legal, financial and technological framework for disaster management in the country. Following the recommendations of this committee, the NCDM was upgraded to the National Institute of Disaster Management (NIDM) in 2003.

This transformative period also marked a fundamental shift from a relief-centric to a mitigation and preparedness-centric approach. Initiatives to establish SDMAs and to prepare disaster management plans at state and district levels were taken. Furthermore, the Government of India launched the GOI-UNDP project from 2002 to 2008, implementing the Natural Disaster Risk Management Programme in 169 multi-hazard prone districts across 17 states. During this time, comprehensive disaster management plans and Emergency Operations Centres (EOCs) were established, with Community-Based Disaster Preparedness (CBDP) as the programme's primary objective.

The devastating Indian Ocean Tsunami of 2004 prompted a crucial legislative milestone in India's history, leading to the creation of the NDMA through an Act of Parliament. The NDMA was tasked with spearheading and implementing a holistic and integrated approach to disaster management in India. The National Disaster Management Act of 2005 catalysed the establishment of Disaster Management Authorities and Disaster Response and Mitigation Funds at national, state and district levels, alongside the formation of National and State Disaster Response Forces.

Over the years, both mitigation measures and responses have significantly improved at national and state levels, culminating in a shift in the responsibility for disaster management from the Union Agriculture Ministry to the MHA.

The present National Disaster Management Policy (NDMP) (2019) has been structured to ensure coherence and mutual reinforcement of national initiatives in the domains of DRR, sustainable development and responses to the challenges posed by global climate change. This policy takes into account several frameworks and guidelines, most notably the SFDRR.

Sendai Framework for Disaster Risk Reduction (SFDRR). Adopted at the Third United Nations World Conference on Disaster Risk Reduction in March 2015, the SFDRR serves as a successor to the Hyogo Framework for Action (HFA) 2005-2015. It signifies a paradigm shift from traditional DM to a more comprehensive disaster risk management approach, emphasising the reduction of risks rather than merely responding to disasters. Its central aim is to achieve a substantial reduction in disaster risk and losses across various dimensions, including economic, physical, social, cultural and environmental aspects. The SFDRR outlines a clear goal: to prevent new and reduce existing disaster risk through the implementation of integrated and inclusive measures that strengthen resilience. The framework delineates four key priorities:-

Understanding Disaster Risk. This priority focuses on encouraging risk-informed decision-making by integrating scientific, traditional and local knowledge into the planning process.

Strengthening Disaster Risk Governance. This involves establishing clear roles, policies and frameworks for risk reduction at both national and local levels, ensuring effective implementation of disaster management strategies.

Investing in Disaster Risk Reduction for Resilience. This priority promotes risk-sensitive public and private investments, sustainable development practices and the construction of resilient infrastructure.

Enhancing Disaster Preparedness for Effective Response and to "Build Back Better". This entails strengthening disaster preparedness mechanisms, improving early warning systems and developing robust strategies for post-disaster recovery.

The seven global targets of SFDRR are as shown:-

Figure 3: SFDRR Global Targets

(Source: NDMA: The NDMP)

Sustainable Development Goals (SDGs). These were adopted by the United Nations General Assembly on 25 September 2015 and serve as a global blueprint aimed at achieving peace, prosperity and environmental sustainability. Comprising 17 Goals and 169 targets, the SDGs are designed to address a wide array of global challenges, including poverty eradication, climate action, disaster resilience, economic development and social justice. These goals build upon the foundation laid by the Millennium Development Goals (MDGs) while also incorporating new priority areas such as climate change adaptation, DRR, economic inequality and sustainable urbanisation. The SDGs emphasise the importance of collective action, encouraging nations, communities and individuals to come together to create a sustainable future for all. Each goal is interconnected, reflecting the complexity of the challenges the world faces and the need for integrated solutions across various sectors. A pictorial description of the SDGs is as shown:-

Figure 4: SDG Global Targets

(Source: NDMA: The NDMP)

A critical link exists between sustainable development and DRR. Major disasters can undo years of developmental progress, while inadequate disaster preparedness exacerbates economic and social vulnerabilities. The SFDRR is closely aligned with the SDGs, particularly in areas related to resilient infrastructure, climate action and risk governance.

Prime Minister's 10-Point Agenda for Disaster Risk Reduction. Introduced in 2016 during the Asian Ministerial Conference on Disaster Risk Reduction (AMCDR), this agenda serves as a strategic framework aimed at enhancing disaster resilience across India. It seeks to weave DRR into the fabric of development policies, governance structures and capacity-building initiatives at all levels. The focus is on prioritising risk-informed planning, leveraging technology and fostering improved coordination between national and local authorities. The ten key priorities outlined in the agenda are:-

Integration of Disaster Risk Management. All development sectors must incorporate the principles of disaster risk management.

Risk Coverage for Vulnerable Populations. Strive towards comprehensive risk coverage for all, particularly the poor and vulnerable communities.

Investment in Resilient Infrastructure. Prioritise investment in disaster-resilient infrastructure to minimise economic losses related to disasters.

Strengthening Governance. Enhance disaster risk governance at all administrative levels to ensure effective disaster management.

Leveraging Technology. Utilise technology, including AI and predictive analytics, to bolster disaster risk reduction efforts.

Protection of Livelihoods. Cultivate a greater emphasis on protecting livelihoods and employment opportunities in the aftermath of disasters.

Regional and International Cooperation. Foster stronger regional and international collaboration in the realm of disaster management.

Ecosystem-Based Approaches. Increase the use of ecosystem-based methods for risk mitigation, acknowledging the role of natural systems in disaster resilience.

Cultural Heritage and Local Traditions. Strengthen the resilience of cultural heritage sites and acknowledge the significance of local traditions in disaster response.

Disaster Resilience in Business and Industry. Ensure that businesses and industries adopt measures to enhance their disaster resilience.

This agenda aligns with India's commitments to global disaster risk reduction frameworks like the SFDRR and the SDGs. It reinforces the necessity of comprehensive risk governance, investment in preparedness and an inclusive, whole-of-society approach to disaster resilience.

In the past decade, India has witnessed both qualitative and quantitative improvements in disaster response mechanisms. During this period, 162 disaster events were recorded, prompting a unified governmental response that effectively provided

relief and support. The efficient handling of major disasters—such as floods, cyclones, landslides, Glacial Lake Outburst Floods (GLOFs) and incidents like the Silkyara tunnel accident—have notably resulted in a decrease in loss of human lives. The same can be judged from the figure below:-

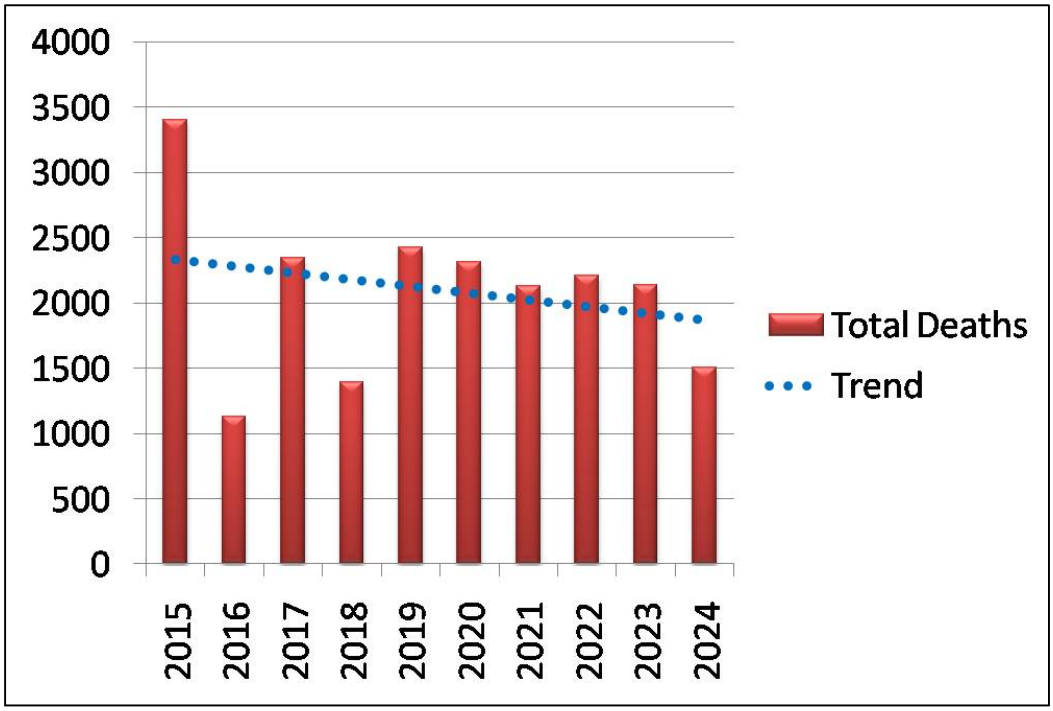

Figure 5: Total Number of Deaths in India in Natural Disasters in a Decade

(Source: EM-DAT, CRED: https://public.emdat.be/data)

CHAPTER 3

LITERATURE REVIEW

The Disaster Management Act (2005) authorises 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." Chapter 5 of the Act elaborates on the actions to be taken by the states for Disaster Management (DM), but it notably lacks specific guidelines for the armed forces or IAF. The Amendment Bill of 2024 specifies how different agencies—NDMA, SDMAs, Urban Disaster Management Authorities (UDMAs), SDRFs and local municipal bodies—are to coordinate with each other to avoid overlapping responsibilities and improve efficiency. It however, does not introduce specific provisions to further define or enhance civil-armed forces coordination. This oversight hampers the effective utilisation of the IAF's capabilities in disaster relief efforts. Amending the Act for air operations would provide clear operational guidelines, improving coordination and efficiency in response to disasters. This could significantly bolster the overall disaster management framework at state and district levels, enabling better outcomes during crises.

According to the National Policy on Disaster Management (NPDM) (2009) the Armed Forces are a critical component of the government's response capacity. It highlights their speed of operational response and ability to provide emergency support in severe disaster scenarios. It also emphasises the role of the Armed Forces in capacity building, including the training of trainers and DM managers in specialised areas like Chemical, Biological, Radiological and Nuclear (CBRN) response, high-altitude rescue, heli-insertion, watermanship and paramedic training. However, while the policy mentions

these roles, it lacks clarity on who coordinates these activities, leaving a significant gap in the form of actionable guidelines. Moreover, the NPDM does not detail specific protocols for deploying and facilitating air operations by the IAF, a critical element in disaster response.

The Annual Report (2022-23) of the NDMA outlines various mock drills and exercises carried out with the Armed Forces aimed at enhancing capacity. These activities encompass online training, tabletop simulations and field exercises. However, a critical evaluation of the outcomes is noticeably absent, particularly regarding the identification of shortcomings or the documentation of lessons learned. This lack of assessment represents a missed opportunity to refine DM plans and procedures, ultimately hindering the ability to ensure continuous improvement.

NDMA has issued the "Model Framework for District Disaster Management Plan" (2014), which outlines protocols for requesting Armed Forces assistance and the development of Standard Operating Procedures (SOPs) tailored to various disaster types. The framework emphasises the need for coordination between various stakeholders, including district authorities, state agencies and central institutions, to ensure an integrated disaster response mechanism. It also provides guidance on establishing Emergency Operations Centers (EOCs) and protocols for resource mobilisation, communication strategies and early warning systems. However, it lacks specific guidelines for the systematic deployment of IAF aircraft in relief operations, which is a critical gap in ensuring rapid and efficient disaster response in remote and inaccessible areas.

Since there were no well formulated guidelines for the deployment and employment of IAF assets for DM in the literature mentioned above, the state and district level DM plans were also found to be wanting on the same aspect. The DM plans of states like Assam, Punjab, Karnataka, Maharashtra, Kerala, Tamil Nadu, Uttar Pradesh, Odisha and Uttarakhand address the role of Armed Forces in disaster relief. However, they often lack specific guidelines tailored to the IAF's air operations. Additionally, the District Disaster Management Plans (DDMPs) for districts such as Kendrapara, Cuddalore, Chikkamagaluru, Wayanad, Darrang and Saharanpur do not provide adequate SOPs for IAF's involvement. This presents challenges in supporting IAF missions, particularly in remote areas. Given the IAF's capabilities in terms of speed and reach, a well-structured support plan is essential for effective relief operations.

Nikam et al, in their book, "Fundamentals of Disaster Management" (2018) have covered aspects related to mitigation, preparedness, response and recovery. They bring out the fact that the Armed Forces have played a vital role during disaster emergency, providing prompt relief even in the most inaccessible and remote areas of the country. However, the book speaks briefly about the role of Armed Forces in disaster response and not in capacity building.

Ranjeeta Soni, in her book "Environmental Studies and Disaster Management" (2023), has discussed the aspects of ecosystems, biodiversity, natural resources, pollution, solid waste management, social issues, environmental acts, ethics and disaster management. Protocol for seeking help from other agencies which include Armed Forces is also mentioned. However, the book does not discuss any framework for DM in India.

Singh, P, et al, in their book “Recent Technologies for Disaster Management and Risk Reduction: Sustainable Community Resilience & Responses” (2021), provide a comprehensive examination of modern technological advancements in disaster management. The book focuses on geospatial technologies, remote sensing, artificial intelligence and big data analytics to enhance disaster preparedness, risk assessment and response strategies. It highlights how these tools can improve decision-making and coordination in disaster-prone regions, making it a valuable resource for policymakers and disaster management professionals. While the book effectively explores technology-driven disaster risk reduction strategies, it neither discusses the role of the IAF in disaster response nor provides a framework for integrating these technologies into a Civil–IAF disaster response framework.

Shruti Kanga et al, in their book "Disaster Management in the Complex Himalayan Terrains" (2022), examine key hazards such as landslides, earthquakes, floods and GLOFs, emphasizing that their severity is increasing due to climate change. Historical seismic events in Uttarkashi (1991), Gujarat (2001) and Kashmir (2005) illustrate the region's tectonic instability. Additionally, case studies on landslides, such as those along the NH-44A Srinagar-Jammu Highway, highlight the risks posed by unregulated development. The 2014 Jammu and Kashmir floods and the Kedarnath GLOF (2013) further underscore the necessity for improved watershed management, remote sensing-based monitoring and early warning systems. The book also explores earthquake forecasting using InSAR technology and deep learning models, which enhance predictive capabilities and risk assessment. Furthermore, satellite-based

monitoring assesses forest fire vulnerability in Jammu and Kashmir, providing insights into how climate change affects precipitation patterns, flash floods and snow avalanches.

Despite its comprehensive coverage, the book identifies certain research gaps, particularly in evaluating the effectiveness of existing policies and community-based disaster risk reduction strategies. The role of civil-military coordination in disaster response, a crucial aspect in the region, is also underexplored. Addressing these gaps could enhance disaster preparedness by integrating technological advancements, policy interventions and local community participation.

Pravin Khandve, in his book "Fundamentals of Disaster Management" (2024), provides essential insights into various aspects of disaster management. The book covers a wide range of topics, including:-

Types of Disasters. It outlines both natural and man-made disasters, supported by charts and photographs for better understanding.

Disaster Management Phases. The text elaborates on the critical phases of disaster management—mitigation, preparedness, response and recovery—detailing the activities associated with each stage.

Technological Integration. The author examines the significance of technologies such as Geographic Information Systems (GIS), Global Positioning Systems (GPS) and Remote Sensing (RS) in enhancing disaster management strategies.

Socio-Economic Impacts. The book analyses the socio-economic effects of disasters, emphasising their wider implications on communities and nations.

This comprehensive approach ensures that readers gain a thorough understanding of disaster management practices and their implications. However, while it discusses roles and responsibilities of govt agencies, NGOs and civil societies, it does mention the crucial role played by the armed forces, specifically the IAF even though they are the first responders on most of the occasions.

The book "Disaster Management in India" (2011), published by the Ministry of Home Affairs, serves as an essential resource for understanding the country's disaster management framework. It delineates the evolution of policies and institutional structures resulting from the Disaster Management Act of 2005, categorising disasters into natural, man-made and industrial hazards. India's diverse geo-climatic landscape makes it particularly vulnerable to various disasters, necessitating the involvement of multiple institutional levels—national, state and district. The book underscores the roles of the NDMA, SDMAs and DDMAs, while also stressing the importance of preparedness, financial arrangements and international collaboration in mitigating disaster risks.

However, the book falls short in its examination of inter-agency coordination, especially between civilian disaster response agencies and the IAF. While it outlines institutional responsibilities, it lacks a thorough analysis of collaboration challenges and operational inefficiencies that may hinder effective disaster response. Furthermore, the potential use of emerging technologies is not explored. Addressing these gaps is vital for improving India's disaster resilience and ensuring a seamless integration of military and

civil resources for more effective emergency responses. This aspect of coordination and technological integration is crucial for optimising the overall disaster management strategy in the country.

AK Shrivastava's book "Textbook of Disaster Management" (2021) offers a comprehensive overview of disaster preparedness, response and recovery, emphasising community readiness, governmental responsibilities and the use of modern technology for mitigation. It effectively details national and state-level frameworks for disaster management but lacks a specific discussion on the role of Armed Forces and the IAF in large-scale disaster response. Given the IAF's crucial functions, such as aerial reconnaissance, rapid deployment and logistical support, the absence of a reference to the role of the IAF in DM and the requirement of a Civil–IAF coordination mechanism highlights a significant research gap.

Air Cmde Rohit Mahajan's dissertation, "Disaster Management: Impact on Armed Forces" (2019), offers a comprehensive examination of the Indian Armed Forces' growing role in disaster response. It explores their strengths, the challenges they face and how this involvement affects their overall operational readiness. The analysis includes the existing institutional framework, highlighting the Armed Forces' contributions to HADR, as well as the coordination with civil authorities. One notable limitation of the study is its lack of a structured approach to improving Civil–IAF coordination, which is essential for boosting the efficiency of disaster response efforts.

Brigadier Rajesh Srivastava's dissertation, "National Disaster Response Force: Strength & Weaknesses and Its Synergy with the Armed Forces" (2019), offers a

thorough examination of the NDRF, focusing on its strengths, weaknesses and its collaborative role with the armed forces in disaster management. The study critically analyses the institutional setup, resource limitations and emphasises the necessity for improved integration between civilian and military entities during disaster response scenarios. While the dissertation highlights the cooperative efforts between the NDRF and the armed forces, it notably omits a detailed discussion on the IAF's specific contributions to disaster response operations. Given the IAF's essential roles in aerial reconnaissance, evacuation and logistical support during emergencies, the lack of a structured coordination mechanism between civil authorities and the IAF is a significant research gap. Addressing this gap by establishing clear protocols and enhancing interoperability between the IAF and civilian agencies could lead to more efficient and effective disaster response outcomes.

Commodore Chanti Varanasi's dissertation, "Study & Analysis of AI-Based Expert System for Disaster Risk Reduction Specific to Andhra Pradesh" (2022) investigates how AI can be harnessed for effective disaster management, with a focus on early warning systems and risk mitigation strategies. The research emphasises the importance of AI-driven predictive models, machine learning algorithms and data analytics in enhancing disaster preparedness. However, while it effectively outlines AI's potential in risk reduction, it falls short of exploring how AI can be operationally integrated with the IAF disaster response capabilities. Given the IAF's crucial functions in aerial reconnaissance, relief logistics and evacuation operations, the absence of a structured AI-enabled coordination framework between Civil authorities and the IAF highlights a significant research gap. Addressing this gap could lead to improved

efficiency in disaster response, leveraging AI-driven decision support tools tailored specifically for military-civilian collaboration.

Air Cmde Kailas Gurao's dissertation, "Role of Indian Armed Forces in Disaster Management: Challenges and Way Forward" (2023), has identified challenges faced, effect on operational readiness and institutional measures to better prepare Armed Forces for DM. He further states that the deployment of the Armed Forces for DM affects their operational readiness and hence they need to be the last resort and not the first responders. However, the dissertation does not bring out policy suggestions for better integration of the Armed Forces in the DM plans.

Pintu Kumar Mahla's article titled "Air Power and HADR: Defining the Role of the Indian Air Force in Disaster Management in India" (2024) highlights the pivotal role of the IAF in HADR operations. It discusses the unique capabilities of the IAF, such as rapid mobilisation, high-altitude access and delivery of large-scale relief in disaster-struck areas. The study underscores the lack of coordination mechanisms between civil authorities and the IAF, leading to delays in deployment and operational inefficiencies. However, it lacks actionable guidelines for establishing standardised protocols for integrating civil agencies and the IAF during disaster response. It does not address the challenges of resource allocation, communication and decision-making between these entities.

Lloyd Michael Puckett's article titled "Civil-Military Coordination in Disaster Preparedness and Response" (2021) explores the global challenges and opportunities in civil-military coordination during disaster preparedness and response. It discusses the

importance of trust, communication and clearly defined roles between civil and military entities to avoid duplication of efforts. The paper emphasises that a lack of predefined SOPs often hinders swift disaster relief. However, the study is not India-specific and only briefly mentions the Indian context. It does not delve into the unique logistical challenges and regional variances within India or how the IAF could be integrated into state and district-level disaster management plans.

Markus Ries's article titled "Global Key Concepts of Civil-Military Cooperation for Disaster Management in The Covid-19 Pandemic—A Qualitative Phenomenological Scoping Review" (2022) focuses on global civil-military cooperation during the COVID-19 pandemic. It highlights best practices from various countries, such as centralised command systems and inter-agency collaboration for resource allocation and medical aid delivery. Lessons from these global experiences are valuable for improving India's disaster response framework. Although it offers global perspectives, the study does not provide a localised framework that addresses the nuances of India's disaster scenarios. The pandemic-specific focus also limits its applicability to broader disaster types requiring air operations by the IAF.

International Federation of Red Cross and Red Crescent (IFRC) & United Nations Development Programme's (UNDP's) collaborative document, "Effective Law and Regulation for Disaster Risk Reduction" (2014) provides a foundational understanding of how laws and regulations serve as enablers of DRR. It highlights the need for cohesive governance structures that align disaster management with national development policies. Key focus areas include:-

Integrating DRR into land-use planning, environmental protection and infrastructure development.

Strengthening accountability mechanisms among government institutions.

Enhancing community involvement through legally supported participatory approaches.

This publication underscores that laws should explicitly define the roles and responsibilities of all stakeholders, from national governments to local communities, ensuring that accountability and coordination are at the heart of disaster management.

"The Checklist on Law and Disaster Risk Reduction" by IFRC (2015) offers a practical tool for governments to assess and refine their existing legal frameworks. It emphasises the importance of:-

Enforcing building codes and regulations to reduce disaster risks.

Mandating the use of risk assessments in urban planning and development.

Providing legal backing for community-based DRR initiatives.

The checklist has proven effective in helping nations identify gaps and inconsistencies in their legal frameworks. It serves as a catalyst for governments to update outdated laws and harmonise them with international standards.

The Disaster Law Database by IFRC serves as a global repository for disaster-related laws, policies and academic materials. It facilitates the exchange of knowledge and best practices by enabling governments and researchers to:-

Compare legal frameworks across countries.

Study successful legislative approaches in disaster management.

Develop customised policies suited to local contexts.

This database is invaluable for policymakers looking to adapt proven strategies to their specific needs. It also encourages cross-border cooperation in addressing shared disaster risks.

The study, “Coordination of Civil and Military Forces in Natural Disasters: A Systematic Review” by Araghizadeh et al (2021), systematically analyses global practices of civil-military coordination in natural disaster management. It identifies key factors for successful collaboration, including clear role definitions, interoperable communication systems, joint training exercises and robust legal frameworks. Challenges such as cultural differences, lack of integrated training and communication barriers are also highlighted. The recommendations include developing integrated command structures, creating SOPs and strengthening legal frameworks to improve coordination. While comprehensive, the study’s general focus lacks specific insights into air force integration and post-disaster evaluations, leaving room for India-specific research, particularly regarding the Indian Air Force's role in disaster response.

The publication, “Humanitarian Civil-Military Coordination in Emergencies: Towards A Predictable Model (2020 edition)” by United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA), emphasises the role of the Regional Consultative Group (RCG) on Humanitarian Civil-Military Coordination and the Global Consultative Group in fostering predictable frameworks for disaster response, particularly in the multi-stakeholder environment of the Asia-Pacific. It highlights the importance of trust-building, joint training and harmonised guidelines like the Oslo Guidelines to enhance collaboration between civilian and military actors. The RCG facilitates stakeholder alignment in disaster-prone regions, promoting effective and principled coordination. The study does not focus on India-specific challenges, such as integrating the Indian Air Force into disaster frameworks or addressing logistical issues in remote areas. These gaps call for localised solutions tailored to India's unique disaster management context.

The article, “India’s Role and Contribution to Building Global Resilience in Disaster Management,” by Amita Singh (2022), provides an in-depth examination of how India has developed its disaster management framework with a focus on enhancing resilience, offering humanitarian assistance and engaging in diplomatic efforts. The article outlines India’s involvement in the Hyogo and Sendai Frameworks and emphasises the significance of the NDRF and initiatives like the Coalition for Disaster Resilient Infrastructure (CDRI). However, the article falls short in addressing the crucial contributions of the armed forces and specifically, the IAF regarding rapid response, aerial reconnaissance and logistical support during disasters. This oversight reveals a significant research gap.

CHAPTER 4

CURRENT COORDINATION FRAMEWORK AND CHALLENGES

Response agencies need to interact with their communities and make them familiar with the essential drill of disaster response.

Shri Narendra Modi, Prime Minister AMCDRR, 2016

The existing civil–IAF disaster response framework in India follows a structured but often fragmented approach. The NDMA, SDMAs and DDMAs form the core of civil disaster response, while the IAF is deployed as per the requirements of the situation. Despite institutional mechanisms in place, real-time coordination challenges, resource allocation inefficiencies and procedural gaps limit the effectiveness of the response framework.

The framework operates under the legal and policy directives provided by the Disaster Management Act, 2005 and the NPDM. These documents establish a foundational structure for disaster preparedness, response and recovery while highlighting the importance of the armed forces in aiding civil authorities. Despite these directives, significant gaps persist in operational guidelines, coordination mechanisms and institutional integration, particularly concerning the deployment of IAF resources.

Legal and Policy Provisions

The Disaster Management Act, 2005, provides the legislative framework for disaster management in India. It establishes a multi-tiered structure, comprising the NDMA, SDMAs and DDMAs. The Act empowers these authorities to requisition

assistance from the armed forces, including the IAF, during large-scale disasters. However, the provisions are limited to high-level directives and there are no detailed operational protocols for deploying IAF resources in coordination with civil authorities.

The Act mandates the establishment of the National Executive Committee (NEC), chaired by the Union Home Secretary, to ensure effective disaster response. The NEC has the authority to direct the deployment of armed forces; however, the absence of pre-defined roles, responsibilities and coordination mechanisms for the IAF often leads to delays and inefficiencies in execution. Moreover, the Act does not include provisions for the training of civil authorities in understanding military operations, which limits their capacity to collaborate effectively during emergencies.

The NPDM underscores the role of the armed forces as "immediate responders" in disaster situations. It identifies key tasks such as aerial evacuation, delivery of relief materials and reconnaissance operations (NPDM, 2009). However, it does not provide actionable frameworks or SOPs for integrating IAF operations with state and district-level disaster management plans. It emphasises capacity building and inter-agency collaboration but lacks clear guidelines for joint training programmes or multi-agency simulation exercises. This omission hinders the operational readiness of both civil and military actors.

The NDMP further recognises the importance of civil-military cooperation. While highlighting the logistical and aerial capabilities of the IAF, it also underscores the need for capacity building through targeted training programmes for all stakeholders involved in disaster management. The NDMP identifies training gaps in understanding military

operations, emphasising the importance of educating civil authorities about air logistics operations, such as securing airspace, preparing suitable landing zones and ensuring fuel and logistical support. While the NDMP advocates for proactive resource allocation and improved stakeholder training, the procedural details regarding engagement with the IAF and conducting joint simulation exercises to enhance operational readiness are still unclear.

Institutional Framework of Disaster Management in India

Prior to 2001, disaster management was under the Ministry of Agriculture, but since June 2002, the MHA has taken over as the overall coordinator. The key committees involved in top-level decision-making for disaster management include the Cabinet Committee on Security (CCS) and the NCMC. Established in May 2005, the NDMA is the lead agency responsible for preparing the National Disaster Management Plan (NDMP), with the latest edition released in 2019. NDMA's roles include policy formulation, coordination and implementation of disaster management activities.

The central government has designated nodal ministries to coordinate responses to disasters. Typically, state governments handle disaster management with central support, although they may seek assistance from the central government depending on the disaster's type, scale and extent. Once a disaster is acknowledged, the central government allocates funds to the state, which is responsible for requisitioning aviation assets for disaster relief. Payment for these assets is generally the state's responsibility but may be reimbursed by the MHA. The national DM institutional mechanism is shown below:-

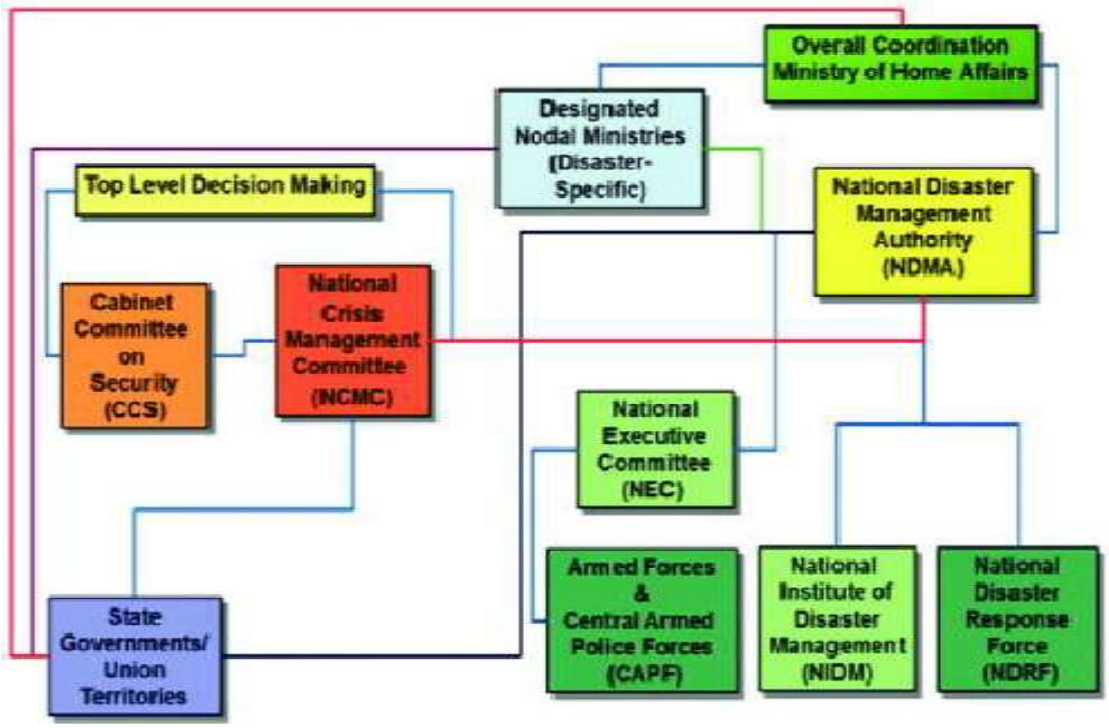

Figure 6: Institutional Framework of DM at the National Level

(Source: NDMP, 2019)

At the national level, there is NDRF comprising of 16 battalions which have been positioned at various locations across the country for a rapid response to a disaster. Each State has a separate institutional framework for DM. The provision of the DM Act 2005 directs the setting up of SDMA at the state level and DDMA at the district level. Each state also has a State Disaster Response Force (SDRF) to assist in disaster-related activities. The location of NDRF pan-India is as shown:-

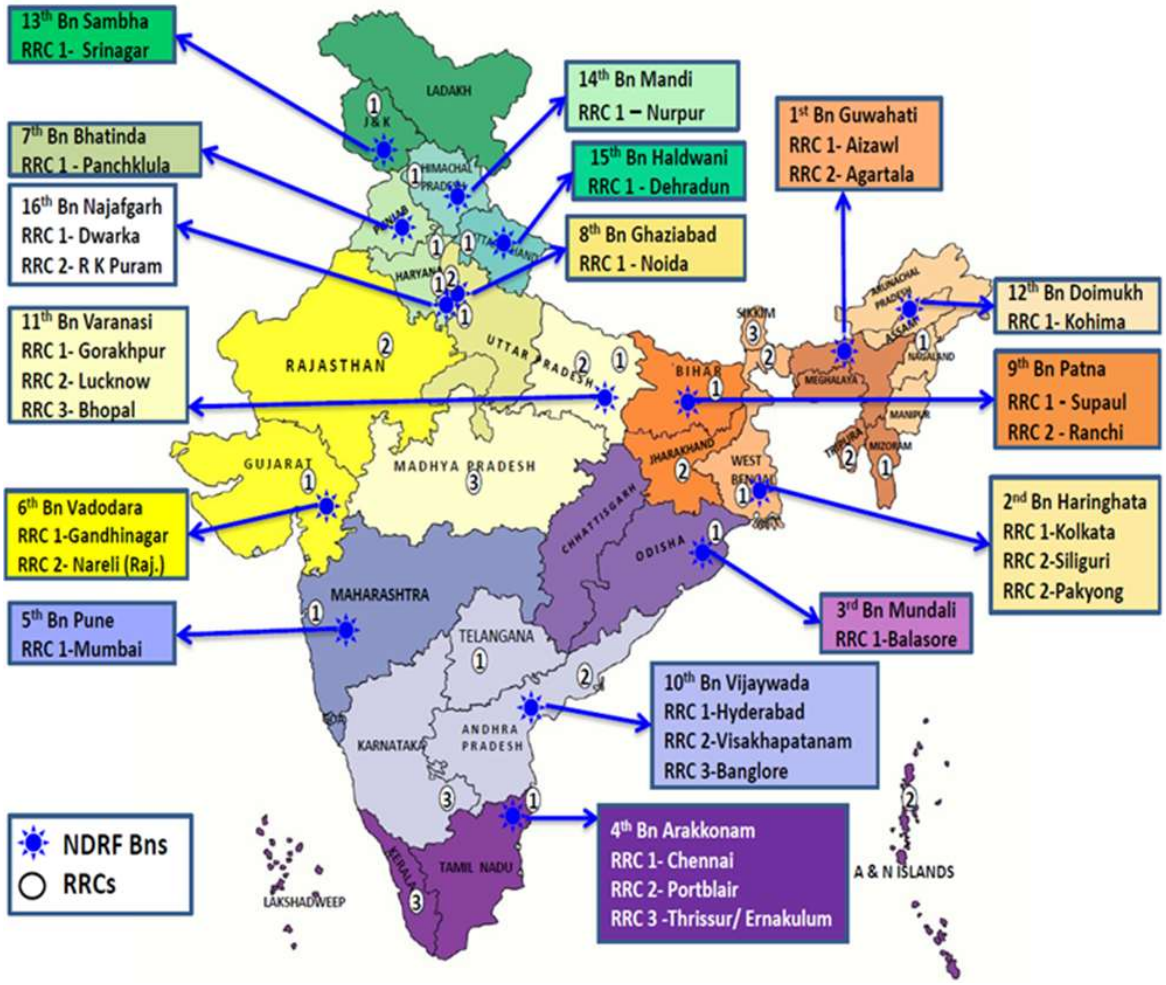

Figure 7: Location of NDRF Battalions and Their Respective Areas of Responsibility

(Source: NDRF, https://ndrf.gov.in/en/about-us)

While all states derive their disaster management plans from the NDMP, the implementation and response vary significantly and so does the interaction with the Armed Forces to utilise their resources during crises.

Institutional Framework of Armed Forces for Disaster Management

The Armed Forces are integrated into the disaster management framework with the MHA being the overall coordinator, delegating tasks to the Ministry of Defence

(MoD). Armed Forces support disaster responses through personnel, equipment, ships and aircraft. Army personnel assist both the state and central governments, while aircraft and ships are used to transport the NDRF and to execute mass evacuations. During large-scale disasters, fighter jets, Remotely Piloted Aircraft (RPA) and satellites are employed for surveillance of affected areas.

Key appointments and committees responsible for disaster management within the Armed Forces include:-

National Crisis Management Committee (NCMC). It is chaired by the Cabinet Secretary, with the Defence Secretary representing the Armed Forces.

Defence Crisis Management Group (DCMG). It is established by the MoD and chaired by the Chief of Integrated Defence Staff (CISC).

Operational Logistics Directorate (Op Lgs Dte) at HQ IDS. Acts as the nodal agency for disaster management, responsible for establishing crisis command rooms for information flow to the MHA. The Brigadier (Op Lgs) at HQ IDS coordinates disaster response within the Armed Forces.

Security Response Group (SRG). Formed in response to terrorist attacks or security issues, it is chaired by the NSA and includes the Defence Secretary as a member.

Joint Ops Room. It is set up as necessary, with the co-option of the Chief of the relevant Armed Forces service depending on the crisis.

For requesting an aircraft from the IAF for disaster management, the following options are available:-

Direct Approach. The DM Authority can contact the nearest Air Force Station. A Station Commander (Wg Cdr rank or above) can clear emergency requests after a written requisition is provided and they will inform Command/Air HQ before deployment.

Request through Headquarters. The State Government may forward a written requisition to Air HQ or the nearest Command HQ, which will then task the necessary field units.

Requisition to MHA. The State Government can also send a requisition to the MHA for further action with the MoD, which in turn will forward it to HQ IDS to coordinate the necessary service headquarters for aircraft tasking.

During operations, the Armed Forces coordinate with local formations through district and state-level DM officers, ensuring timely provision of aviation assets as requested by state officials to Command HQ. Simultaneously, HQ IDS collaborates with the MHA to provide the utmost assistance to the state.

Role of the IAF in Disaster Response

The Indian Air Force is crucial in disaster management, using its aerial capabilities to provide swift relief in difficult and unreachable areas. It operates a diverse fleet, including transport aircraft like the C-17 Globemaster, C-130J Super Hercules, IL-76 and

An-32 and helicopters such as the Mi-17 and its variants, Chinook, Dhruv, Chetak and Cheetah. These assets enable the IAF to perform critical disaster response functions which include:-

Aerial Evacuations. The IAF conducts rescue operations in flood-affected areas, high-altitude regions and disaster-hit zones where road connectivity is compromised. For instance, during the 2018 Kerala floods, the IAF evacuated over 4370 stranded individuals from inaccessible areas. PIB (2019).

Transport of Relief Materials. The IAF's transport fleet delivers essential supplies such as food, medical kits and water purification units to disaster zones. During Cyclone Fani (2019), the IAF airlifted over 400 tons of relief materials within 72 hours (Indiatimes, 2019).

Reconnaissance and Surveillance. The IAF conducts aerial surveys to assess disaster impacts and prioritise response efforts. During the Ladakh snowstorm in January 2020, the IAF played a crucial role in transporting essential supplies, rescuing stranded individuals and conducting aerial reconnaissance to identify affected zones. This operation involved deploying Mi-17 helicopters and C-130J Super Hercules aircraft to deliver food, medical supplies and winter clothing to isolated areas. The IAF's real-time aerial assessments helped direct ground rescue teams to priority zones, showcasing its capacity to act swiftly in severe weather conditions.

Despite its critical contributions, the IAF faces several challenges, including limited coordination with civil agencies, inadequate logistical support and delays in resource requisitions. The absence of standardised protocols for communicating with state and district authorities often hinders operational efficiency. This observation is based on analyses of past disaster responses, such as the Kerala floods in 2018 and Cyclone Fani in 2019. Official reports and documentation from disaster management stakeholders highlighted challenges in communication and resource allocation during these events.

Civil Administration's Role and Limitations

The civil administration is guided by SDMAs and DDMAs and is entrusted with the critical responsibility of mobilising resources, ensuring logistical support and coordinating response efforts during disasters. According to the NDMA's Model Framework for DDMP, civil authorities are specifically tasked with requisitioning military support, facilitating arrangements such as helipad preparation and fuel availability and ensuring overall ground-level preparedness. Despite these well-articulated responsibilities, the implementation of such frameworks is often marred by significant challenges.

One of the primary constraints is the lack of financial and material resources, which limits the ability of district authorities to establish essential infrastructure to support air operations. During the 2018 Kerala floods, the district authorities faced challenges in identifying and preparing suitable helipads for IAF helicopters, leading to delays in relief and evacuation operations. Additionally, logistical issues such as

availability of aviation fuel and ground handling staff resulted in bottlenecks, which further exacerbated operational delays.

A major concern is the insufficient training of civil administrators in effectively collaborating with military forces. The National Institute of Disaster Management (NIDM) offers training modules focussed on State Disaster Management Plans (SDMPs) that prioritise capacity building for civil authorities to improve their strategies for responding to disasters. These modules emphasise the significance of understanding resource constraints, fostering inter-agency cooperation and integrating military assistance during crisis situations. However, an in-depth analysis of these modules reveals that key components, such as payload limits, air operation guidelines and military safety standards, are not sufficiently addressed. This indicates a pressing need for more specialised content that can effectively bridge the gap between civilian and military operations.

Moreover, the implementation of these training programs is inconsistent across various districts, resulting in differing levels of preparedness. For example, during the 2018 Kerala floods, some districts managed to work successfully with the IAF to set up helipads and ensure the availability of fuel. In contrast, other districts faced delays due to a shortage of trained staff and inadequate communication systems. This disparity illustrates the critical need for a standardised training framework that can be uniformly adopted across all districts. The lack of standardisation contributes to a gap in civil-military coordination, particularly during large-scale emergencies that necessitate the prompt deployment of air support.

Administrative hurdles significantly compromise the efficiency of civil administration. Slow decision-making, coupled with bureaucratic hierarchies, often leads to a disconnect between the needs for resources and their actual availability in the field. These shortcomings underscore the urgent requirement for streamlined protocols, enhanced training programs and improved resource allocation strategies to bolster the operational preparedness of civil authorities, enabling them to work more effectively with the IAF in disaster response situations.

Communication and Resource Allocation

Communication continues to be one of the most significant challenges in ensuring effective coordination between civilian authorities and the IAF. The current methods predominantly depend on informal networks and personal connections instead of established institutional systems, resulting in delays and inconsistencies during emergencies. The NDMA's District Disaster Management Plan (DDMP) framework highlights the importance of inter-agency communication but falls short of adequately addressing the technical and logistical dimensions of military operations. For example, critical aspects such as air traffic coordination, payload management and helipad readiness are frequently overlooked, leading to misaligned priorities and operational inefficiencies.

The urgent need for a unified communication platform became especially clear during the 2018 floods in Kerala. District officials faced challenges in transmitting real-time updates, which affected the prioritisation of rescue and relief efforts. Specifically, delays in the preparation of helipads for IAF helicopters and the coordination of logistical

requirements like fuel availability created inefficiencies in the airlifting of relief materials to the most affected regions. These issues highlighted the pressing necessity for a centralised communication system that intertwines military and civilian operations, thereby facilitating quicker decision-making and responses in emergencies. Furthermore, reliance on separate communication systems resulted in redundant efforts and missed chances to optimise operations. A centralised communication platform that merges both military and civilian channels could have significantly enhanced coordination, allowing for swifter and more efficient disaster responses. Such a platform would guarantee that actionable information—such as updated maps, weather forecasts and logistical needs—is disseminated in real time, thereby greatly improving operational effectiveness.

Resource allocation represents another crucial challenge that detracts from the efficiency of disaster response efforts. The MHA Handbook on Disaster Management underscores the necessity of proactive resource planning but lacks concrete guidelines for task prioritisation. For instance, the evacuation of stranded individuals often competes with the transportation of essential relief supplies, resulting in decision-making bottlenecks. This was observable during Cyclone Fani, where conflicting demands led to delays in the effective deployment of IAF assets. This situation revealed systemic deficiencies in pre-disaster planning, such as the lack of clear protocols for quickly assessing immediate needs and dynamically allocating resources. These deficiencies emphasise the critical need for integrated frameworks capable of addressing both operational priorities and the distinct constraints of IAF capabilities, including payload limits, airfield requirements and logistical support systems. The development of these

protocols could greatly enhance the speed and effectiveness of resource allocation in future disaster situations.

Challenges in Civil–IAF Coordination

The integration of IAF capabilities into India's disaster response framework encounters numerous challenges, including institutional barriers and operational inefficiencies. These issues diminish the effectiveness of disaster management, especially during large-scale or multi-state emergencies:-

Communication Barriers and SOP Gaps. While official protocols exist for requesting IAF assistance, the process is bureaucratic and time-consuming. There is no dedicated real-time communication platform that enables seamless collaboration. During a survey conducted online, the responding civil administrators highlighted that, during major disasters, decision-making is often reactive rather than pre-planned, resulting in a suboptimal allocation of IAF resources. 56% of civil administration officials mentioned that there were no structured communication drills conducted with the IAF prior to disaster events. Additionally, 63% of surveyed administrators noted that the lack of a centralised coordination system made it difficult to track the real-time availability of IAF assets. Many respondents indicated that confusion over responsibility between multiple agencies resulted in further delays, particularly in high-impact disaster scenarios such as floods and cyclones. Moreover, 47% of officials expressed the need for a dedicated communication liaison within EOCs to streamline coordination with IAF units and improve response effectiveness.

Training and Preparedness Deficiencies. One of the most pressing challenges is the lack of regular, structured joint training programmes that involve the IAF and civil agencies. The NDMA Annual Report for 2022-23 emphasises the importance of conducting mock drills with state authorities to improve disaster preparedness. However, these exercises often do not include direct participation from military forces, particularly the IAF, which significantly reduces their effectiveness. This absence of collaborative training leads to significant gaps in operational understanding, including issues related to payload limitations, air traffic management dynamics during emergencies and the technical standards required for helipads suitable for IAF helicopters. During a survey conducted online, the responding IAF pilots noted that they often operate with limited knowledge of the specific requirements and constraints of civil disaster response teams, which affects overall mission effectiveness. Survey responses indicate that 82% of IAF pilots have never participated in a pre-disaster coordination exercise with civil administration.

During the 2018 Kerala floods, the lack of established coordination between the IAF and civil agencies led to delays in preparing suitable helipads and caused misunderstandings regarding payload priorities. Civil authorities struggled to manage the specific needs and restrictions of military air operations, such as fuel logistics, aircraft loading protocols and rapid deployment procedures, due to insufficient training and simulation exercises. These challenges underscored the urgent need for joint preparedness exercises and clear protocols to streamline operations during large-scale disasters.

In contrast, countries like Japan regularly conduct joint drills with their Self-Defense Forces (SDF), ensuring that civil administrators and military personnel align their disaster response strategies. These simulations often include scenarios requiring complex evacuation plans, resource prioritisation and real-time communication management for enhancing inter-agency synergy. Similarly, Australia conducts frequent training between the Australian Defence Force (ADF) and civil agencies with the aim to facilitate seamless coordination during events like "Operation Bushfire Assist." These examples highlight the need for India to establish joint training programmes that not only familiarise stakeholders with operational constraints but also foster trust and collaboration between civil and military agencies. The absence of such practices in India makes its disaster management framework vulnerable to miscommunication and inefficiencies during actual operations.

Absence of Unified Communication Platforms. One of the prerequisites of effective disaster management is real-time information sharing between all the involved stakeholders – civil authorities, disaster management agencies and the IAF. India currently lacks a centralised communication platform akin to FEMA's National Incident Management System (NIMS) in the United States. NIMS provides stakeholders across the whole community with the shared vocabulary, systems and processes to successfully deliver the capabilities described in the National Preparedness System. NIMS defines operational systems, including the Incident Command System (ICS), Emergency Operations Center (EOC) structures and Multiagency Coordination Groups (MAC Groups) that guide how personnel

work together during incidents. NIMS applies to all incidents, from traffic accidents to major disasters. (NIMS, 2017).

The lack of a coordinated system in India became strikingly clear during the Uttarakhand floods of 2021. The fragmented communication among district authorities, state disaster management agencies and the IAF led to significant delays in identifying priority areas and effectively allocating resources. For example, conflicting reports about the severity of damage in different regions resulted in the misallocation of air assets, which delayed critical rescue and relief operations in the worst-affected areas. Additionally, the reliance on outdated and disparate communication methods, such as phone calls and manual reports, further exacerbated these delays.

A unified communication platform could effectively address these challenges by integrating real-time data from various sources, including satellite imagery, ground-level assessments and reconnaissance reports from the IAF. This platform would enable stakeholders to instantly share updated maps, weather conditions, logistics requirements and priority zones. Additionally, it could incorporate built-in task management systems that dynamically allocate resources based on evolving needs, thereby minimising duplication of efforts and significantly improving response times. Such a system would also promote interoperability between civil and military communication networks, which is crucial for effective disaster response in India.

Inadequate Protocols for Resource Allocation. Resource allocation remains a persistent challenge due to the lack of standardised protocols tailored to the operational needs of military air operations. While the MHA Handbook on Disaster Management provides general guidelines for resource allocation, it does not address the specific requirements for deploying IAF resources. Key areas that need attention include determining payload limits for aircraft, ensuring consistent refuelling availability at remote locations and arranging ground handling support at improvised helipads or airstrips. These gaps in logistical coordination become even more apparent during large-scale disasters, where they can significantly impact mission success. During the online survey, the civil administration officials expressed concerns that the lack of structured pre-disaster planning often results in the underutilisation or misallocation of aerial assets. 61% of civil administrators highlighted logistical bottlenecks as a major hindrance to effective collaboration with IAF units.

During the 2018 Kerala floods, several challenges became apparent in the disaster response efforts. Although the IAF had available assets, delays in coordinated logistics planning significantly hindered the distribution of relief materials. Local authorities faced difficulties in identifying and preparing adequate helipads for Mi-17 helicopters, resulting in inefficient delivery of critical supplies to the most affected areas. Additionally, a lack of clarity regarding fuel stockpile locations for air operations created operational bottlenecks, forcing aircraft to work under tight timelines.

Implementing integrated resource management systems could mitigate these inefficiencies by centralising real-time data on resource availability, operational constraints and priority requirements. Such systems would facilitate dynamic allocation of resources, ensuring optimal use of IAF capabilities. Furthermore, pre-disaster planning frameworks should include detailed SOPs for inter-agency coordination, clearly defining the roles of civil and military agencies. For example, joint planning exercises could proactively establish procedures for loading relief materials, prioritising rescue missions and identifying logistical chokepoints, thereby minimising delays during actual operations.

CHAPTER 5

CASE STUDY AND LESSONS LEARNED

This chapter explores significant disaster events to evaluate the effectiveness of response mechanisms, identify gaps and extract key lessons for enhancing future disaster management strategies. By examining past incidents, the chapter aims to highlight best practices, challenges encountered and areas that require strategic improvement.

Several disaster cases were studied to analyse the effectiveness of response mechanisms and identify opportunities for enhancement. The selection criteria focussed on cases that provided the most valuable insights into inter-agency coordination, logistical challenges and policy implications. Although incidents like the Sikkim GLOF of 2022 and the Silkyara tunnel rescue operation of 2023 showcased impressive civil-IAF coordination, they were excluded from the detailed analysis. The goal was to concentrate on cases that revealed critical gaps and areas needing strategic enhancement.

KERALA FLOOD RELIEF OPERATIONS, 2018

Background

Between June and August 2018, Kerala experienced its worst floods in nearly a century. Triggered by exceptionally heavy monsoon rainfall, the disaster affected all 14 districts of the state, causing widespread destruction, displacing millions and resulting in the death of over 480 people. The floods were exacerbated by the simultaneous opening of 35 of the state's 54 dams, which released massive amounts of water into already overflowing rivers.

With roads submerged, bridges collapsed and entire villages cut off, the scale of the crisis overwhelmed local authorities. As the situation worsened, the IAF was called in to support the rescue and relief operations. The IAF played a critical role in reconnaissance, casualty evacuation, supply drops and airlifting stranded residents to safety. The IAF's intervention, along with efforts by the NDRF, Indian Navy and civil agencies, ultimately helped mitigate the impact of the disaster.

Chronology of Events

The sequence of events of this large scale disaster is as follows:-

June–August: Continuous Rainfall & Deterioration of Conditions. Heavy monsoon rains caused reservoirs to reach dangerous levels, leading to the release of water from multiple dams. Rivers overflowed, flooding towns, villages and major highways.

14–15 August 2018: Statewide Emergency Declared. The Kerala government declared a state of emergency as water levels continued to rise. Local authorities struggled to evacuate people due to submerged roads and broken infrastructure.

16 August 2018: IAF Deployment Begins. The IAF was mobilised to assist in search-and-rescue operations. Helicopters were deployed for aerial reconnaissance to assess the worst-hit areas. Relief material was air-dropped to marooned communities.

17–22 August 2018: Peak of IAF Operations. Mi-17 helicopters, C-130J transport aircraft and ALH were extensively used for airlifting stranded people and delivering relief supplies. IAF pilots conducted daring rooftop rescues, winching people from

flooded homes. Specially trained IAF Garud commandos were deployed for high-risk rescue missions.

23 August 2018: Water Levels Begin to Recede. As rains subsided, flood waters began to recede in many areas. Evacuations slowed and focus shifted to rehabilitation efforts.

IAF Involvement and Operational Response

Aerial Reconnaissance & Damage Assessment. IAF helicopters conducted extensive reconnaissance sorties to map flood-hit areas. High-resolution aerial images were used to prioritise rescue efforts.

Casualty Evacuation & Rescue Operations. IAF teams executed multiple rooftop rescues using winching operations. Critically injured and elderly individuals were airlifted to medical facilities.

Insertion of NDRF & Relief Teams. Helicopters inserted NDRF and other relief personnel into isolated areas to facilitate ground rescues.

Relief Material Distribution. Aerial supply drops delivered food, drinking water, medical kits and life-saving equipment. C-130J aircraft transported large quantities of relief material from other parts of India.

Medical Aid & Emergency Support. The IAF airlifted medical teams and equipment to flooded regions. Temporary medical camps were established at air bases for displaced people.

Observations

Rapid Deployment & High Operational Readiness. The IAF's swift response was a major factor in the success of the relief efforts. Helicopters and fixed-wing aircraft were mobilised within hours of the request, demonstrating high operational preparedness.

Seamless Civil–Military Coordination. Unlike past disasters where integration was a challenge, coordination between civil authorities, the IAF and disaster response agencies was notably efficient in this operation. Real-time data sharing between agencies improved decision-making and task prioritisation.

Challenges in Communication & Task Prioritisation. Initial communication gaps led to duplication of efforts in some areas while other severely affected regions received delayed aid. The absence of a dedicated, real-time coordination platform highlighted the need for a standardised communication system between the IAF and civil authorities.

Asset Availability & Resource Constraints. The demand for helicopters far exceeded availability, limiting the speed of evacuation operations. The reliance on military assets underscored the need for a larger fleet of dedicated disaster relief aircraft in civilian agencies.

Importance of Pre-Disaster Preparedness. The disaster highlighted the need for predictive flood modelling and pre-positioning of resources in high-risk areas. Regular joint training exercises between the IAF and civil agencies could further enhance disaster preparedness.

Public Perception & Community Impact. The IAF's rescue efforts were widely praised by the public, particularly the daring rooftop winch rescues. The presence of military aircraft reassured stranded civilians and boosted morale in affected communities.

Conclusion

The 2018 Kerala flood relief operations demonstrated the critical role of the IAF in disaster management. The IAF's rapid deployment, high-risk rescue missions and large-scale relief efforts were instrumental in minimising casualties and alleviating suffering. Though the response was largely successful, the operation also revealed areas for improvement, particularly in communication, resource allocation and preparedness.

By implementing lessons from the Kerala floods, future disaster management strategies can be strengthened through better inter-agency coordination, investment in dedicated disaster-response aircraft and improved predictive modelling to enhance preparedness.

UTTARAKHAND FLOODS, 2021

Background

In 2021, Uttarakhand faced severe weather-related disasters, marking it as the second worst year for loss of life since the 2013 Kedarnath flash floods. Among these events, the Chamoli flash flood on 07 Feb 21, was particularly devastating. Triggered by the sudden dislodgement of a massive glacier in the Chamoli district, it led to an air blast and a significant debris flow through the river valleys in the Joshimath area.

The flash flood inflicted extensive damage on infrastructure, including bridges and hydroelectric facilities, with a tragic toll of 204 civilian lives lost and around 186 livestock perishing. The disaster also disrupted vital services, severing road and electricity connections to 13 villages, exacerbating the humanitarian crisis (NDMA, 2022).

Chronology of Events

On 07 Feb 21, a huge mass of glacier and rock dislodged from approximately 5,500 metres and resulted in the following sequence of events:-

Initiation. At around 10:08:45 hours, the glacier and rock material detached and began their descent down a steep slope of 2.9 km.

Impact and Air Blast. Travelling at high speed, the mass struck the terminal moraine, causing a powerful air blast that uprooted trees and generated significant dust clouds, complicating the situation.

Debris Flow and Infrastructure Damage. The debris flow resulted in widespread destruction, notably affecting the Rishiganga hydro project (13 MW) and the NTPC project (520 MW). A key bridge maintained by the Border Roads Organisation (BRO) was also washed away.

Human and Livestock Impact. The event led to the loss of 204 lives and approximately 186 livestock, severely disrupting connectivity to several villages.

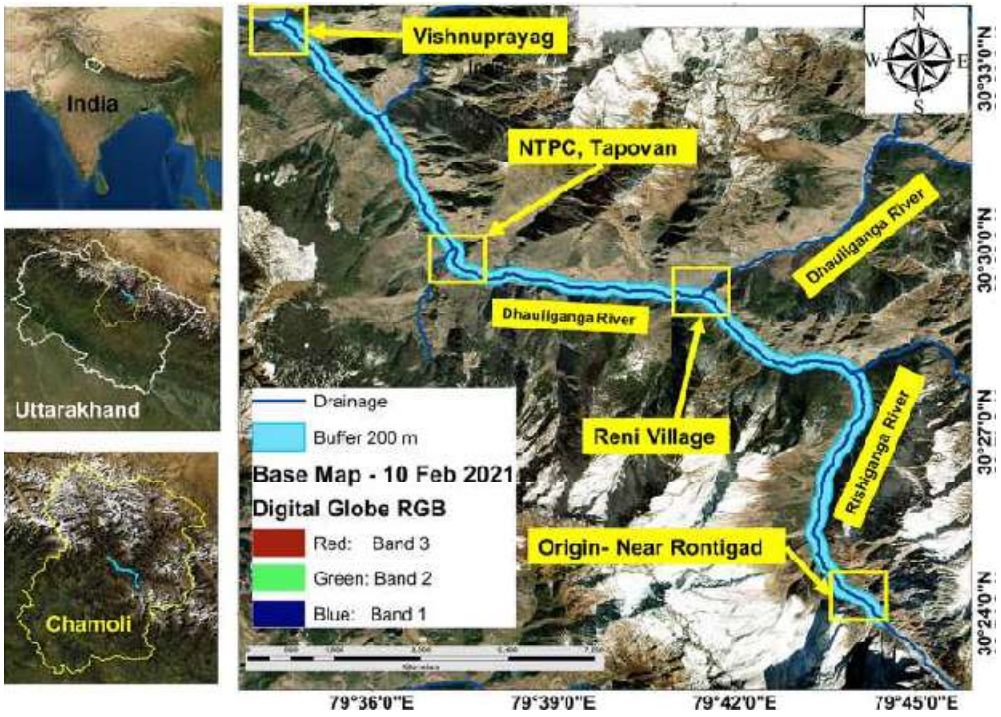

Figure 8: Path of the Chamoli Flash Floods

(Source: NDMA: https://ndma.gov.in/sites/default/files/PDF/Reports/Detalied_report_UK_Disaster.pdf)

IAF Involvement and Operational Response

Upon receiving the alert for the disaster, IAF helicopters were mobilised quickly from Air Force Station Bareilly and carried out the following actions:-

Rapid Aerial Reconnaissance (Recce). An Advanced Light Helicopter (ALH) was deployed for initial recce, providing critical information on glacier dislodgement and debris flow. Photographs taken were shared with the SDMA for damage assessment.

Casualty Evacuation and Rescue. Although a large number of lives were tragically lost to the flash flood, the IAF conducted several rescue sorties over the following days to save numerous lives. These operations focused on evacuating survivors from critical

locations, particularly from areas where debris flow had created life-threatening conditions.

Support for Scientific Assessment. In addition to rescue operations, IAF helicopters carried out sorties for scientific teams tasked with assessing the formation of an artificial lake that had resulted from debris damming. Instruments such as an Echo Sounder were winched down to measure the lake's depth, which ranged between 6 to 9.5 metres at an elevation of 2.3 km.

Operational Limitations. Despite the prompt response, challenges arose, including limited helicopter availability and integration issues between IAF operations and local disaster management. These procedural and communication gaps led to delays in initiation of full-fledged rescue and relief efforts.

Observations

The Chamoli flashflood event on 07 February 21 revealed several shortcomings in the disaster response system, particularly concerning the coordination between civil authorities and the IAF. These are as follows:-

Lack of Pre-Disaster Planning and Swift Integration. This tragic incident revealed a lack of pre-arranged protocols for mobilising a rapid IAF response upon the initial signs of glacier mass dislodgement. According to the NDMA report, there was no effective mechanism in place to alert or deploy IAF assets promptly when the glacier broke away. This lapse resulted in significant delays that hampered rescue efforts, ultimately exacerbating the crisis. It is imperative that robust early integration procedures are established to ensure a rapid response in future emergencies.

Critical Breakdown in Communication. One of the most significant operational gaps observed was the fragmentation in communication between civil authorities and the IAF. Although IAF helicopters were deployed from Bareilly for aerial reconnaissance, the communication channels between the pilots and the ground-based disaster management teams were not unified. The NDMA case study reports that vital information—such as the extent of debris flow and the formation of an artificial lake—was not relayed in real time due to the use of disparate communication methods. This disjointed information flow delayed decision-making and resource mobilisation at critical moments, thereby impeding an effective response.

Resource Allocation Challenges. The event also highlighted severe resource constraints. The continuous tasking of IAF aviation assets across multiple concurrent disasters in 2021 limited the availability of helicopters for the Chamoli incident. The case study documents that, despite the urgency, the nearest aviation assets from other services (e.g state-owned or Army helicopters) were not effectively utilised due to a lack of coordinated resource allocation protocols. This resulted in suboptimal use of the IAF's capabilities and delayed the initiation of rescue operations. Such challenges in resource pre-positioning and allocation emphasise the need for a dynamic and integrated resource management system.

Underutilisation of Aerial Recce for Scientific Assessment. Although the IAF conducted several aerial sorties to document the glacier mass dislodgement and subsequent debris flow, the integration of this critical scientific data into the broader disaster response strategy was limited. The IAF's aerial recce provided valuable visual evidence—such as photographs and video footage—that confirmed the severity of the

event and helped in mapping the affected areas. However, these insights were not seamlessly incorporated into decision-making processes at the ground level, suggesting a gap in interdisciplinary collaboration. The lack of a structured channel for sharing and analysing this data diminished the overall effectiveness of the response.

Impact on Affected Communities. The above mentioned operational deficiencies had a profound impact on the affected population. Extensive damage to infrastructure which included bridges, roads and hydroelectric projects and the loss of 204 human lives and approximately 186 livestock, underscore the tangible consequences of delays in coordination and resource mobilisation. The disruption of essential services, such as electricity and road connectivity to 13 villages, further compounded the humanitarian crisis, emphasising the critical need for an optimised framework.

Conclusion

The case study of the Chamoli flashflood in Uttarakhand on 07 February 21 reveals critical gaps in the current disaster management framework. This event brings out the critical necessity for an enhanced civil–IAF coordination framework. By addressing the gaps in pre-disaster planning, communication and resource allocation through strategic integration, technological advancements and targeted training, we can ensure a more effective and timely response in future disasters. It is vital that we take action now to safeguard our communities and streamline our disaster response efforts for a safer tomorrow.

AGARTALA FLOODS, 2024

Background

In August 2024, Agartala and its surrounding regions in Tripura were devastated by severe flooding caused by incessant monsoon rains. Within hours, entire neighbourhoods were submerged, roads turned into rivers and thousands of residents found themselves stranded in their homes. Panic spread quickly as the floodwaters rose, cutting off access to essential services. With critical infrastructure like bridges and power lines damaged, the city was in crisis and the need for immediate intervention became evident.

Recognising the urgency, the IAF was called in to assist. In response, two Mi-17 helicopters and one Advanced Light Helicopter (ALH) were deployed for aerial reconnaissance, casualty evacuation, insertion of NDRF personnel and supply of essential relief material. Over the course of the operation, the IAF helicopters flew for a total of 40 hours and delivered approximately 55 tonnes of relief material to the worst-affected areas.

Chronology of Events

The pace of the sequence of events was rapid, overwhelming the state machinery:-

Initial Flooding and Emergency Alert. In the early hours of 15 August, torrential rains battered Agartala, causing the Haora River to overflow its banks. By dawn, vast stretches of the city were under water, with thousands of people stranded. The SEOC issued distress calls and disaster response teams quickly realised that ground operations

alone would not be enough. With roads submerged and the scale of devastation worsening, aerial support was deemed necessary.

Deployment of Aerial Assets. Responding to the Tripura government's request, the IAF immediately scrambled two Mi-17 helicopters and one ALH from the nearest operational base. The sorties commenced at dawn, with an ALH conducting an aerial reconnaissance mission to assess the worst-hit areas. The images and videos captured helped authorities prioritise relief efforts, identifying stranded families, collapsed structures and high-risk zones.

Rescue and Relief Operations. Over the next two days, the IAF carried out extensive rescue operations which included:-

Casualty Evacuation. The Mi-17s transported stranded individuals from rooftops and flooded homes to safer areas. Several medical evacuations were carried out for critically ill patients who were unable to reach hospitals.

Insertion of NDRF Troops. Troops were airlifted and inserted into cut-off locations to conduct on-ground rescue efforts, reinforcing the overwhelmed local response teams.

Supply of Relief Material. The helicopters air-dropped food packets, drinking water and medical supplies to affected communities.

Scaling down of Operations. By the evening of 18 August, water levels began to recede in some areas, allowing ground rescue teams to take over. The IAF continued to provide aerial support where needed, ensuring that the supplies reach the most inaccessible regions before beginning withdrawal operations.

IAF Involvement and Operational Response

Aerial Reconnaissance & Situational Awareness. The ALH played a crucial role in mapping the flood-hit areas, capturing real-time visuals that helped coordinate ground relief efforts. The aerial perspective enabled better decision-making, ensuring resources were allocated where they were needed the most.

Casualty Evacuation & Rescue Operations. Many residents, including children, elderly individuals and patients in urgent need of medical care, were stranded in waterlogged areas. The Mi-17s evacuated those in critical condition, ferrying them to medical centers or safer locations.

Insertion of NDRF Troops. Since many neighbourhoods were completely cut off, NDRF teams had no way to reach affected communities on foot. The helicopters swiftly inserted response teams directly into these areas, enabling rescue operations to begin sooner.

Relief Material Distribution. With surface transport severely disrupted, airlifting supplies became the only viable option. The Mi-17s transported and airdropped 55 tonnes of essential relief items, including food packets, bottled water, medical kits and shelter materials.

Observations

The Agartala flood event on 15 August 24 revealed several shortcomings in the disaster response system, particularly concerning the coordination between civil authorities and the IAF. These are as follows:-

Swift Mobilisation and High Operational Readiness. The IAF's rapid deployment made a significant difference in the early hours of the crisis. Within hours of receiving the request, helicopters were in the air, demonstrating the high state of preparedness of the armed forces. This quick response undoubtedly saved lives, particularly for those in medical distress.

Challenges in Real-Time Coordination. While the IAF's role was crucial, lack of an integrated disaster response system was evident. Despite aerial reconnaissance providing critical data, delays in relaying information to ground teams led to inefficiencies in task prioritisation. This highlights the need for a real-time digital information-sharing platform between civil agencies and the armed forces.

Resource Allocation & Availability Constraints. While the IAF helicopters proved invaluable, the availability of aviation assets remains a concern. With multiple disaster-prone regions requiring similar resources simultaneously, the allocation of helicopters must be dynamically managed. A more structured system for pre-positioning assets in high-risk zones could enhance future response times.

Communication Barriers Between Agencies. Coordination between civil authorities and IAF teams was occasionally hindered by differences in operational procedures and communication protocols. While both entities worked towards the same goal, their approaches were not always synchronised, leading to minor delays in task execution. Standardised inter-agency training programmes could mitigate such challenges.

Importance of Pre-Disaster Preparedness. The relief operation underscored the importance of proactive planning. Had pre-disaster aerial surveys been conducted as part of standard preparedness measures, the response effort could have been even more efficient. Investing in predictive flood modelling and joint training exercises would strengthen disaster resilience in the long run.

Public Perception & Impact on Affected Communities. The presence of IAF helicopters in the sky provided hope to the affected communities. Many stranded residents described the relief operations as a "lifeline" during their worst moments. The timely arrival of food and water in isolated areas also prevented a secondary humanitarian crisis from developing.

The Agartala flood relief operations of August 2024 showcased the IAF's remarkable ability to respond swiftly and effectively to natural disasters. Their role in reconnaissance, casualty evacuation, troop insertion and relief material delivery was instrumental in preventing further loss of life and mitigating the crisis. However, the operation also highlighted gaps in inter-agency communication, real-time information sharing and resource allocation that need to be addressed for future disaster responses.

These insights highlight the need for a more integrated, technology-driven disaster management framework that ensures seamless coordination between military and civil authorities. Strengthening these mechanisms will enhance India's disaster resilience and enable even faster, more effective responses to future emergencies.

CHAPTER 6

PROPOSED FRAMEWORK FOR OPTIMISED CIVIL–IAF COORDINATION

Disaster preparedness, whether it's in anticipation of potential weather-related incidents or terrorist incidents requires a skill set that in my mind someone has to be trained for.

Bennie Thompson

Effective disaster management in India requires a strong and unified framework that aligns civil and military capabilities, particularly those of the IAF, to improve disaster response. The unique strengths of the IAF—such as air logistics, reconnaissance and rapid deployment—make it an essential component of India's disaster management strategy. However, challenges related to coordination, communication and resource allocation often hinder the full potential of this collaboration.

This chapter proposes a structured and comprehensive framework aimed at addressing these challenges by enhancing integration, streamlining decision-making and improving preparedness. By incorporating global best practices, optimising existing systems and fostering collaboration between civil and military stakeholders, the framework seeks to achieve seamless integration, operational efficiency and a more proactive disaster response system that minimises human and material losses.

Defining the Framework Objectives

The proposed framework is centred around four primary objectives:-

Improved Coordination. Establishing mechanisms to ensure synchronised planning and execution between civil authorities and the IAF, emphasising real-time data sharing and streamlined operational structures. A key component of this coordination is the effective use of EOCs at the national, state and district levels. Mandated by the NPDM, these centres act as the primary hubs for integrating IAF operations into civil disaster response frameworks. By placing IAF representatives in EOCs and enhancing their technological capabilities, the framework aims to ensure real-time communication, seamless resource allocation and reduced response times.

Enhancing Real-Time Decision-Making. Improving the functionality of existing EOCs is crucial for ensuring that decision-making during disasters is both timely and well-informed. To enhance their effectiveness, the proposed framework includes the implementation of advanced decision-support systems, such as AI-driven analytics and GIS tools. While EOCs already employ GIS-based tools, the proposed framework highlights the need for AI-based tools to fuse multiple data inputs into a single composite operational picture. These technologies will provide real-time situational updates and predictive modelling to aid in decision-making. Furthermore, the development of SOPs will help streamline the flow of information and prioritise tasks, ensuring that resource allocation and operational strategies are executed promptly. Regular audits and simulation exercises will also be conducted to identify and address potential bottlenecks, thereby strengthening the role of EOCs as the backbone of disaster management decision-making.

Resource Optimisation. This involves ensuring that the specific capabilities of the IAF, such as air logistics, reconnaissance and rapid deployment, are aligned with the requirements of disaster response. The framework highlights the importance of systematically assessing disaster needs—such as evacuation, supply delivery or infrastructure repairs—and matching them with the IAF's operational strengths. By establishing task prioritisation protocols within the EOCs, the framework ensures that the unique resources of the IAF are deployed optimally to tackle high-priority tasks. This alignment not only minimises the waste of critical assets but also enhances the overall efficiency of disaster response efforts.

Capacity Building. A key component of the proposed framework, capacity building focuses on equipping both civil and military stakeholders with the skills, knowledge and operational understanding necessary for effective disaster response. Joint training programmes will feature comprehensive modules covering topics such as air logistics, resource prioritisation and inter-agency coordination. Simulated drills and tabletop exercises will provide practical experience, ensuring that stakeholders are familiar with protocols for high-altitude rescues, aerial evacuations and supply chain logistics. Additionally, structured knowledge-sharing platforms will facilitate the exchange of best practices and lessons learned from previous operations. By fostering a culture of continuous learning and collaboration, capacity building enhances the overall readiness and cohesion of disaster response teams.

Alignment with SFDRR, SDGs and PM's 10-Point Agenda. The framework aims to align with the SFDRR's priority of strengthening disaster risk governance and enhancing

preparedness for effective response. SFDRR's Priority 2 focuses on strengthening disaster risk governance, which is to be addressed by institutionalising structured civil-IAF coordination mechanisms. Additionally, SFDRR's Priority 4 emphasises enhancing disaster preparedness for effective response, which is to be met by leveraging technology for decision-making, pre-positioning of resources and capacity-building initiatives. The framework also aims to support SDGs, specifically SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action), by promoting the development of resilient and coordinated disaster response efforts.

It also incorporates essential components of the Prime Minister's 10-Point Agenda on Disaster Risk Reduction, including the use of technology in disaster response, investment in capacity building and the enhancement of inter-agency coordination.

Leveraging Global Best Practices in Disaster Management

India's disaster response framework can greatly benefit from adapting proven international models that provide structured approaches to multi-agency coordination and disaster management. The following examples demonstrate how global best practices can inspire tailored solutions for the Indian context:-

FEMA's NIMS. NIMS integrates various stakeholders, including federal, state and local agencies, into a unified response framework. This centralised coordination model ensures clear communication, seamless resource allocation and accountability. For India, a similar centralised system could be established to integrate the IAF with National, State

and District Disaster Management Authorities, effectively utilising EOCs to operationalise these principles.

Japan's SDF. Japan's SDF is renowned for its disaster preparedness, particularly through regular joint exercises with local governments. These simulations of complex scenarios foster readiness, collaboration and clarity of roles. For India, replicating such joint exercises involving the IAF and civil agencies could enhance mutual understanding and improve coordination during actual emergencies.

Australia's Civil-Military Cooperation (CIMIC). The Australian Defence Force's CIMIC framework highlights structured command hierarchies and adaptable resource management strategies. During large-scale disasters, such as bushfires, this framework ensures effective coordination between military and civilian agencies. India could refine its civil-military coordination by adopting elements of CIMIC, establishing clear lines of authority, efficient task allocation and adaptive logistical planning.

Optimising EOCs

The framework emphasises strengthening the existing EOCs mandated by the NPDM, which serve as the backbone of India's disaster response mechanism. These centres operate at the national (NEOC), state (SEOCs) and district levels (DEOCs), ensuring a hierarchical and decentralised approach to disaster management. To enhance their functionality and better integrate IAF operations, the framework proposes the following improvements:-

Integration of Military Liaisons. Deploy IAF representatives to NEOC, SEOCs and DEOCs immediately upon receipt of disaster warnings. These officers will serve as coordination focal points, ensuring that IAF capabilities—such as aerial reconnaissance, transport and logistics—align with the evolving needs of civil agencies. This on-demand deployment allows for flexibility and maintains readiness for a swift response. Survey data from IAF pilots revealed that 81% faced delays due to unclear directives from civil authorities, which could be mitigated through early-stage coordination. Similarly, 59% of civil administration officials noted that the presence of dedicated IAF personnel would streamline task allocation.

Advanced Technological Tools. Equip EOCs with cutting-edge technologies like AI-powered decision support systems and GIS mapping tools to improve situational awareness. These tools will enable the centres to analyse disaster scenarios, predict resource needs and monitor ongoing operations more effectively. Survey responses from civil administration officials indicate that 72% believe AI-driven tools would significantly improve response efficiency by reducing the time taken for resource allocation. Additionally, 68% of IAF pilots stated that AI-generated tasking could enhance mission planning by providing real-time operational insights.

Clear Role Definitions and Joint SOPs. Develop detailed Joint SOPs that specify the roles and responsibilities of all stakeholders for seamless coordination with the IAF. This will ensure that task prioritisation is based on urgency and operational feasibility, thereby reducing redundancies and delays.

Comprehensive Training Programmes. Conduct joint training sessions and simulation exercises for EOC personnel and IAF representatives. While simulation exercises are mandated under existing guidelines, they are conducted inconsistently at all levels, resulting in varying levels of preparedness among stakeholders. The proposed framework emphasises the need for regular simulation drills to ensure that the teams are adequately prepared for real-world disaster scenarios. These drills will promote a collaborative working environment, improve inter-agency coordination and address gaps in operational readiness.

Data Integration and Real-Time Updates. Establish a centralised digital platform within EOCs to integrate data from various sources, including satellite imagery, field reports and meteorological forecasts. This will facilitate real-time decision-making and dynamic task allocation, ensuring swift responses to evolving disaster conditions. Delay in receiving the weather updates has been cited as a critical hindrance to relief operations by IAF pilots.

Institutionalising Joint Training

Establishing joint training programmes is essential for fostering effective collaboration between civil authorities and the IAF during disaster response operations. These programs aim to build inter-agency trust, enhance understanding of operational constraints and improve disaster preparedness through comprehensive and standardised training approaches.

Annual Multi-Agency Exercises. While NDMA does conduct regular mock exercises, the participation by the stakeholders, especially at field level is suboptimal. Regular multi-agency simulation drills need to be included in the annual training programme of both civil and IAF authorities so that the participation levels improve. These drills will replicate realistic disaster scenarios, such as high-altitude rescues, flood relief operations and post-earthquake evacuations. These drills will involve all stakeholders, including district officials, state agencies and the IAF, ensuring that roles and responsibilities are clearly understood and practiced.

Customised Training Modules. It is crucial to develop tailored training modules for civil authorities and IAF personnel. These modules will cover logistics management, air operation protocols, disaster communication strategies and evacuation planning. Special attention will be given to familiarising civil authorities with the operational capabilities and limitations of the IAF.

Integrated Learning Platforms. Establishing digital platforms for continuous learning will facilitate knowledge sharing and collaboration. These platforms will host training resources, case studies and post-exercise evaluations, making essential information easily accessible to stakeholders.

Continuous Evaluation and Feedback Mechanisms. Implementing feedback loops after every training session and drill will ensure continuous improvement. Regular audits will be conducted to assess the effectiveness of the training programmes, with adjustments made to address identified gaps and evolving challenges.

Training for Technological Integration. As advanced tools like AI-driven analytics, GIS mapping and disaster management dashboards become increasingly important, training sessions will incorporate these technologies to ensure that all personnel can use them effectively. This will enhance situational awareness and decision-making capabilities across agencies.

Knowledge Exchange Mechanisms

A robust knowledge exchange system is vital but must consider the operational realities of frequent personnel transfers and busy schedules faced by both civil and IAF personnel. Disaster management is typically a reactive role, making it challenging to engage in standalone platforms. Instead, the framework emphasises practical, embedded mechanisms for knowledge sharing.

Post-Disaster Joint Debriefs. Following every disaster response operation, mandatory joint debriefs will be conducted to document lessons learned, challenges encountered and best practices identified. These sessions will ensure that critical insights are institutionalised and shared across agencies.

Operational Knowledge Repositories. Centralised digital repositories will be established within EOCs to store actionable reports, guidelines and best practices. These repositories will provide readily available resources for incoming personnel, reducing the loss of institutional memory resulting from frequent transfers of personnel.

Embedded Learning During Operations. Encourage real-time knowledge exchange during active disaster operations through informal coordination and direct engagement

between civil and IAF teams. This approach ensures continuous learning without disrupting operational priorities.

Focused, Short Workshops. Organise brief, targeted workshops before or after disaster events to address specific operational challenges. These workshops will minimise time commitments while maximising impact by resolving immediate and relevant issues.

Communication and Information-Sharing Protocols

Unified Communication Framework. Effective communication is crucial for efficient disaster response. In situations requiring seamless coordination between civil authorities and the IAF, a unified communication framework ensures real-time information flow, reducing delays and ambiguity. The framework proposes the following components:-

Centralised Communication Systems. Develop a comprehensive digital platform that connects the NEOC, SEOCs, DEOCs and IAF Operations Rooms at corresponding levels. This platform will facilitate the real-time exchange of critical data, including task priorities, resource requirements and operational updates. By integrating satellite communication, secure data networks and mobile platforms, the system will ensure uninterrupted connectivity, even in remote areas or challenging conditions or disaster-hit areas.

Standardised Protocols. Establishing detailed Joint SOPs to define communication flows and decision-making hierarchies is essential. These protocols will include predefined templates for resource requests, situation reports

and inter-agency alerts, ensuring consistency and reducing confusion during emergencies.

Integration with Advanced Tools. Use of GIS-based mapping tools, AI-driven analytics and live tracking dashboards provides for actionable insights and enhances situational awareness. For example, real-time mapping of affected areas can effectively guide resource deployment and evacuation plans.

Training on Communication Systems. Specialised training sessions will be conducted to ensure that both civil and IAF personnel are proficient in using the unified communication platform. This training will include mock scenarios to familiarise stakeholders with the platform's functionalities, ensuring efficient usage during actual disasters.

By implementing this unified communication framework, the proposed system ensures faster, more coordinated responses, minimising delays and maximising the impact of disaster relief efforts.

Technological Integration

Leveraging advanced technology is central to creating an efficient and responsive disaster management framework. The integration of sophisticated tools and platforms enhances situational awareness, improves decision-making and optimises resource deployment during emergencies. The proposed framework emphasises the following technological advancements:-

GIS and AI Systems. GIS tools provide precise mapping of disaster-affected areas, enabling responders to identify hotspots, assess damage and plan evacuation routes. Coupled with AI, these systems can offer predictive analytics, helping forecast disaster impacts and prioritise resource allocation based on real-time data. Survey responses from civil administration officials indicate that 72% believe AI-driven tools would significantly improve response efficiency by reducing the time taken for resource allocation. Additionally, 68% of IAF pilots stated that AI-generated tasking could enhance mission planning by providing real-time operational insights.

Mobile Applications for Coordination. Custom-built disaster management mobile applications facilitate field-level updates, task tracking and inter-agency communication. These applications will enable civil and IAF personnel to coordinate effectively by providing access to real-time information and allowing immediate reporting of challenges or updates from the ground.

Disaster Dashboards. Interactive dashboards integrated with EOCs can serve as centralised hubs for monitoring disaster response activities. These dashboards will compile data from multiple sources, such as field reports, satellite imagery and weather updates, providing a comprehensive overview for decision-makers.

Remote Sensing and RPAs. Incorporating remote sensing technology and RPAs allows for real-time aerial surveillance of disaster zones. RPAs can be deployed to inaccessible areas, providing critical data for assessing damage, locating stranded populations and delivering essential supplies.

Secure Communication Networks. Developing robust and secure multi-channel communication systems ensures uninterrupted connectivity during disasters. These networks will support the transmission of sensitive information and enable coordination between civil agencies and IAF, even in remote or heavily impacted regions.

Automated Resource Management Systems. Utilising technology-driven tools to track, allocate and monitor resources dynamically ensures that critical supplies reach the right locations at the right time. Automated systems can reduce inefficiencies, prevent duplication of efforts and improve overall logistics management.

By incorporating these technological tools into disaster management practices, the framework ensures a more proactive and adaptive response to emergencies, minimising human and material losses while enhancing the effectiveness of civil and IAF coordination.

Command Structures and Role Clarity

Hierarchical Integration. Effective disaster response requires a well-defined hierarchical command structure to ensure streamlined coordination between civil and military agencies. The proposed framework aims to integrate IAF roles within the existing structures of the NDMA, SDMAs and DDMAs. This integration will enhance decision-making and execution during emergencies. Key components include:-

Unified Command Chains. Establishment of clear command chains that incorporate IAF representatives into the disaster response hierarchy. This

integration will allow civil authorities and the IAF to jointly prioritise tasks, allocate resources and execute operations seamlessly.

Role Integration Protocols. Development of specific protocols for embedding IAF roles into disaster response planning, including aerial reconnaissance, high-capacity logistics and rapid deployment. These protocols will clearly outline responsibilities and ensure that the IAF's unique capabilities are fully utilised without duplication of efforts.

Training for Command Synergy. Conduct of joint exercises that emphasise hierarchical integration, thus enabling both civil and military personnel to understand and respect each other's command structures. This will foster mutual trust and ensure operational synergy during actual disasters.

Real-Time Command Coordination. Establishment of communication hubs within EOCs to facilitate real-time coordination among different command levels. These hubs will utilise advanced technologies to provide updated situational awareness, enabling commanders to adapt quickly to evolving scenarios.

By strengthening hierarchical integration, the framework ensures a unified approach to disaster response, leveraging the combined strengths of civil and military agencies for greater effectiveness.

Clear Role Demarcation. Clear role demarcation is essential to prevent overlaps, confusion and delays during disaster response. Establishing distinct responsibilities for

civil and military agencies allows each stakeholder to operate within well-defined boundaries, enabling seamless collaboration. Key aspects include:-

Civil-Military Task Allocation. Responsibilities for each phase of disaster management—mitigation, preparedness, response and recovery—must be clearly assigned. For example, while the IAF could handle aerial reconnaissance, evacuation and supply drops, the civil agencies would manage ground-level logistics, public communication and shelter operations. This clarity avoids duplication and ensures optimal resource use.

Defined SOPs for Joint Operations. SOPs that outline the precise roles of each agency during joint operations must be formulated at state level. These SOPs will address scenarios such as coordinating air and ground logistics, integrating military resources into civil plans and managing multi-state disasters.

Review and Adjustment Mechanisms. Implementation of periodic reviews of assigned roles and responsibilities in order to adapt to evolving challenges. These reviews will include feedback from stakeholders to identify any overlaps or gaps, ensuring continuous improvement in coordination.

On-Ground Role Adaptation. Empowering on-ground commanders from both civil and military teams to dynamically adjust roles based on real-time needs during emergencies is crucial. This flexibility will ensure that resources are allocated efficiently and that response efforts remain effective under changing circumstances.

Documentation and Knowledge Sharing. It is crucial to maintain comprehensive records of role demarcations and operational outcomes from past disaster events. These records will serve as valuable resources for training new personnel and refining role definitions over time.

By ensuring clear task allocation, standardised processes and continuous adaptation, the framework minimises confusion and enhances the overall effectiveness of disaster response operations.

Logistical Optimisation

Logistical optimisation is a critical component of effective disaster response. It ensures that resources are strategically managed and efficiently deployed to meet the dynamic needs of affected areas. By integrating advanced planning, technology and inter-agency collaboration, the proposed framework aims to overcome logistical challenges and improve the overall efficacy of disaster operations.

Pre-Positioning Resources. Pre-positioning resources involves identifying high-risk zones and strategically placing critical supplies and infrastructure in anticipation of potential disasters. Key aspects include:-

Strategic Stockpiling. This can be accomplished by identifying high-risk zones, such as flood-prone areas or regions susceptible to earthquakes, through hazard assessments. Essential supplies, such as food, water, medical kits and fuel, will be pre-stocked in these areas to ensure their availability during emergencies.

Helipad Infrastructure. Developing and maintaining helipads in remote and vulnerable regions is essential for facilitating air logistics. These helipads will enable the swift transport of supplies, evacuation of affected populations and deployment of emergency response teams.

Infrastructure Resilience. The pre-positioned resources are to be stored in disaster-resilient facilities to prevent their destruction during the very events they are meant to mitigate.

Dynamic Logistics Management. Dynamic logistics management focuses on leveraging technology and inter-agency collaboration to adapt resource allocation to evolving disaster scenarios. Key components include:-

Real-Time Tracking Systems. Implementation of GPS-enabled tracking systems will enable monitoring the movement and delivery of resources. This technology will allow for dynamic adjustments to supply routes based on real-time conditions, such as blocked roads or emerging needs.

Inter-Agency Resource Pools. Establishing shared resource pools that are accessible to both civil and military agencies is crucial. This collaboration will ensure the availability of critical assets, such as vehicles, personnel and equipment, without duplication of efforts.

Automated Allocation Algorithms. Use of AI-based systems will enable prioritisation of resource distribution based on the severity of needs and geographic constraints. These algorithms will ensure equitable and efficient allocation, reducing delays and wastage.

Post-Disaster Logistics Analysis. Post-disaster evaluations are essential for improving logistical frameworks over time. Key initiatives include:-

Documentation of Lessons Learned. Capture the detailed insights into logistical successes and challenges faced during disaster response operations. These records will guide future planning and resource allocation.

Stakeholder Feedback. Engaging both civil and military responders to gather feedback on logistical processes and identify areas for improvement.

Infrastructure Upgrades. Use of post-disaster analysis to prioritise infrastructure upgrades, such as roads, bridges and storage facilities that were identified as bottlenecks to relief operations.

By focusing on pre-positioning, adaptive management and continuous improvement, the framework will ensure that logistical systems remain agile and effective, even in the most challenging disaster scenarios.

CHAPTER 7

EVALUATION OF THE PROPOSED FRAMEWORK

The evaluation of the proposed framework for optimised civil-IAF coordination is a crucial step in determining its potential to enhance disaster management in India. This chapter explores the key metrics that define the framework's effectiveness, including operational efficiency, communication, adaptability and stakeholder engagement. By comparing the framework to globally established best practices and incorporating feedback from key stakeholders, the analysis identifies strengths, weaknesses and opportunities for improvement. Through this comprehensive evaluation, the chapter aims to provide actionable insights that will refine the framework and facilitate its successful implementation in various disaster scenarios.

Criteria for Evaluation

The evaluation of the proposed framework for optimised civil-IAF coordination in disaster management is grounded in comprehensive and practical criteria that reflect its relevance and effectiveness in addressing India's unique disaster management challenges. These criteria assess the framework's impact across multiple dimensions, ensuring it addresses operational bottlenecks, enhances coordination and aligns with global best practices while remaining adaptable to local contexts.

Operational Efficiency. The proposed framework aims to improve operational efficiency by addressing critical inefficiencies in the existing system. Currently, disaster response efforts often experience delays due to fragmented coordination and redundant

processes. The integration of EOCs will provide a centralised platform for task coordination, enabling real-time resource allocation and better alignment of efforts between civil agencies and the IAF. SOPs will standardise actions, eliminating ambiguity and reducing overlap in responsibilities. Unlike the existing system, which lacks advanced digital tools, the proposed framework advocates for adopting real-time tracking systems and integrated digital platforms. These technologies will enable dynamic decision-making, resource monitoringand adaptive responses, ensuring that operational bottlenecks are minimised. By addressing these gaps, the framework promises a significant improvement over current practices, enhancing the speed and efficiency of disaster response.

Coordination and Communication. The proposed framework significantly enhances coordination and communication by introducing unified communication platforms and clearly defined SOPs. The existing system suffers from a lack of real-time communication tools and unclear protocols, which lead to delays and misalignment between civil and military agencies. The proposed framework addresses these issues by:-

Centralised Communication Systems. Implementing digital platforms that connect EOCs at all levels, enabling real-time data sharing and situational awareness.

Pre-Defined SOPs. Establishing standardised protocols for resource requests, task allocation and inter-agency alerts to eliminate ambiguities and ensure consistency in operations.

Integrated IAF Representation. Embedding IAF representatives within EOCs during disaster events to facilitate seamless collaboration and quick decision-making.

Scalability and Adaptability. The proposed framework greatly improves scalability and adaptability compared to the current system by incorporating modular and flexible components designed to handle a wide range of disaster scenarios. The existing system's lack of standardised procedures and resource allocation mechanisms often hampers its ability to scale operations for large or multi-state emergencies. The proposed framework addresses this through:-

Modular Training Programmes. These programmes can be tailored to cater to different levels of personnel expertise and varying disaster magnitudes, ensuring that both civil and military stakeholders are prepared for diverse scenarios.

Adaptable Logistics. By utilising pre-positioned resources and dynamic logistics management systems, the framework ensures that supply chains remain functional and responsive, even in rapidly changing disaster environments.

Integration of Lessons Learned. Continuous feedback loops allow the framework to incorporate insights from smaller, localised disasters into planning for larger-scale emergencies, enhancing its adaptability.

Sustainability and Capacity Building. The proposed framework significantly improves sustainability and capacity building compared to the existing system by

institutionalising mechanisms that promote long-term collaboration and readiness. Joint training programs are fundamental components, ensuring that both civil and military personnel are well-equipped to handle a variety of disaster scenarios. These programs aim to create a standardised approach that bridges operational gaps between agencies. Additionally, knowledge-sharing mechanisms, such as centralised digital repositories and post-operation debriefings, help preserve institutional memory and facilitate continuous learning. Unlike the current ad-hoc approach, this framework introduces structured feedback loops to refine processes based on lessons learned from prior disasters. However, consistent implementation of these initiatives will require strong institutional support, including adequate funding, policy alignment and sustained leadership commitment. By addressing these elements, the framework ensures a resilient and adaptable disaster response system.

Stakeholder Acceptance. The proposed framework enhances stakeholder acceptance by directly addressing operational challenges and aligning with the practical realities faced by civil and IAF stakeholders. Unlike the existing system, which often neglects the need for tailored coordination mechanisms, this framework promotes engagement by introducing focused training programs and clearly defined roles that minimise disruptions to stakeholders' primary responsibilities. By integrating IAF representatives within EOCs during disasters and encouraging collaborative planning through joint exercises, the framework fosters opportunities for mutual understanding and trust-building. It also emphasises the use of digital platforms to reduce administrative burdens, enabling stakeholders to focus on their core functions while still effectively participating in

disaster response efforts. This practical alignment ensures that stakeholders view the framework as a supportive and feasible enhancement to their current roles.

Alignment with International and National Disaster Management Policies

The framework is designed to align with global and national disaster management policies, ensuring a structured and resilient disaster response mechanism.

SFDRR. The framework supports SFDRR's emphasis on enhancing disaster risk governance and ensuring effective disaster response mechanisms. It specifically aligns with Priority 2 (Strengthening Disaster Risk Governance) by institutionalising clear coordination mechanisms between the IAF and civil authorities and Priority 4 (Enhancing Preparedness for Effective Response) by integrating AI-based decision support tools and structured pre-disaster planning.

SDGs. It contributes to SDG 11 by promoting resilient disaster response mechanisms and (SDG 13 (Climate Action) by promoting adaptive disaster response strategies.

Prime Minister's 10-Point Agenda on Disaster Risk Reduction. The proposed framework directly addresses the agenda's focus areas, including leveraging technology for disaster management and strengthening inter-agency coordination.

Comparison with Global Best Practices

The effectiveness of the proposed framework is evaluated through a thorough comparison with globally established models to identify its strengths, weaknesses and areas for improvement. This analysis examines how well the framework aligns with

proven strategies while addressing the unique challenges faced by India. By drawing insights from FEMA's centralised coordination systems, Japan's focus on preparedness through joint exercises and Australia's strong civil-military cooperation frameworks, this evaluation offers actionable recommendations to refine and adapt the framework for optimised disaster response in India. The emphasis is on contextualising global best practices to enhance operational efficiency, collaboration among stakeholders and adaptability in disaster management operations.

FEMA's NIMS. FEMA's NIMS is widely viewed as a gold standard for centralised disaster management coordination. By integrating federal, state and local agencies through standardised protocols, it ensures seamless collaboration during emergencies. A critical component of NIMS is the ICS, which provides a hierarchical structure for effective decision-making. The proposed framework aligns with this approach by emphasising the role of EOCs and unified communication platforms to bridge inter-agency gaps (FEMA, 2017). However, unlike FEMA's well-established infrastructure, India's decentralised governance and diverse geographic challenges require significant contextual adaptation. For instance, India must address logistical bottlenecks in remote regions and ensure that EOCs are adequately equipped to manage multi-state disasters. By leveraging India-specific solutions, such as adaptive command structures and localised training, the framework can become more effective in addressing these challenges.

Japan's SDF. Japan's SDF plays a crucial role in disaster preparedness by conducting regular joint exercises with local authorities and other agencies. These drills

simulate large-scale disasters, such as earthquakes and tsunamis, to test readiness, refine protocols and foster collaboration among multiple stakeholders. A key strength of the SDF's approach is its emphasis on integrating military capabilities with civil needs, ensuring that resources are optimally deployed to areas of greatest need (Japan Ministry of Defense, 2022). The proposed framework draws inspiration from this model by recommending institutionalised joint training programs and simulation exercises that replicate large-scale scenarios. However, India's disaster management framework faces distinct challenges, including resource constraints and the frequent transfer of personnel, which can disrupt continuity in training and collaboration. To address these issues, the framework emphasises modular training programs that are adaptable to varying levels of expertise and focused on building long-term institutional memory. Additionally, leveraging technology to document and share lessons learned from exercises can help mitigate the impact of personnel changes and enhance overall preparedness.

Australia's CIMIC. Australia's CIMIC model excels at establishing structured command hierarchies and implementing adaptive logistics systems, which have proven effective in managing large-scale disasters like bushfires and floods. A notable feature of CIMIC is its clear delineation of roles between civil and military agencies, supported by predefined coordination mechanisms and extensive training programs. These efforts ensure that military resources are seamlessly integrated into civilian disaster management plans. The proposed framework in India mirrors these strengths by advocating for clear command structures and joint training initiatives. However, India's approach to integrating the IAF into existing EOCs introduces unique logistical and operational challenges, such as the need for real-time task synchronisation and addressing geographic

diversity. By adapting Australia's structured command strategies to India's decentralised governance and leveraging localised training, the framework aims to overcome these challenges and improve operational efficacy.

This comparative analysis highlights the framework's alignment with global best practices while emphasising the need for tailored adaptations to suit India's specific context.

Stakeholder Feedback

The effective implementation of the framework relies significantly on feedback from both civil authorities and IAF stakeholders, as their insights are essential for refining and enhancing its applicability. This feedback acts as a bridge between theoretical proposals and on-ground realities, helping to identify operational gaps, highlight areas needing further support and prioritise actionable improvements. By incorporating the perspectives of key stakeholders, the framework ensures that its design aligns with practical requirements, addresses existing challenges and improves overall disaster response effectiveness. Key insights include:-

Civil Authorities. Feedback from civil authorities emphasises critical shortcomings in the current disaster response system, particularly the lack of streamlined communication protocols. These inefficiencies often lead to delays and miscommunication, undermining the overall effectiveness of disaster response efforts. Stakeholders have highlighted the need for clear and comprehensive SOPs that delineate roles and responsibilities across agencies, thereby reducing ambiguity during high-

pressure situations. Furthermore, robust, scenario-specific training programs tailored to the unique challenges of disaster management are deemed essential for bridging operational gaps and promoting inter-agency collaboration. These insights underscore the importance of aligning the proposed framework with the practical requirements and operational constraints of civil authorities to ensure its relevance and feasibility.

IAF Personnel. IAF stakeholders have identified several key challenges that hinder effective disaster response. A significant issue is the frequent breakdown in coordination, often resulting from unclear task assignments and inadequate integration of IAF roles within civil disaster management plans. This lack of clarity delays operational execution and leads to inefficient use of IAF resources. Stakeholders strongly advocate for enhanced resource pre-positioning, particularly in disaster-prone areas, to ensure rapid deployment of supplies and personnel during emergencies. Additionally, they emphasise the necessity of aligning civil requirements with IAF capabilities through improved communication and collaborative planning. By incorporating these elements into the proposed framework, the aim is to streamline task allocation, minimise delays and leverage the unique strengths of the IAF in aerial reconnaissance, evacuation and logistical support.

Challenges Identified.

Operational Workload. Civil and IAF personnel often cite their main job responsibilities as a significant barrier to fully participating in disaster management training and planning. For civil authorities, the pressures of routine administrative duties frequently take precedence over preparedness efforts,

leading to a reactive approach to disaster management instead of a proactive one. Similarly, IAF personnel mainly concentrate on defene and operational tasks, leaving them limited time for in-depth engagement in disaster-specific training. This challenge is worsened by the absence of dedicated time or institutional frameworks that give priority to disaster management alongside their primary roles. The suggested framework tackles this concern by proposing targeted, short-duration training sessions and efficient coordination exercises that can be seamlessly incorporated into current schedules. This approach ensures that disaster preparedness becomes a feasible component of the stakeholders' overall duties.

Technological Gaps. Stakeholders have highlighted the lack of integrated digital platforms that offer real-time updates, task prioritisation and resource allocation tracking. The current absence of centralised systems results in fragmented communication and delays in decision-making during disaster response efforts. For instance, civil agencies and the IAF frequently use separate communication channels, leading to ineffective coordination. The suggested framework addresses these issues by promoting advanced digital solutions, such as GIS-based dashboards, AI-driven analytics and mobile applications for field updates. These tools would allow stakeholders to access a unified system for situational awareness, adaptive task management and resource optimisation. By incorporating such technologies, the framework seeks to establish a smooth flow of information, enhancing overall responsiveness and efficacy in disaster response operations.

Inter-Agency Coordination. Effective collaboration between civil and military agencies is a significant challenge in disaster response operations. The absence of regular joint exercises and organised knowledge-sharing opportunities often results in misalignment of operational strategies and delays in decision-making. Civil authorities and the IAF personnel frequently face communication barriers that contribute to these issues, leading to inefficiencies during high-pressure situations. IAF pilots noted that the lack of pre-disaster engagement with civil agencies often led to inefficiencies during mission execution. The proposed training reforms, backed by survey data showing 79% support from IAF personnel, would significantly improve on-ground collaboration. The proposed framework aims to address these challenges by institutionalising joint training programs that prioritise collaborative decision-making and operational alignment. It recommends scenario-based simulation exercises to replicate real-world disaster conditions, allowing stakeholders to practice and refine their coordination strategies. Additionally, post-disaster debriefs will provide a platform for evaluating performance, identifying gaps and improving future response efforts. Periodic inter-agency workshops and seminars are also suggested to build professional relationships, align goals and promote a culture of mutual respect and reliability. By embedding these mechanisms into the disaster management process, the framework ensures that inter-agency coordination is both effective and sustainable over time.

Summary of Evaluation

The evaluation indicates that the proposed framework has substantial potential to transform disaster response in India through improved coordination, enhanced communication and optimised logistical efficiency. By addressing critical gaps identified in the current system, such as fragmented coordination mechanisms and inadequate training initiatives, the framework provides a pathway toward a more integrated and responsive approach. The strong alignment with international frameworks such as SFDRR and national priorities including SDGs and the PM's 10-Point Agenda further reinforces its relevance and effectiveness in strengthening India's disaster preparedness capabilities.

Key challenges, including stakeholder engagement, alignment of civil and military operational protocols and the adoption of advanced technological systems, are essential to its success. Incorporating actionable stakeholder feedback and adapting global best practices to India's unique disaster management landscape will enable the framework to evolve into a resilient, adaptable and scalable solution that meets both immediate and long-term needs.

CHAPTER 8

ANALYSIS OF SURVEYS AND INTERVIEWS

Introduction

This chapter provides a comprehensive analysis of surveys conducted with the IAF pilots and civil administration officials, along with the key findings from interviews with senior stakeholders. The surveys offer crucial data on operational challenges, coordination inefficiencies and potential improvements in civil-IAF disaster response. Additionally, the interviews provide expert insights into existing frameworks, policy gaps and strategic recommendations. The objective of this chapter is to evaluate current coordination mechanisms, identify recurring bottlenecks and validate the proposed framework through empirical data. By analyzing firsthand experiences and stakeholder perspectives, this chapter aims to highlight key areas that require structural and procedural reforms for a more effective and synchronised disaster response system.

Survey Analysis of IAF Pilots

Experience with Disaster Response. The survey findings indicate that 73% of IAF pilots have participated in multiple disaster relief operations, with floods and cyclones being the most common scenarios. Additionally, 42% of respondents noted the challenge of unpredictable weather conditions, which affect flight operations and mission execution.

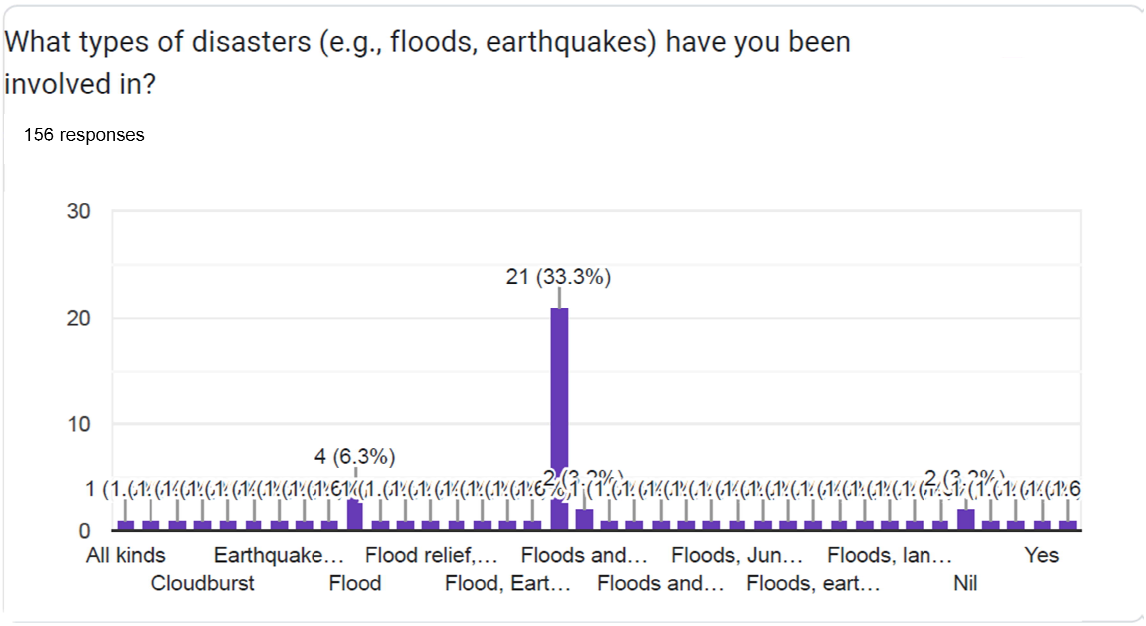

Figure 9: Type Of Disasters That IAF Pilots Have Been Involved in

Coordination with Civil Authorities. A significant concern among pilots was the lack of real-time communication. About 67% reported experiencing delays due to unstructured tasking from civil authorities, which led to inefficiencies in air operations. Furthermore, 58% expressed a need for pre-established communication channels to ensure clarity in assignments.

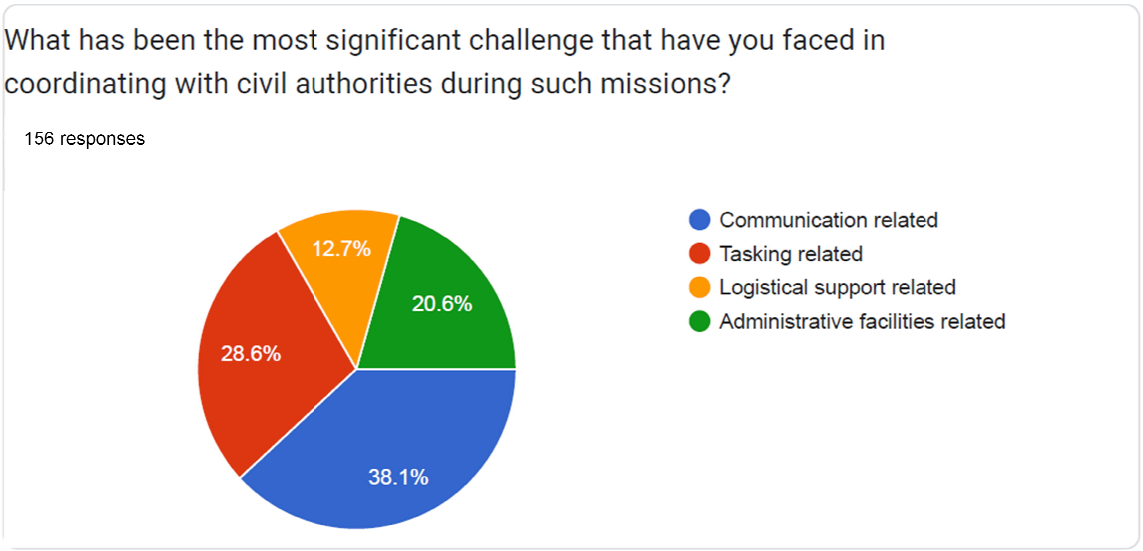

Figure 10: Coordination with Civil Authorities

Operational Bottlenecks. The survey revealed that the most significant bottlenecks include delays in obtaining approvals for sorties (61%) and inadequate logistical planning at airbases (48%). Several pilots pointed out that the absence of a dedicated nodal officer within EOCs is a major hurdle.

Recommendations for Improvement. The survey highlighted strong support for AI-based tasking, with 79% of pilots advocating for AI-driven mission planning tools to optimise sortie allocation. Additionally, 72% recommended embedding dedicated IAF liaison officers within civil disaster management teams to ensure smoother coordination.

Survey Analysis of Civil Administration Officials

Perceptions of IAF's Role in Disaster Response. Civil administration officials acknowledged the crucial role played by the IAF in disaster response, with 88% rating the IAF's performance as highly effective. However, 46% mentioned that requesting IAF assistance can be a cumbersome bureaucratic process, which leads to delays in response times.

Figure 11: Rating of Support Provided by the IAF

Gaps in Existing Protocols. A significant gap identified was the lack of structured joint training programs. 62% of civil officials stated that they had never participated in joint drills with the IAF. Moreover, 50% felt that SOPs governing civil-military coordination were not available in all the states.

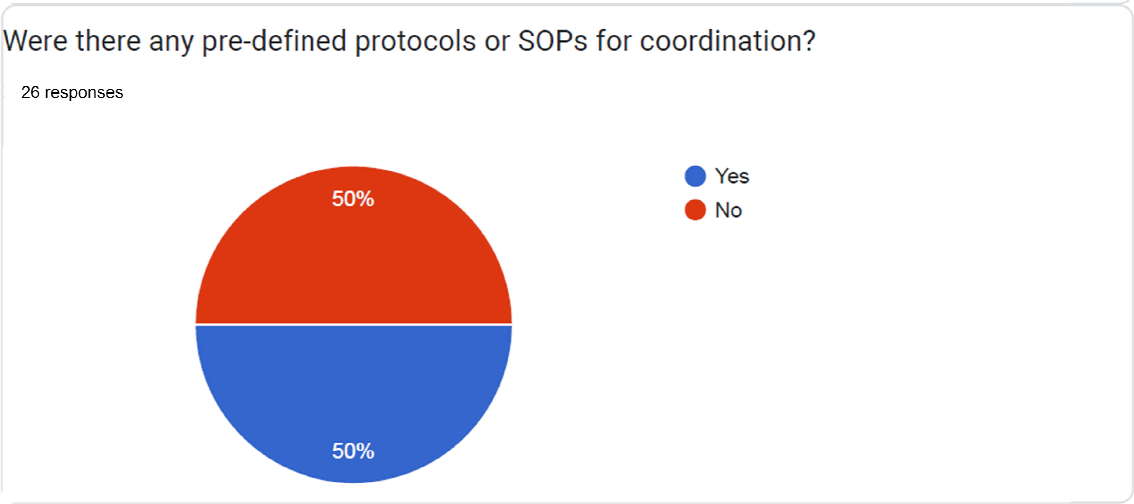

Figure 12: Availability of DM SOPs in all the States

Recommendations for Improvement. To improve response efficiency, 68% of civil administrators suggested adopting real-time coordination tools, such as a centralised digital disaster response platform that allows for seamless integration of civil and military resources. Additionally, 54% advocated for AI-based decision support systems within EOCs, which would utilise predictive analytics to forecast disaster impact, automate resource allocation and provide real-time recommendations for optimising IAF deployments. Respondents also emphasised the need for regular simulations and drills to test these systems under realistic disaster scenarios, ensuring effective deployment during actual emergencies.

Key Findings from Stakeholder Interviews

Senior NDMA Official. The NDMA official stressed the necessity of institutionalising a national framework for civil-IAF coordination. Key recommendations included enhancing the role of SEOCs and DEOCs in liaising with the IAF, implementing mandatory pre-disaster coordination meetings and integrating AI-based decision support tools within EOCs to improve real-time situational awareness. The official noted that while the NDMA establishes disaster relief guidelines, it does not directly intervene in operations, relying instead on mock exercises and tabletop drills to improve coordination among stakeholders. However, there is a pressing need for field-level officials to participate actively in these exercises. The official also indicated that neither the Disaster Management Act of 2005 nor its amendment in December 2024 comprehensively addresses military integration. Future revisions should include clearer protocols for IAF involvement in disaster response. Additionally, standardised communication protocols and enhanced resource mobilisation—especially in remote areas—were emphasised as critical areas for improvement.

Assisstant Chief of Air Staff (Ops (T&H)). The ACAS (Ops (T&H)) highlighted key challenges in the IAF's disaster relief operations, such as unpredictable weather, a lack of pre-designated landing zones, airspace congestion and delays in coordinating with civil authorities. Logistical issues, including fuel availability and limited ground support in remote areas, also hinder efficiency. He stressed the need to develop parallel capacity in the civil sector—both government and private—to enhance HADR efforts, alongside acquiring fixed-wing and rotary-wing aircraft.

He pointed out that the Disaster Management Act of 2005 and the National Policy on Disaster Management provide a framework for the Armed Forces but lack guidelines for integrating IAF assets with civil agencies. Structured frameworks defining authority, requisition timelines and communication channels are necessary. He identified gaps in SOPs for pre-disaster planning and joint helicopter response protocols and recommended establishing a central Civil-IAF Disaster Response Cell. Communication challenges remain, as full integration with civil agencies' digital platforms is lacking. He cited the 2013 Uttarakhand floods as an example of inefficiencies due to airspace deconfliction issues, highlighting the need for pre-coordination drills.

Lastly, he mentioned that while the IAF conducts joint exercises with the NDMA and SDMAs, these should be more frequent. Civil administrators would benefit from orientation programs on military air operations, which could improve coordination. He also recommended using AI-driven modelling, digital coordination platforms and satellite communication to enhance response times.

Air Commodore (Ops (T)). The Air Commodore (Ops (T)) emphasised that transport aircraft serve as the backbone of disaster relief logistics. Key planning factors include weather conditions, terrain challenges and the availability of suitable induction and de-induction bases. He highlighted that operational efficiency depends on real-time intelligence and precise task prioritisation, significantly enhanced through AI-driven logistics planning tools.

Regarding preparedness and training, he noted that while the IAF conducts regular joint exercises with the NDMA and SDMAs, there is a need for more frequent

simulation-based training for both transport crews and ground support personnel. He suggested that integrating emerging technologies, such as AI-assisted mission planning and drone reconnaissance, could enhance situational awareness, reduce response times and improve transport efficiency.

In discussing coordination mechanisms, he acknowledged the importance of regular meetings between the IAF and disaster management authorities at both national and state levels. However, he pointed out that effective execution requires standardised protocols and improved interoperability between military and civilian agencies. While existing SOPs are robust and continuously refined based on past operations, state-level disaster management authorities need to align their SOPs with national frameworks to ensure seamless integration with IAF operations.

Addressing logistical and operational challenges, he mentioned that limited civil infrastructure at disaster sites often affects the rapid deployment of transport aircraft. The IAF mitigates these constraints through careful advance planning, ensuring that aircraft refuelling and maintenance facilities are positioned at unaffected airbases to avoid delays in relief efforts.

Regarding the role of technology, he emphasised that real-time tracking, predictive analytics and AI-based load management systems are increasingly being integrated into transport operations. He further stressed that future IAF transport operations would heavily rely on RPAs for reconnaissance and early warning, significantly improving the efficiency of disaster response missions.

Reflecting on past disaster relief missions, he cited the COVID-19 crisis as an example where transport aircraft played a crucial role in airlifting medical supplies, including oxygen containers from international locations, while ensuring crew safety through meticulously managed duty rosters. Key lessons from these missions highlight the importance of early warning systems, rapid deployment capabilities and structured inter-agency coordination to maximise operational effectiveness.

Looking ahead, he predicted that civil-IAF coordination would continue to evolve, with national and state-level mock exercises becoming increasingly realistic to reflect actual disaster scenarios. He advocated for greater involvement of local administration in these exercises, ensuring that disaster response plans are practical, well-rehearsed and seamlessly integrated into national frameworks. The Air Commodore (Ops (T)) underscored the necessity for pre-disaster air asset planning, ensuring that transport aircraft are strategically pre-positioned for the rapid deployment of relief supplies and personnel.

Air Cmde (Ops (H)). Air Commodore (Ops (H)) emphasised the critical role of helicopters in disaster relief operations but noted ongoing challenges, including unclear tasking, conflicts in airspace management and coordination gaps with civil agencies. To address these issues, he proposed the implementation of a centralised air traffic management system for disaster zones and stronger pre-disaster planning measures. He also highlighted the need for structured training modules aimed at civil authorities to improve their understanding of helicopter-specific operational requirements.

Regarding coordination mechanisms, he mentioned that while nodal officers exist in each state, establishing a dedicated Air Operations Coordination Cell at the state level would significantly enhance efficiency. He pointed out that civil authorities often lack understanding of critical helicopter requirements, such as minimum helipad dimensions, approach clearances and payload constraints. A structured training program for district officials could help fill this gap.

On operational challenges, he stressed that delayed and incorrect requisitioning, unclear command hierarchies and limited refuelling infrastructure in remote areas pose major obstacles. He recommended the implementation of a digital requisition system, real-time asset tracking and a pre-approved contingency deployment mechanism to expedite response times.

Moreover, he underscored the need for greater technological integration, including the use of RPAs for real-time reconnaissance and damage assessment. Reflecting on past operations, he cited the Uttarakhand floods of 2013, where initial delays in airspace deconfliction hampered efficiency. As a corrective measure, a dedicated Air Tasking Order system was later introduced to streamline missions. He recommended establishing pre-identified landing zones, clear command structures and SOPs specifically for IAF helicopter operations to enhance overall disaster response effectiveness.

Analysis

The analysis of the survey and interviews underscores the urgent need for structured reforms in civil-IAF coordination. The findings highlight the significance of

AI-driven decision-making, well-organised training programs and the appointment of dedicated liaison officers. Additionally, the responses point out critical gaps in communication protocols, logistical planning and inter-agency collaboration that need immediate attention.

There is widespread agreement on the adoption of advanced technologies, such as AI-driven mission planning and RPA reconnaissance, as a means to enhance situational awareness and improve operational efficiency. Stakeholders unanimously emphasise the necessity of pre-disaster preparedness, which includes regular joint training exercises, SOPs across all states and the pre-positioning of essential air assets before disasters occur. The consistent emphasis on the role of dedicated liaison officers embedded within EOCs is also noted as a crucial factor in bridging the gap between civil and military authorities.

Moving forward, civil-IAF coordination in disaster response must adopt a proactive approach that utilises predictive analytics, real-time intelligence sharing and streamlined command structures. The integration of these measures will not only enhance India’s disaster resilience but also ensure a faster and more effective response to future crises. The strong consensus among stakeholders provides a robust endorsement of the proposed framework, highlighting its potential to significantly improve disaster management practices across the country.

CHAPTER 9

CONCLUSION AND RECOMMENDATIONS

Conclusion

Disaster management in India has seen significant evolution over the years. Initially, the approach was reactive, focusing mainly on post-event relief efforts with limited coordination among agencies. The Disaster Management Act of 2005 marked a transformative shift towards a more structured and proactive approach. This legislation established the NDMA and clarified responsibilities across central, state and district levels. Subsequent policies, including the NPDM and frameworks like the SFDRR, have reinforced the importance of resilience, risk mitigation and improved inter-agency coordination. However, some gaps remain, particularly in integrating military resources such as the IAF into the broader disaster response architecture.

Despite the IAF's extensive involvement in HADR operations, coordination between civil authorities and the IAF has often been fragmented, reactive and lacking structured protocols. The need for this research arose from challenges observed in recent disaster relief efforts, where delays in tasking IAF assets, inconsistent inter-agency communication and logistical inefficiencies have hindered optimal response outcomes. Therefore, this study aims to bridge these gaps by formulating a structured and technology-driven framework that ensures seamless integration of IAF resources within India's disaster response system.

This dissertation has explored the existing civil–IAF disaster response framework, identified challenges in coordination and proposed a structured, technology-driven approach to optimise disaster response. The research addresses gaps related to real-time communication, logistical planning, resource allocation and inter-agency collaboration, which have historically impacted disaster management efforts in India.

To substantiate these findings, case studies were conducted to analyse past disaster relief operations in which the IAF had played a critical role. These included the Kerala Floods of 2018, the Uttarakhand Floods of 2021 and the Agartala Flood Relief Operations of 2024. Each case study provided valuable insights into the strengths and weaknesses of existing coordination mechanisms. Issues highlighted include delays in tasking air assets, fragmented communication channels and challenges in integrating IAF resources with civil administration efforts. The lessons drawn from these real-world scenarios have been instrumental in shaping the proposed framework, ensuring that the recommendations are practical, evidence-based and aligned with both national and global best practices.

Analysis of survey data from IAF pilots and civil administration officials, coupled with insights from senior stakeholders, underscores the urgent need for reforms. Findings indicate that delays in tasking IAF assets, a lack of structured training and the absence of a unified command structure have significantly hindered disaster response operations.

The proposed framework incorporates elements from global best practices while aligning with India's national disaster management policies, the SFDRR, the SDGs and the Prime Minister's 10-Point Agenda for Disaster Risk Reduction. A systematic

evaluation of the framework was conducted based on criteria such as operational efficiency, coordination effectiveness, scalability and stakeholder acceptance. The evaluation process, which included insights from IAF pilots, civil administration officials and senior disaster management stakeholders, reaffirmed the framework's relevance and feasibility in real-world disaster response situations.

Key conclusions from this research include:-

Technology. Integration of AI-based decision-making tools within the EOCs to enhance real-time situational awareness and improve resource allocation.

Simulation. Institutionalisation of structured joint training exercises between the IAF and civil administration to improve inter-agency coordination.

Manpower. Nomination of dedicated IAF liaison officers within SEOCs and DEOCs to streamline tasking and enhance response efficiency. These officers would report to their respective centres on the activation of the DM plan.

Communication. Implementation of standardised communication protocols for seamless information exchange between military and civil agencies.

Planning. Emphasis on pre-disaster preparedness, including pre-positioning of critical resources and conducting periodic simulations.

The research findings validate that an optimised framework with structured coordination mechanisms can significantly enhance disaster preparedness and response capabilities.

Recommendations

To operationalise the proposed framework and enhance disaster response efficiency, the following recommendations are made:-

Strengthening Disaster Risk Governance (Aligned with SFDRR Priority 2).

Revise the Disaster Management Act of 2005 to establish guidelines for civil-military coordination protocols and ensure their integration into national and state-level disaster management plans.

Mandate the inclusion of AI-driven decision support systems in all the EOCs to facilitate data-driven resource allocation.

Enhancing Preparedness for Effective Response (Aligned with SFDRR Priority 4 and SDG 13 – Climate Action).

Institutionalise joint simulation-based training programmes to improve inter-agency collaboration.

Ensure that the SDMAs and DDMAs conduct regular joint mock drills annually with the IAF, with mandatory participation from all stakeholders at every level.

Develop a centralised platform for knowledge sharing to archive lessons learned from past disaster responses, making them accessible for real-time learning.

Leveraging Technology for Disaster Resilience (Aligned with the Prime Minister's 10-Point Agenda).

Utilise RPAs for disaster reconnaissance and real-time mapping of affected areas to enhance response accuracy.

Integrate predictive analytics into logistics planning to pre-position critical assets and better anticipate disaster impacts.

Create an AI-enabled National Disaster Response Dashboard that consolidates data from multiple agencies, providing a comprehensive situational overview.

Streamlining Command and Control Structures (Aligned with the Prime Minister's 10-Point Agenda on Disaster Risk Reduction).

Deploy IAF liaison officers to all the SEOCs and DEOCs immediately following disaster warnings to improve communication and reduce response times.

Implement an integrated air tasking and coordination system to ensure efficient real-time deployment of IAF resources.

Formulate SOPs for all state-level disaster management authorities to ensure alignment with national-level directives.

The Way Forward

The findings and recommendations from this research offer a comprehensive strategy for improving India's disaster response framework by enhancing coordination between civil authorities and the IAF. Future research should further investigate policy

interventions, international collaborations and technological advancements that can contribute to a more resilient disaster management system. Implementing this optimised framework, which is supported by AI-driven tools, structured coordination mechanisms and strategic training initiatives will not only enhance India's disaster preparedness but also position the country as a global leader in civil-military disaster response.

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Appendix A

EXCERPTS OF INTERVIEW WITH MAJ GEN S BEHL (RETD)

LEAD CONSULTANT, NDMA

NDMA's Strategic Role in Disaster Management

1. How does the NDMA view the role of the Indian Air Force in disaster management, particularly in large-scale emergencies?

Ans) The IAF plays a crucial role in disaster management, considering its rapid response time and reach. In case of large-scale emergencies where the state or district machinery gets overwhelmed, the IAF's involvement is critical in providing immediate relief, evacuation of casualties and insertion of NDRF, SDRF or Army personnel.

2. What mechanisms does NDMA currently employ to ensure seamless coordination between civil agencies and the IAF during disaster relief operations.

Ans) While NDMA only lays down guidelines for the conduct of disaster relief operations, it does not get involved directly. It does conduct mock exercises, table top exercises and seminars to ensure that the coordination between all stakeholders is seamless.

Policies and Frameworks

3. The Disaster Management Act, 2005, provides the legislative framework for disaster response. Do you think it adequately addresses the integration of military resources like the IAF into civil disaster management plans?

Ans) The Disaster Management Act is of 2005 vintage and laid down the duties and responsibilities of various agencies for the first time. Revision of the Act has been proposed and hence this is the time to addresses the issue of integrating the armed forces into civil disaster management plans.

4. Are there any ongoing initiatives by NDMA to develop specific SOPs or frameworks for better coordination between civil authorities and the IAF?

Ans) The NDMA has already promulgated various guidelines for better coordination between various stakeholders. These include National DM Policy, National DM Plan, NDMA Guidelines, DM Plan Templates and NDMA SOPs.

Coordination Challenges and Improvements

5. What are the biggest challenges NDMA has observed in coordinating with the IAF during disaster management operations?

Ans) The biggest challenges have been chain of communication and availability of aircraft for rescue operations, especially helicopters.

6. Could you share any examples where coordination between NDMA, state governments and the IAF was particularly effective or ineffective?

Ans) An example of a good coordination that comes to mind is the Silkyara tunnel rescue in November 2023. Employment of multiple aircraft simultaneously, airlift of rescue teams, heavy drilling equipment and critical DRDO equipment from various locations were seamlessly coordinated.

Training and Preparedness

7. Does NDMA conduct or oversee joint training exercises involving civil authorities and the IAF? If so, how effective have these been in addressing real-world challenges?

Ans) Yes. These have been very effective in preparing all the stakeholders for a better and coordinated response. However, participation from the field level is less, which needs to be addressed as it is people on ground who would be directly involved in the rescue operations.

8. Are there plans to institutionalise regular simulation drills that focus specifically on air operations in disaster management?

Ans) Yes there are and the simulation drills are being regularly conducted under the aegis of the NDMA.

Logistics and Resource Mobilisation

9. How does NDMA address the logistical challenges that arise when integrating IAF assets into civil disaster relief operations?

Ans) The NDMA has provided guidelines for the stakeholders which also include handling logistical challenges through planning and preparation.

10. What steps can be taken to improve resource mobilisation, particularly in remote or disaster-prone areas, where the IAF plays a crucial role?

Ans) Resource mobilisation can be improved by planning and preparation in anticipation of a disaster situation. It would involve pre-positioning of resources at the remote locations or nearby key locations.

Technology and Innovation

11. Does NDMA leverage any specific technologies to facilitate real-time communication and coordination between civil agencies and the IAF?

Ans) The NDMA is in the process of developing an AI based tool for improved decision making by taking inputs from various sources. It is a centralised project and planned to be provided to all the states.

12. How can advancements like GIS mapping, RPAs, or AI-driven decision-making improve civil-IAF coordination in the future?

Ans) Well, GIS mapping is already providing accurate location and prediction data which are invaluable inputs for decision making. RPAs and drones are being used for identifying vulnerable areas before onset of a disaster as well as to carry out recce of affected areas post disaster event. AI based tool would be able to combine all the available inputs to provide a decision matrix in a short period of time. These advancements would greatly enhance the coordination, provided all the stakeholders have access to them.

Lessons Learned and Recommendations

13. What recommendations would you suggest for enhancing NDMA’s role in fostering better civil-IAF coordination, especially at the state and district levels?

Ans) Firstly, it is recommended to nominate IAF liaison officers for SEOCs and DEOCs to ensure real-time coordination. Secondly, states should formulate joint SOPs that clearly lay down procedures for DM. They should be practiced regularly with the involvement of all the stakeholders for capacity building and training. Lastly, implementing AI-based decision support tools within EOCs would facilitate real-time data sharing between civil agencies and the IAF.

Future Outlook

14. Finally, how do you envision NDMA's role evolving in ensuring India's disaster preparedness and response capabilities remain world-class?

Ans) NDMA is poised to play an increasingly important role in ensuring world-class disaster preparedness in India. This involves measures to transition from a reactive to a proactive approach using integrated climate risk assessments, early warning systems and community based disaster preparedness. Partnering with international organisations like UNDRR, UNOCHA and ASEAN would enable us to adopt global best practices. Harnessing cutting edge technologies like GIS based tool, drones and AI would greatly enhance our capabilities. Enhancing civil-military coordination by policy implementation and mock exercises is a critical aspect of DM. Finally, increased public awareness and community engagement is being done on a large scale to improve disaster response and minimise loss of lives.

Appendix B

EXCERPTS OF INTERVIEW WITH AVM S VASHISHTH

ACAS OPS (T&H), IAF

Strategic Role of IAF in Disaster Management

1. What are the primary challenges faced by the IAF in deploying transport and helicopter assets during disaster relief operations?

Ans) The biggest challenges include unpredictable weather conditions, lack of pre-designated landing zones, airspace congestion and coordination delays with civil authorities. Additionally, logistical constraints, such as fuel availability and limited ground support in remote areas, often impact operational efficiency. There is a need to develop parallel capacity in the civil sector (govt and even private) to deal with HADR situations. Both fixed and rotory wing aircraft and role equipment need to be acquired. Our industry needs to focus on design and development of rescue equipment and relief methods. Palletised readymade solutions are the future.

Coordination Frameworks and Policies

2. The Disaster Management Act, 2005 and the National Policy on Disaster Management highlight the role of Armed Forces in disaster response. However, do you feel these frameworks provide adequate guidance for the integration of IAF operations with civil administration?

Ans) While these frameworks establish a broad role for the Armed Forces, there are no guidelines for integrating IAF assets with civil disaster management agencies. A more structured framework, with clear jurisdictional authority, timelines for requisitioning and streamlined communication channels, is required for better synergy.

3. In your opinion, are there any gaps in the SOPs or policies related to civil-IAF coordination during disasters?

Ans) There are gaps, particularly in pre-disaster planning and real-time coordination. The absence of joint response protocols for helicopter operations, limited clarity on airspace management during crises and delayed decision-making at the civil administration level often hinder quick response times.

4. What initiatives has the IAF taken to improve coordination with civil authorities at the state and district levels?

Ans) The IAF regularly conducts liaison meetings with state disaster management authorities. It also participates in mock drills for refining interoperability with civil agencies.

Operational Challenges and Communication

5. How does the IAF manage communication challenges when coordinating with multiple civil agencies during disaster operations?

Ans) The IAF uses secure radio networks, satellite communication and designated liaison officers to maintain real-time coordination. However, integrating these systems with civil agencies' communication platforms remains a challenge.

6. Could you share any examples where delays in coordination or miscommunication impacted the efficiency of relief efforts?

Ans) During the 2013 Uttarakhand floods, initial delays in airspace deconfliction and last-minute landing zone changes created inefficiencies. Lessons from this experience led to better pre-coordination drills and improved air traffic management protocols.

7. Are there established mechanisms for real-time information sharing between the IAF and civil agencies during disaster management?

Ans) While mechanisms like EOCs exist, a dedicated digital platform that enables live tracking of assets, resource allocation and mission status updates is needed for seamless coordination.

Joint Training and Preparedness

8. Joint training and simulation exercises are often cited as critical for improving coordination. How often does the IAF participate in such exercises with civil agencies?

Ans) The IAF participates in joint exercises with the NDRF, SDRF and state governments. Annual large-scale drills involving all stakeholders would greatly enhance preparedness.

9. Do you think the current training programs for both IAF personnel and civil administrators adequately address the complexities of joint operations?

Ans) While IAF personnel are well-trained in disaster response, civil administrators often are not conversant with military air operations. Structured joint training modules tailored for civilian disaster managers would bridge this gap.

10. Is there a structured mechanism for training civilian disaster managers about IAF's operational constraints, particularly regarding helicopters and transport aircraft?

Ans) Currently, such mechanisms are limited. A dedicated orientation program covering aspects like helicopter payload limitations, helipad preparation and aircraft loading procedures would significantly improve ground coordination.

Lessons Learned and Recommendations

11. From previous missions, what have been the key takeaways in terms of improving interoperability between civil agencies and IAF assets?

Ans) The need for pre-designated helipads, pre-stocked refuelling facilities and real-time digital coordination platforms are key lessons. Additionally, faster requisitioning processes and pre-disaster planning exercises have proven to be crucial for efficient operations.

Another important aspect is that we need to develop capacity to handle disasters involving large areas and mass casualties. This would involve procurement of

adequate quantities of rescue equipment and portable, rapid erection hospitals which can be easily airlifted.

12. What recommendations would you suggest for enhancing civil-IAF coordination, especially in light of increasing frequency and intensity of disasters?

Ans) Establishing a centralised Civil–IAF Disaster Response Cell, integrating digital coordination platforms and conducting mandatory annual joint training exercises would significantly enhance coordination.

Future Outlook

13. How do you foresee the role of IAF evolving in disaster management, particularly with advancements in technology and changing disaster scenarios?

Ans) The IAF will increasingly rely on AI-driven predictive modelling, RPA-assisted reconnaissance and satellite-based voice and data communication for faster disaster response. Modernising helicopter fleets with all-weather capability will also be a priority.

14. Are there plans to institutionalise any new frameworks or technologies to improve interoperability with civil agencies?

Ans) Yes, discussions are underway to incorporate digital platforms for mission planning, logistics tracking and AI-assisted decision support systems.

Appendix C

EXCERPTS OF INTERVIEW WITH AIR CMDE R VIJENDRAN

AIR CMDE OPS (T), IAF

Strategic Role of Transport Aircraft in Disaster Management

1. Transport aircraft often serve as the backbone of disaster relief logistics. What are the key factors you consider when planning large-scale airlift operations?

Ans.) There are numerous factors to be consider when planning large scale operations, however to name a few key factors, weather and terrain considerations, availability of suitable induction and de-induction bases and the total air effort required to complete the evacuation are the primary factors that are considered at planning stage of a disaster relief operation.

Preparedness and Training

2. Does the IAF conduct regular joint exercises with civil agencies to simulate disaster scenarios involving transport aircraft?

Ans) IAF conducts regular joint exercises with NDMA and SDMA at national and state level respectively on a periodic basis to enhance jointmanship and cooperation between IAF and civil agencies.

3. Are there specific training modules for transport crew and ground staff to prepare them for disaster relief missions?

Ans) IAF conducts regular training at field level wherein HADR exercises are conducted to train transport crew and ground staff for disaster relief missions.

4. How do aircrew prepare for operations in challenging terrain or areas with limited airfield and infrastructure?

Ans) IAF conducts regular operations to airfields in northern as well as north eastern sectors with limited airfield infrastructure. Challenging terrain and limited infrastructure operations are thus a routine and normal activity for transport aircrew as they are trained in these operations starting from the beginning of their careers in IAF.

Coordination Mechanisms with Civil Agencies

5. What mechanisms are in place to ensure seamless coordination between civil disaster management authorities and IAF transport operations?

Ans) IAF conducts regular meetings with NDMA at National level and SDMA at state level to ensure smooth and seamless coordination between the civil sisaster management authorities and IAF at levels of management and execution.

6. Are there any challenges in aligning the operational priorities of the IAF with the immediate needs of civil agencies during disaster response?

Ans) Conduct of disaster relief operations requires coordination and prioritisation of tasks at execution level and management level alike. Whatever challenges that are faced while carrying out such operations are resolved through effective communication at all levels.

7. Are there SOPs in place for integrating transport aircraft into state-level disaster management plans, are these being followed effectively?

Ans) IAF SOPs ae effective and exhaustive in nature owing to their development over a long period of time and continues improvement in the same is being done as per lessons learnt after each operation. NDMA has also issued exhaustive guidelines for conduct of disaster management and they are broadly in line with IAF SOPs. State authorities at their level need to align SOPs in line with NDMA guidelines which will automatically ensure effective integration with IAF SOPs. Regular efforts are being made through state level disaster relief exercise to ensure the alignment of the SOPs and their effective integration into the broader theme of Disaster relief operation.

Logistical and operational Challenges

8. How does the IAF overcome logistical challenges such as refuelling, loading/unloading and aircraft maintenance during disaster relief operations in remote areas?

Ans) Logistical and maintenance challenges are a part of every Disaster relief operations whether in a remote area or not. These challenges are mitigated by effective planning on ground which involves refuelling and logistics support at a nearby airbase having adequate facilities and not affected by the disaster. At times this challenge involves landing and refuelling at nearby bases before actually reaching the disaster prone or affected areas.

9. Are there instances where limited civil infrastructure at disaster sites has affected the deployment of transport aircraft? How does the IAF address such issues?

Ans) There are numerous instances wherein the infrastructure required to support air operations is degraded due to the effect of disaster itself. In all such instances, effective ground planning involves identifying a nearby suitable and available air base for conducting the disaster relief operation. Effective planning on ground results in mitigating the effect of degraded and limited infrastructure.

Role of Technology in Transport Operations

10. How is technology, such as real-time tracking and load management systems, being used to enhance the efficiency of IAF transport operations during disaster?

Ans) Technology is an ever evolving field and its utilisation by IAF transport aircrew in all spheres of operations is not new. Real time tracking of cyclones and effective prediction models help us in planning the relief operation in advance wherein the NDRF and SDRF teams are positioned before the cyclone hits the affected areas. This helps in mitigating the effect of the disaster effectively acts as force multiplier to Disaster relief operation.

11. Could emerging technologies like RPAs or AI-based logistics planning complement IAF transport operations in disaster management?

Ans.) Technology is emerging as a game changer in all spheres of life and air operations ae no exception to this. RPAs are being utilised for effective image gathering and for reconnaissance roles in disaster relief area. Utilisation of small drones and effective AI based models is likely to increase in future too. IAF transport operations utilise all these image gathering modules to analyse and plan the operations on ground before actual launch of the mission itself.

Case Studies and Lessons Learnt

12. Could you share an example where transport aircraft played a crucial role in disaster relief and what were the coordination challenges faced?

Ans) Transport aircraft play a crucial role in all disaster management and relief operations. The most notable in the recent past has been the most devastating disaster which was the breakout of Covid-19. Transport aircraft flew intensively to bring oxygen containers from across the globe to our country. The isolation of crew after each mission abroad was managed in such a manner that there was not a single infection amongst the crew by appropriate regularisation of duty roster.

13. What lessons has the IAF learned from previous disaster relief missions involving transport aircraft?

Ans.) There are always important lessons from each mission that IAF undertakes and this defines the learning curve for IAF. The most important lessons that IAF has learnt from the recent operations underscore the importance of Civil Military cooperation and coordination at ground level for effective conduct of HADR missions. In addition, advent of modern technologies like advance notice and warning of cyclones has ensure timely reach of NDRF forces to the affected area thus mitigating the affect of natural disasters and their aftermath.

Enhancing Civil-IAF Coordination

14. How can state and district disaster management authorities improve their coordination with IAF transport operations?

Ans) State and district disaster management authorities can significantly contribute in terms of social outreach and theses aspects should form an underlining aspect of the various state level mock exercises being conducted periodically.

15. Are there specific SOPs or frameworks you recommend for integrating IAF transport aircraft into civil disaster relief plans?

Ans) NDMA guidelines for disaster relief provide comprehensive coverage on disaster relief operations. Effective implementation of the same at ground level can contribute to frameworks recommended for integrating IAF transport aircraft into civil disaster relief plans.

Future Perspectives

16. As disaster grow more complex, how is the IAF preparing its transport fleet to tackle future challenges?

Ans) Disasters today can be broadly categorised in to natural and manmade. Many natural disasters are themselves created due to long term manifests of human actions. IAF is training steadily to respond to any kind of natural or manmade disasters. Many peace time HADR exercises address this aspect of preparation.

17. How do you see the role of transport aircraft evolving in civil-IAF co-ordination for disaster management in the next decade?

Ans) Civil IAF coordination has been on an increasing trend ever since NDMA has started taking lead in National Disaster management and associated activities. Numerous state level and national level mock exercises are being conducted periodically to increase

the Civil IAF coordination. Next decade would entail practical focus on these exercises and we would aim to make the exercise scenarios more realistic in nature and effort.

Appendix D

EXCERPTS OF INTERVIEW WITH AIR CMDE AP SINGH

AIR CMDE OPS (H), IAF

Operational Insights on IAF's Role in Disaster Management

1. How does the IAF typically coordinate with civil authorities during disaster relief missions? Are there pre-established protocols in place?

Ans) The IAF operates within a well-established framework under the Disaster Management Act, 2005. Coordination primarily takes place through the Ministry of Defence, with requests routed via HQ IDS by the NDMA and respective state governments. Pre-established SOPs exist, but execution often requires real-time adaptability based on the evolving situation on the ground.

Preparedness and Training

2. Does the IAF conduct joint training exercises with civil administration to enhance disaster response capabilities?

Ans) Yes, periodic joint exercises with NDRF, SDRF and other civil agencies help refine interoperability. However, more structured joint drills with the involvement of all the agencies would enhance mutual understanding and coordination. Frequency of such exercises should be optimised to ensure participation by all the concerned agencies.

3. How does the IAF prepare for the logistical challenges of operating in disaster-affected areas, especially in regions with limited infrastructure?

Ans) The IAF conducts reconnaissance, establishes forward operating bases and uses modular logistics planning. Airborne assets are stocked with requisite equipment to minimise response time.

Coordination Mechanisms

4. Helicopter missions often require immediate coordination on the ground. How do you ensure civil agencies are prepared to facilitate such missions effectively?

Ans) Civil authorities are briefed about operational requirements in coordination meetings before missions. However, real-time communication remains a challenge due to varying levels of preparedness and awareness at different administrative levels.

5. Is there a dedicated liaison structure at the state or district level for coordinating air operations during disasters?

Ans) While Nodal Officers exist in each state, a dedicated Air Operations Coordination Cell at the state level would significantly improve efficiency.

6. Are there challenges in civil authorities understanding helicopter-specific requirements, such as helipad preparation or payload limitations?

Ans) Yes, there is often a gap in understanding critical aspects like minimum helipad dimensions, approach clearances and payload constraints. A structured training module for district officials could address this.

Logistical and Operational Challenges

7. In your opinion, what are the biggest hurdles in integrating IAF helicopters into civil disaster relief operations?

Ans) Key challenges include delayed and incorrect requisitioning, unclear command hierarchies, airspace management and limited refuelling infrastructure in remote areas.

Technology and Infrastructure

8. Are there specific technological tools or platforms that the IAF employs for real-time communication and coordination with civil agencies?

Ans) The IAF uses satellite communication, secure radio networks and GIS-based disaster mapping tools. However, direct integration with civil agencies' digital platforms remains a work in progress.

9. Are there any plans to integrate RPAs or drones with helicopter operations to expand the IAF’s disaster response capabilities?

Ans) Yes, RPAs are being evaluated for real-time reconnaissance, damage assessment and guiding relief drop operations.

Lessons from Past Operations

10. Can you share a case where helicopter operations faced significant challenges due to gaps in civil-IAF coordination? How were these addressed?

Ans) During the Uttarakhand floods of 2013, initial delays in airspace deconfliction hampered operations. A dedicated Air Tasking Order system was later implemented to streamline missions.

11. What lessons has the IAF learned from past disaster relief missions and how have these been integrated into operational planning?

Ans) Key lessons include the need for pre-identified refuelling points, improved night-vision capabilities and improved HADR SOPs.

Recommendations for Improved Coordination

12. What are your suggestions for streamlining the process of requisitioning and deploying helicopters for disaster relief?

Ans) A digital requisition system, real-time tracking of assets and a pre-approved contingency deployment mechanism would expedite response times.

13. How can state and district disaster management authorities better support helicopter operations, particularly in terms of landing zones, refueling and logistics?

Ans) Designating pre-surveyed helipads, ensuring fuel stockpiles at strategic locations and having trained ground handlers would greatly enhance operational efficiency.

14. Do you believe a dedicated SOP by civil authorities for IAF helicopter operations in disaster relief is required? If so, what should it include?

Ans) Yes, it should include pre-identified landing zones, clear command chains, airspace deconfliction measures and standard payload guidelines.

Future Perspectives

15. With disasters becoming more frequent and complex, how does the IAF plan to enhance its helicopter capabilities for such missions?

Ans) The IAF is modernising its helicopter fleet with advanced all-weather capabilities, enhancing night operations and realistic training of aircrew and ground crew.

16. How do you envision civil-IAF coordination evolving in the next decade to tackle disasters more effectively?

Ans) Integrated EOCs at all levels, greater technological integration and AI-assisted decision making tools will define the future of disaster management coordination.

Appendix E

ONLINE SURVEY QUESTIONNAIRE

ENHANCING DISASTER RESPONSE THROUGH OPTIMISED CIVIL – INDIAN AIR FORCE COORDINATION: A FRAMEWORK

(FOR IAF PILOTS)

This is an online survey as a part of the Research Paper being submitted to the Panjab University for the Advanced Professional Programme in Public Administration (APPPA) conducted by the Indian Institute of Public Administration (IIPA).

This questionnaire is designed to gather insights from IAF pilots about their experiences, challenges and recommendations for enhancing coordination with civil administration during disaster management. All responses will remain anonymous and will be used solely for academic purposes.

* Indicates required question

Personal Details

1. Name *

2. Rank *

3. Years of service in the IAF *

Experience in Disaster Management

4. How many disaster relief operations have you participated in?

5. What types of disasters (e.g., floods, earthquakes) have you been involved in?

6. Can you briefly describe a significant disaster relief mission where civil-IAF coordination was critical?

Coordination with Civil Administration

7. How would you rate the overall effectiveness of coordination with civil administration during disaster operations?

1 2 3 4 5

☆ ☆ ☆ ☆ ☆

8. What has been the most significant challenge that have you faced in coordinating with civil authorities during such missions?

Mark only one oval.

◯ Communication related ◯ Tasking related

◯ Logistical support related ◯ Administrative facilities related

9. Were there any pre-defined protocols or SOPs for coordination?

Mark only one oval.

◯ Yes ◯ No

10. How effective were they?

1 2 3 4 5

☆ ☆ ☆ ☆ ☆

Communication and Planning

11. How effective are the communication channels between IAF and civil administration during disaster response?

1 2 3 4 5

☆ ☆ ☆ ☆ ☆

12. Do you get adequately briefed about the civil administration's expectations before deployment?

Mark only one oval.

◯ Yes ◯ No

13. Are you involved in joint planning or simulation exercises with civil agencies?

Mark only one oval.

◯ Yes ◯ No

14. How frequent are these exercises?

Mark only one oval.

◯ Frequent ◯ Seldom ◯ Never

Logistics and Support

15. Were logistical arrangements (e.g, fuel, landing zones, supplies etc) made by the civil administration adequate?

Mark only one oval.

◯ Yes ◯ No

16. What additional support do you think civil agencies could provide to facilitate IAF operations?

Recommendations

17. What changes do you suggest to improve civil-IAF coordination in disaster

management?

18. How can joint training or exercises be made more effective for real-time disaster management?

19. Are there specific resources or technology that would enhance IAF's effectiveness in disaster response?

Appendix F

ONLINE SURVEY QUESTIONNAIRE

ENHANCING DISASTER RESPONSE THROUGH OPTIMISED CIVIL – INDIAN AIR FORCE COORDINATION: A FRAMEWORK

(FOR CIVIL ADMINISTRATION OFFICIALS)

This is an online survey as a part of the Research Paper being submitted to the Panjab University for the Advanced Professional Programme in Public Administration (APPPA) conducted by the Indian Institute of Public Administration (IIPA).

The objective of the questionnaire is to understand the civil administration's perspective on coordinating with the Indian Air Force during disaster management. All responses will remain anonymous and will be used solely for academic purposes.

* Indicates required question

Personal Details

1. Name *

2. Designation *

3. Department/Organisation *

Experience in Disaster Management

4. How many disaster response operations have you been involved in?

5. Have you previously coordinated with the Indian Air Force? If yes, please describe the experience briefly.

Coordination with IAF

6. How would you rate the support provided by the IAF during disaster response?

1 2 3 4 5

☆ ☆ ☆ ☆ ☆

7. What were the challenges in coordinating with the IAF during disaster operations?

Mark only one oval.

◯ Communication related ◯ Tasking related ◯ Logistical support related (Load, fuel, etc) ◯ Administrative arrangement related (Helipad requirement, accommodation, etc)

8. Were there any pre-defined protocols or SOPs for coordination?

Mark only one oval.

◯ Yes ◯ No

9. How effective were they?

1 2 3 4 5

☆ ☆ ☆ ☆ ☆

Communication and Planning

10. How effective were the communication mechanisms between your department and the IAF?

1 2 3 4 5

☆ ☆ ☆ ☆ ☆

11. Were there any joint planning or training exercises conducted prior to the disaster?

Mark only one oval.

Yes ◯ No

12. If yes, how useful were they?

Mark only one oval.

Very useful ◯ Useful ◯ OK ◯ Not useful

13. What challenges did you face in communicating critical information with the IAF during operations?

Logistics and Support

14. Were the logistical requirements (e.g, fuel, landing zones, supplies etc) of the IAF adequately communicated to you?

Mark only one oval.

◯ Yes ◯ No

15. What challenges did you encounter in providing logistical support to the IAF?

Policy and Guidelines

16. Are you aware of any national or regional guidelines for civil-military coordination in disaster management?

Mark only one oval.

◯ Yes ◯ No

17. Do you think existing policies adequately address the integration of IAF in disaster response?

Mark only one oval.

◯ Yes ◯ No

Recommendations

18. What changes would you recommend to improve civil-IAF coordination in disaster management?

19. How can joint training or preparedness exercises be enhanced to better align civil and IAF efforts?

20. What additional resources or systems would facilitate smoother collaboration with the IAF?

Annexure

EM-DAT Data on Disasters in India (2000-24)

Year	Country	Disaster Group	Disaster Subtype	Total Events	Total Affected	Total Deaths	Total Damage (USD, original)
2000	India	Natural	Drought	1	50000000	20	588000000
2000	India	Natural	Flash flood	3	3252016	329	173000000
2000	India	Natural	Flood (General)	1	534035	6	
2000	India	Natural	Riverine flood	2	46600000	1751	734500000
2000	India	Natural	Landslide (wet)	3	7038	187	
2000	India	Natural	Cold wave	1		275	
2000	India	Natural	Tropical cyclone	2	30000		
2001	India	Natural	Ground movement	1	6321812	20005	2623000000
2001	India	Natural	Flash flood	1	2800000	48	26000000
2001	India	Natural	Flood (General)	4	7000040	342	129000000
2001	India	Natural	Riverine flood	4	10810000	191	206924000
2001	India	Natural	Landslide (wet)	3		98	
2001	India	Natural	Cold wave	2		173	
2001	India	Natural	Lightning/Thunderstorms	1		21	
2001	India	Natural	Tropical cyclone	2	27000	78	
2002	India	Natural	Drought	1	300000000		910722000
2002	India	Natural	Ground movement	1	200	2	
2002	India	Natural	Flood (General)	1	200	20	
2002	India	Natural	Riverine flood	5	42008050	715	50772000
2002	India	Natural	Cold wave	1		900	
2002	India	Natural	Heat wave	1		1030	
2002	India	Natural	Hail	1	10200		
2002	India	Natural	Lightning/Thunderstorms	1		11	
2002	India	Natural	Tropical cyclone	2	5050	133	416000
2003	India	Natural	Flash flood	2	45	193	
2003	India	Natural	Riverine flood	4	7564500	259	169000000
2003	India	Natural	Avalanche (wet)	1		25	
2003	India	Natural	Cold wave	1		400	
2003	India	Natural	Heat wave	1		1210	400000000
2003	India	Natural	Hail	1	485910	30	16000000
2003	India	Natural	Storm (General)	2	204	34	
2003	India	Natural	Tropical cyclone	4	45200	100	28000000
2004	India	Natural	Tsunami	1	654512	16389	1022800000

Year	Country	Disaster Group	Disaster Subtype	Total Events	Total Affected	Total Deaths	Total Damage (USD, original)
2004	India	Natural	Flash flood	2	100000	193	
2004	India	Natural	Riverine flood	4	33106000	1155	2776000000
2005	India	Natural	Ground movement	1	156622	1309	1000000000
2005	India	Natural	Flash flood	1	800000	27	
2005	India	Natural	Riverine flood	16	27481571	2102	6190000000
2005	India	Natural	Avalanche (wet)	1	5000	250	50000000
2005	India	Natural	Landslide (wet)	1	20	12	
2005	India	Natural	Heat wave	1		329	
2005	India	Natural	Severe winter conditions	1		180	
2005	India	Natural	Storm (General)	4	68590	82	
2006	India	Natural	Flash flood	3	15000	78	
2006	India	Natural	Riverine flood	14	7219178	1116	3390000000
2006	India	Natural	Heat wave	1		47	
2006	India	Natural	Lightning/Thunderstorms	1		76	
2006	India	Natural	Tropical cyclone	1	150300	114	
2007	India	Natural	Coastal flood	1	7200000	80	275000000
2007	India	Natural	Flash flood	1	200000	127	
2007	India	Natural	Flood (General)	1	8	40	
2007	India	Natural	Riverine flood	13	30743000	1804	101151000
2007	India	Natural	Cold wave	2	25	113	
2007	India	Natural	Heat wave	1		72	
2007	India	Natural	Tropical cyclone	1			
2008	India	Natural	Flash flood	2	8703740	1117	123000000
2008	India	Natural	Flood (General)	1	10278	37	2000000
2008	India	Natural	Riverine flood	5	5275000	436	20000000
2008	India	Natural	Landslide (wet)	1		37	
2008	India	Natural	Cold wave	1		70	
2008	India	Natural	Sand/Dust storm	1	50	111	25000000
2009	India	Natural	Drought	1			
2009	India	Natural	Flash flood	1		11	
2009	India	Natural	Riverine flood	5	5986008	1489	2434000000
2009	India	Natural	Landslide (wet)	2		55	
2009	India	Natural	Heat wave	1	25	120	

Year	Country	Disaster Group	Disaster Subtype	Total Events	Total Affected	Total Deaths	Total Damage (USD, original)
2009	India	Natural	Lightning/Thunderstorms	1	12	35	
2009	India	Natural	Severe weather	2	23	52	
2009	India	Natural	Tornado	1	9050	15	
2009	India	Natural	Tropical cyclone	2	5100000	116	300000000
2010	India	Natural	Flash flood	1	12725	196	
2010	India	Natural	Riverine flood	7	3759683	494	2149000000
2010	India	Natural	Avalanche (wet)	1		17	
2010	India	Natural	Cold wave	1		100	
2010	India	Natural	Heat wave	1		250	
2010	India	Natural	Hail	1	5000	28	
2010	India	Natural	Lightning/Thunderstorms	1		25	
2010	India	Natural	Severe weather	1	2030	12	
2010	India	Natural	Storm (General)	1	50	54	
2010	India	Natural	Tropical cyclone	3	500000	168	
2011	India	Natural	Ground movement	1	575200	112	
2011	India	Natural	Riverine flood	7	12004069	608	1657000000
2011	India	Natural	Cold wave	2		212	
2011	India	Natural	Lightning/Thunderstorms	2	50	59	
2011	India	Natural	Tropical cyclone	1	250000	47	375625000
2012	India	Natural	Avalanche (dry)	1		16	
2012	India	Natural	Riverine flood	6	4248360	279	244000000
2012	India	Natural	Cold wave	2		264	
2012	India	Natural	Tropical cyclone	1	70000	40	
2013	India	Natural	Ground movement	1	59350	3	120000000
2013	India	Natural	Flood (General)	1	2000000	80	
2013	India	Natural	Riverine flood	4	1419473	6373	1362000000
2013	India	Natural	Heat wave	1		557	
2013	India	Natural	Lightning/Thunderstorms	1		32	
2013	India	Natural	Tornado	1		9	
2013	India	Natural	Tropical cyclone	3	13230004	65	895471000
2014	India	Natural	Riverine flood	7	5222500	622	16465000000
2014	India	Natural	Landslide (wet)	1	200	151	
2014	India	Natural	Cold wave	2		40	

Year	Country	Disaster Group	Disaster Subtype	Total Events	Total Affected	Total Deaths	Total Damage (USD, original)
2014	India	Natural	Severe winter conditions	1		140	
2014	India	Natural	Blizzard/Winter storm	1	9610	17	
2014	India	Natural	Lightning/Thunderstorms	2	1954	22	
2014	India	Natural	Storm (General)	1		27	
2014	India	Natural	Tropical cyclone	1	920000	53	7000000000
2015	India	Natural	Drought	1	330000000		3000000000
2015	India	Natural	Ground movement	3	570	98	
2015	India	Natural	Flash flood	2	2322	52	76000000
2015	India	Natural	Flood (General)	4	2691250	348	2200000000
2015	India	Natural	Riverine flood	4	13719887	439	604000000
2015	India	Natural	Landslide (wet)	1	9000	3	
2015	India	Natural	Heat wave	1		2248	
2015	India	Natural	Lightning/Thunderstorms	5	10000	112	909000000
2015	India	Natural	Severe weather	1	125100	100	160000000
2016	India	Natural	Forest fire	1		7	
2016	India	Natural	Ground movement	1	10808	8	75000000
2016	India	Natural	Flash flood	2	2000000	111	250000000
2016	India	Natural	Flood (General)	6	1806000	555	1249000000
2016	India	Natural	Avalanche (wet)	1		10	
2016	India	Natural	Landslide (wet)	1	5	10	
2016	India	Natural	Heat wave	1		300	
2016	India	Natural	Lightning/Thunderstorms	2		104	
2016	India	Natural	Tropical cyclone	1		24	1000000000
2017	India	Natural	Flash flood	2	4012	35	300000000
2017	India	Natural	Flood (General)	6	20532831	936	1817000000
2017	India	Natural	Riverine flood	1	1735000	75	
2017	India	Natural	Avalanche (wet)	1		28	
2017	India	Natural	Landslide (wet)	2	100	68	
2017	India	Natural	Heat wave	1		264	
2017	India	Natural	Lightning/Thunderstorms	3	61282	56	
2017	India	Natural	Tropical cyclone	2	61970	884	
2018	India	Natural	Drought	1	8200000		1100000000
2018	India	Natural	Forest fire	1		17	

Year	Country	Disaster Group	Disaster Subtype	Total Events	Total Affected	Total Deaths	Total Damage (USD, original)
2018	India	Natural	Flash flood	2	23231728	519	2862480000
2018	India	Natural	Flood (General)	7	75970	191	2500000
2018	India	Natural	Cold wave	1		44	
2018	India	Natural	Lightning/Thunderstorms	6	43250	283	275000000
2018	India	Natural	Sand/Dust storm	1	200	143	24000000
2018	India	Natural	Storm (General)	1		61	50000000
2018	India	Natural	Tropical cyclone	3	810200	138	1795000000
2019	India	Natural	Flood (General)	5	3070060	2023	10000000000
2019	India	Natural	Heat wave	2	450	112	
2019	India	Natural	Lightning/Thunderstorms	2		60	
2019	India	Natural	Storm (General)	1		50	
2019	India	Natural	Tropical cyclone	2	20130000	62	1810000000
2020	India	Natural	Flood (General)	5	1485002	2104	11510000000
2020	India	Natural	Landslide (wet)	2	155850	91	
2020	India	Natural	Blizzard/Winter storm	1		11	
2020	India	Natural	Tropical cyclone	3	18007500	110	14920000000
2021	India	Natural	Glacial lake outburst flood	2	24	250	210000000
2021	India	Natural	Ground movement	1	3010	2	
2021	India	Natural	Flash flood	1	122	37	
2021	India	Natural	Flood (General)	8	1324439	1520	3200000000
2021	India	Natural	Landslide (wet)	2	13	68	
2021	India	Natural	Tropical cyclone	5	2506203	249	4400000000
2022	India	Natural	Flood (General)	3	2101260	2098	4200000000
2022	India	Natural	Landslide (wet)	1		67	
2022	India	Natural	Heat wave	1		25	
2022	India	Natural	Severe weather	1	95000	20	
2022	India	Natural	Tropical cyclone	1			
2023	India	Natural	Glacial lake outburst flood	1	88400	178	
2023	India	Natural	Flash flood	1	5	62	3000000
2023	India	Natural	Flood (General)	4	10750000	1562	
2023	India	Natural	Landslide (wet)	3	807	64	
2023	India	Natural	Heat wave	2	790	190	
2023	India	Natural	Lightning/Thunderstorms	1	1074	12	

Year	Country	Disaster Group	Disaster Subtype	Total Events	Total Affected	Total Deaths	Total Damage (USD, original)
2023	India	Natural	Severe weather	2	39	40	
2023	India	Natural	Tropical cyclone	3	4401000	27	125000000
2024	India	Natural	Flash flood	2	2134000	59	
2024	India	Natural	Flood (General)	2	1000020	171	
2024	India	Natural	Landslide (wet)	1	90	10	
2024	India	Natural	Heat wave	1		11	
2024	India	Natural	Hail	1	77000	1	
2024	India	Natural	Severe weather	1	22932	4	
2024	India	Natural	Tropical cyclone	1	2109643	51	
			Total	**9002**	**4597287217**	**1474263**	**3446731390920.00**