



**Capacity Needs and Gaps Analysis,
Training Needs Analysis
and
Competency Framework**

Climate Change Adaptation and Disaster Risk Reduction

Integrated Centre for Adaptation, Disaster Risk Resilience and Sustainability (ICARS)
IIT Roorkee – Greater Noida Campus(NCR), India

**Capacity Needs and Gaps Analysis
Training Needs Analysis
and
Competency Framework**
Climate Change Adaptation and Disaster Risk Reduction

Integrated Centre for Adaptation, Disaster Risk Resilience and Sustainability (ICARS)
IIT Roorkee - Greater Noida Campus (NCR), India

Capacity Needs and Gaps Analysis, Training Needs Analysis and Competency Framework

Climate Change Adaptation & Disaster Risk Reduction

ISBN No.: 978-81-991519-9-4

Copyright © 2025, ICARS - IIT Roorkee-Greater Noida Campus

Edition: 2026

Authors :

Anil Kumar Gupta, Richa Srivastava, Sreeja S. Nair, Sonali Chauhan

Published by :

Integrated Centre for Adaptation, Disaster Risk Resilience and Sustainability (ICARS)-IIT Roorkee, Gr. Noida Campus

Citation :

Gupta, A.K., Srivastava, R., Nair, S.S., Chauhan, Sonali (2025). Integrated Centre for Adaptation, Disaster risk Resilience and Sustainability (ICARS) - Indian Institute of Technology Roorkee, Greater Noida Campus, Page 52.

Disclaimer :

This publication is brought out under the Integrated Centre for Adaptation, Disaster Risk Resilience and Sustainability (ICARS), a CoE of Department of Science and Technology (DST), Govt. of India and Indian Institute of Technology (IIT), Roorkee, under the National Mission on Strategic Knowledge on Climate Change (NMSKCC). This report is based on evidence, inputs, and insights generated through policy dialogues, stakeholder consultations and expert interactions facilitated by IITR-ICARS and inputs and reports from the ministries and line departments. The contents may be referred to, cited, translated, or reproduced-fully or in part-for academic and non-commercial purposes, with due acknowledgment and appropriate citation.





Message

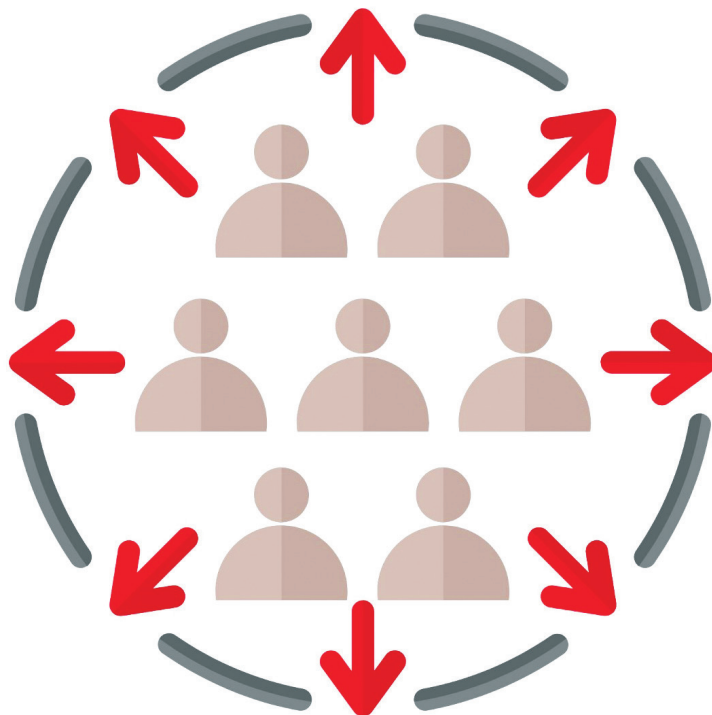


Climate change presents a formidable challenge to India's developmental aspirations, ecological sustainability, and human well-being. In response to this, the Government of India launched the National Action Plan on Climate Change (NAPCC), under which the Department of Science & Technology (DST) has been entrusted with the responsibility of implementing the National Mission on Strategic Knowledge for Climate Change (NMSKCC).

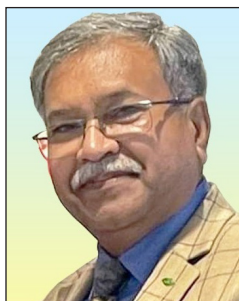
The NMSKCC represents a strategic pivot in India's climate response—placing science, data, and knowledge at the core of national resilience and adaptation planning. Under the NMSKCC a wide range of initiatives are being undertaken pan India including (i) carrying out various research programmes on human and institutional capacity building on climate change; (ii) establishing and strengthening multiple centres of excellence (CoEs); (iii) supporting major R&D programmes (MRDP) on climate change; (iv) developing knowledge network programmes on climate change developed; (v) establishing state climate change cells (NMSKCC-SCCC) etc. The Integrated Centre for Adaptation to Climate Change, Disaster Risk Resilience and Sustainability (ICARS), a CoE of Government of India DST, at IIT Roorkee's Greater Noida Campus has been established under this mission. The centre aims to promote "Capacities and Public-Policy for Resilience and Sustainability (CAPP-RES) in Multi-Hazard Environment" by advancing research-policy-practice interface based strategies. Role of systemic capacity building is critical in this line, and hence the tools like Capacity Need Assessment (CNA) and Training Need Analysis (TNA).

This report presents a systematic assessment of capacity gaps in implementing Climate Change Adaptation and Disaster Risk-Resilience across governance levels in India and proposes a structured institutional competency framework to address the identified gap areas. It provides actionable, risk-informed strategies to translate national climate and disaster policies into effective implementation on the ground. I am pleased to see this important strategic research initiative of ICARS, which directly aims to help improve capacity development programmes in these areas in the country. I complement the team for this endeavour and hope the stateholders find the study of direct use to their programmes.

Anita Gupta



Preface



India today stands at a critical juncture where climate change and disaster risks are no longer future concerns but everyday realities. Floods, heatwaves, cyclones, droughts, and other extreme events are increasingly affecting lives, livelihoods, infrastructure, and development gains. While the country has put in place strong policies and institutional framework for addressing climate risks and disaster risk-resilience, the real challenge lies in turning these frameworks into effective action on the ground, especially at state, district and local. However, challenges lie in effective implementation and impact realization due to existing capacity gaps at different levels across key stakeholders.

Looking to these criticalities in climate and disaster risk governance, strategic research to support effective planning and design of trainings is fundamental. ICARS has been entrusted to carrying out the Capacity Gap and Need Assessment (CNA) and Training Need Analysis (TNA) to help address these gaps.

This report is the outcome of the systemic process of CNA and TNA framework development at the national level. It brings together insights from capacity assessments, stakeholder consultations, and practical experience to understand where capacities exist, where they fall short, and what is needed to strengthen them in a meaningful way. By proposing a clear and practical Institutional Competency Framework for CCA-DRR, the study aims to support institutions and practitioners in building the right skills, coordination mechanisms, and preparedness to manage current and emerging risks. Ultimately, it seeks to contribute to more coherent governance, better decision-making, and stronger, more resilient communities across India.

Prof. Anil K Gupta

Professor- WRDM & Principal Investigator,
ICARS, IIT Roorkee-Greater Noida Campus



CAPACITY BUILDING

Acknowledgement

The Conceptual framework of Capacity Needs and Gaps Analysis (CNA) & Training Need Analysis (TNA) is carried out under Integrated Centre for Adaptation to Climate Change, Disaster Risk Resilience and Sustainability (ICARS) at IIT-Roorkee supported by Department of Science & Technology (DST) the nodal ministry for the National Mission on Strategic Knowledge for Climate Change (NMSKCC), Government of India.

We acknowledge a special thanks to Dr. Anita Gupta (Senior Advisor & Head, CEST, DST-Gol), Dr. Vandana Singh (Scientist-F, CEST, DST-Gol) and Dr. Swati Jain (Scientist-D, CEST, DST-Gol) for entrusting IIT-Roorkee with the opportunity to take up and work on the ICARS-CoE.

The project team is thankful to Prof. K.K.Pant (Director, IIT-Roorkee), Dr. Akhilesh Gupta (Distinguished Professor, CDMM, IIT Roorkee), and Dr. Thangaraj Chelliah (HOD, WRD&M, IIT-Roorkee) for their constant support and encouragement for undertaking the study and ensuring the smooth functioning of the CoE. From the ICARS team, a special thanks to the Co-PIs/ collaborators (Prof. Ashish Pandey, Prof. Manish Goyal (IIT Indore), Dr. Mohit Mohanty, Dr. Komal Tripathi, Dr. Rajarshi Dasgupta (IIT Delhi) and Prof. Akshay Divedi) for their collaborative efforts and valuable contributions to ICARS.

A special thanks to expert collaboration team Dr. Sreeja S. Nair (Team Leader for the World Bank funded Project) and Ms. Sonali Chauhan (Assistant Professor, Rishihood University) for taking up the analysis assignment. Further, I acknowledge Ms. Richa Srivastava (Project Scientist-III) for leading and coordinating the study. Thanks are also due to the team at ICARS including the scientists Ms. Pritha Acharya (Project Scientist-II), Dr. Ravi Katiyar (Project Scientist-II), Ms. Fatima Amin (Project Scientist-I) and Junior Research Fellows Mr. Deepak Pandey and Ms. Alpna for supporting the research study.

Further we acknowledge the support of all the members from various key Ministries, organizations and other stakeholders who were involved and consulted during meetings for finalizing the report. without their invaluable contributions, insightful review comments, and inputs this report would not have been possible.

Prof. Anil K Gupta

Professor- WRDM & Principal Investigator,
ICARS, IIT Roorkee-Greater Noida Campus



Contents

Message	iii
Preface	v
Acknowledgement	vii
Executive Summary	xi
List of Figures	xiii
List of Tables	xv
1. Introduction & Background	1
1.1 Context	1
1.2 About ICARS and Role in Strengthening Climate and Disaster Resilience	1
1.3 Rationale for CNA & TNA	4
1.4 Objectives of the CNA & TNA	4
1.6 Training Needs Assessment (TNA) and Capacity Needs Assessment (CNA) Initiatives on DRR and Climate Change in India	5
2. Conceptual Framework	9
2.1 Definitions and Key Concepts	9
2.2 CNA and TNA	9
2.3 Overall Approach and Methodology	12
2.4 Capacity Needs Assessment (CNA) Methodology	13
2.5 Elaborated Steps for Developing a TNA–CNA Framework (DRR–CCA)	15
2.6 CNA–TNA Integration Framework	16
2.7 Analytical Dimensions	18
2.8 Theory of Change	18
3. Current Status of Training and Capacity Building	21
3.1 DRR Governance Structure	
Evolution of the Institutional Framework	21
3.2 Institutions for Capacity Building and Training	23
3.3 Climate Change Governance Structure	28
3.4 Institutional Connections Between DRR and Climate Governance	29
3.5 Gap, Key Challenges for Capacity Building	31

4.	Competency Framework	37
4.1	About the framework	37
4.2	Competency – Knowledge and Skills Gap	37
4.3	Methodology	38
5.	Recommendations & Capacity Development Roadmap and Role of ICARS	41
5.1	Recommendations	41
5.2	Role of ICARS	43
	References	45
	Annexure 1	49
	Photo Gallery	50



Executive Summary

India's disaster risk landscape is shaped by its vast geographic diversity, high population density, rapid urbanisation, and increasing climate variability. Rising temperatures, erratic monsoons, sea-level rise, cyclones, floods, droughts, heatwaves, and landslides are intensifying disaster risks, threatening development gains, infrastructure resilience, livelihoods, and environmental security. These risks have direct implications for sustainable development and disproportionately affect vulnerable populations. In response, India has established a strong policy and institutional framework, including the Disaster Management Act (2005), the National Disaster Management Plan (NDMP), the National Action Plan on Climate Change (NAPCC), State Action Plans on Climate Change (SAPCCs), and its Nationally Determined Contributions (NDCs) under the Paris Agreement. However, translating these frameworks into effective action on the ground continues to require sustained human, institutional, and systemic capacity across governance levels.

The Integrated Centre for Adaptation to Climate Change, Disaster Risk Reduction and Sustainability (ICARS) at the Indian Institute of Technology Roorkee, supported by the Department of Science and Technology, Government of India, functions as a national Centre of Excellence to strengthen the science–policy–practice interface for climate resilience and disaster risk reduction (DRR). ICARS responds to persistent gaps between policy formulation and implementation by undertaking policy-oriented and action-linked research, developing sectoral strategies and operational toolkits, and supporting evidence-based decision-making across sectors such as infrastructure, urban development, water resources, ecosystems, and industrial systems. Through its integrated mandate, ICARS supports the translation of national and global commitments—including the NDMP, NAPCC, SAPCCs, NDCs, and the Sendai Framework—into actionable strategies, tools, and competencies at state, district, urban, and community scales.

A central pillar of ICARS' work is Human Capacity Building, which addresses one of the most critical constraints in DRR and Climate Change Adaptation (CCA): uneven and inadequate capacities across institutions and governance levels. Through systematic Capacity Needs and Gaps Analyses (CNA) and Training Needs Assessments (TNA), ICARS identifies gaps in knowledge, skills, systems, and coordination mechanisms, and supports the development of Professional Competency Strategies and structured capacity development plans. These assessments are designed to be risk-informed, context-specific, and demand-driven, with particular attention to high-risk geographies such as Himalayan regions, coastal zones, drought-prone areas, and rapidly urbanising systems. Blended training approaches combining classroom learning, field-based exposure, and digital platforms ensure that capacity development is performance-oriented and aligned with evolving climate and disaster risk profiles.

Despite India's robust policy architecture, the assessment highlights persistent gaps between intent and implementation. Key challenges include limited technical expertise at sub-national levels, weak inter-agency coordination, fragmented data and knowledge systems, insufficient field-based training, and inadequate integration of community and

traditional knowledge into formal planning processes. Financial constraints, lack of policy synergy between DRR and CCA frameworks, and insufficient last-mile connectivity of early warning systems further compound these challenges. These gaps underscore the need for a structured, evidence-based approach to capacity development that goes beyond ad hoc training interventions.

The CNA–TNA process aims to systematically assess capacities across individual, institutional, and systemic levels; map stakeholders and institutional roles; identify priority risks and vulnerabilities; diagnose critical capacity gaps; and translate these findings into actionable training and capacity development strategies. The scope of the assessment spans the full disaster risk management cycle—from prevention and mitigation to preparedness, response, recovery, and long-term adaptation—and covers multiple sectors, governance levels, and stakeholder groups, including policymakers, planners, engineers, disaster management professionals, local governments, academia, civil society, the private sector, and communities.

To respond to these challenges, a structured Institutional Competency Framework for Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) is proposed, providing a comprehensive basis for assessing and strengthening capacities at individual, institutional, and systemic levels and for translating assessment findings into targeted capacity development strategies. The framework is anchored around four interrelated dimensions: task-specific technical skills, which capture the ability of individuals and teams to undertake core DRR and CCA functions such as risk and vulnerability assessment, climate and disaster data analysis, planning, implementation, and monitoring; management and coordination capabilities, which encompass leadership, decision-making, inter-agency coordination, and resource optimisation needed to achieve strategic objectives; job-role alignment, which examines the coherence between assigned responsibilities, individual competencies, and institutional mandates to ensure clarity, accountability, and efficient human resource deployment; and contingency and emergency preparedness, which reflects institutional readiness to manage shocks, crises, and uncertainty across preparedness, response, recovery, and resilience pathways.

Overall, this framework and outcome of consultation provides a comprehensive and actionable foundation for strengthening India’s DRR and CCA capacity ecosystem. By anchoring capacity development in rigorous diagnostics, stakeholder engagement, and risk-informed planning, and by leveraging ICARS as a national knowledge and capacity hub, the framework supports more coherent governance, improved implementation, and sustained resilience outcomes. The findings are intended to inform strategic investments in human and institutional capacity, enhance coordination across sectors and governance levels, and ensure that India’s climate and disaster risk commitments translate into measurable and equitable resilience on the ground.

List of Figures

Figure 1	: TNA Steps (Source: AIHR)	10
Figure 2	: Core Principles of CNA and TNA	12
Figure 3	: CCNA Process Flow	14
Figure 4	: Capacity and Training Needs Assessment Framework for CCA and DRR Capacity Development	16
Figure 5	: Core Capacity Dimensions of the CNA - TNA Framework under ICARS	17
Figure 6	: Overview of Disaster Management and Climate Change Governance in India	30
Figure 7	: Stakeholder Perception of Integration of National Climate and Disaster Policies in NDMP, SAPCC and NAPCC	32
Figure 8 a	: Optimum Training Gap Required	33
Figure 8 b	: Training Mode Preference	33
Figure 9	: India's National level of Expertise Regarding DRR and CCA	33
Figure 10	: Four Dimensions of Institutional Competency Framework	38



List of Tables

Table 1	:	Major Training and Capacity Building Organisations	24
Table 2	:	Key Gaps Identified through Expert Deliberations and Questionnaire Survey	35
Table 3	:	Training program topics Recommended by Experts in Stakeholder Meeting.	36



1

Introduction & Background

1.1 Context

India's disaster risk landscape is shaped by its diverse geography, high population density, rapid urbanization, and increasing climate variability. Rising temperatures, erratic monsoons, sea-level rise, cyclones, floods, droughts, heatwaves, and landslides are intensifying disaster risks and threatening development gains. These risks have direct implications for sustainable development, infrastructure resilience, livelihoods, and environmental security. At the national level, India has articulated strong policy commitments through the Disaster Management Act (2005), National Disaster Management Plan (NDMP), National Action Plan on Climate Change (NAPCC), State Action Plans on Climate Change (SAPCCs), and its NDCs under the Paris Agreement. However, translating these frameworks into effective action requires sustained capacity across institutions and stakeholders.

Recent mapping of hydro-meteorological disasters in India shows that exposure, vulnerability, and adaptive capability significantly influence risk, which is not constant (DST, 2024). National assessments by BMTPC show that a large proportion of Indian districts fall under multi-hazard zones, with floods, cyclones, heatwaves, landslides, and droughts increasingly overlapping with dense settlements and critical infrastructure (BMTPC, 2019).

Studies supported by the Department of Science & Technology (DST) and climate projections from IITM also indicate a rise in extreme rainfall events, prolonged heat stress, and compound risks (such as flood–heat or drought–heat interactions) (DST, 2024; IITM, MoES).

Informal settlements, coastal belts, floodplains, hill regions, and dry zones are disproportionately affected by these risks. These areas are more vulnerable due to poor housing quality, reliance on climate-sensitive industries for livelihood, and restricted access to early warning systems and services (CEEW, 2021).

Together, these studies show that disaster risk in India is closely linked to how development happens. Changes in land use, rapid urban growth, and social and economic inequalities increase exposure and vulnerability. This makes risk-informed planning, resilient infrastructure, and targeted adaptation essential to reduce future disaster losses (BMTPC, 2019; DST, 2024).

1.2 About ICARS and Role in Strengthening Climate and Disaster Resilience

The Integrated Centre for Adaptation to Climate Change, Disaster Risk Reduction and Sustainability (ICARS) at the Indian Institute of Technology Roorkee is a Centre of Excellence supported by the Department of Science and Technology, Government of India, mandated to strengthen India's science–policy–practice interface for climate resilience, disaster risk reduction (DRR), and sustainability transitions. The Integrated Centre for Adaptation to Climate Change, Disaster Risk Reduction and Sustainability (ICARS) at the Indian Institute of Technology Roorkee undertakes policy-oriented and action-linked research aimed at strengthening strategic planning, regulatory instruments, and implementation frameworks at national and sub-national levels. This work responds to well-documented gaps between policy formulation and on-ground execution in disaster risk reduction (DRR) and climate change adaptation

(CCA), particularly in complex, multi-hazard contexts (UNDRR, 2015; IPCC, 2022). ICARS supports the development of sectoral strategies and operational toolkits that enable the mainstreaming of DRR and CCA into development planning processes across sectors such as infrastructure, urban development, water resources, and ecosystems.

As outlined in the Third Session of the National Platform for Disaster Risk Reduction (NPDRR) proceedings, Point 6.3 explicitly calls for strengthening linkages between research in science and technology (S&T), social sciences, and interdisciplinary and transdisciplinary domains with policy planning, capacity building, and knowledge integration through suitable academic institutions, Centres of Excellence (CoEs), and research programmes (Government of India, 2023). ICARS' mandate is directly aligned with this strategic direction and operationalises it by functioning as a national knowledge-to-action platform that bridges research, policy, and practice in Disaster Risk Reduction (DRR), Climate Change Adaptation (CCA), and sustainability. Under the NPDRR framework, ICARS contributes to strengthening risk-informed governance, inter-sectoral coordination, and institutional capacity for implementing the Sendai Framework in India by generating policy-relevant evidence, developing applied analytical products, advancing professional competency frameworks, and supporting systematic policy-to-practice translation across national and sub-national levels (UNDRR, 2015).

In alignment with India's National Biodiversity Strategy and Action Plan, ICARS integrates ecosystem-based approaches, nature-based solutions (NbS), and biodiversity considerations into climate adaptation and DRR planning, reinforcing the role of ecosystems as critical infrastructure for resilience. This includes advancing methodologies and tools that link biodiversity conservation with risk reduction outcomes in urban systems, coastal zones, river basins, mountain ecosystems, and drought-prone landscapes, thereby supporting co-benefits for adaptation, mitigation, and sustainable development (MoEFCC, 2014; IPBES, 2019).

ICARS plays a strategic role in advancing the objectives of the National Mission on Strategic Knowledge for Climate Change (NMSKCC), which seeks to enhance India's capacity to generate, synthesize, and apply climate knowledge in support of informed decision-making (DST, 2010). In this context, ICARS acts as a translational knowledge institution, systematically converting scientific research outputs into actionable knowledge products, decision-support systems, policy briefs, operational toolkits, and structured capacity-building modules tailored to the needs of policymakers, planners, engineers, disaster management authorities, and practitioners. By integrating climate science, disaster risk analytics, socio-economic vulnerability assessment, and systems-based approaches, ICARS strengthens the usability, accessibility, and policy relevance of climate knowledge, while promoting inter- and transdisciplinary research that connects physical sciences, social sciences, engineering, and governance domains.

At the regional and global levels, ICARS serves as India's focal point for the Hindu Kush Himalaya DRR Hub, supporting transboundary learning, regional cooperation, and resilience strategies in fragile mountain and cryospheric systems, with particular emphasis on compound hazards, cascading risks, and climate-induced extremes (ICIMOD, 2020). Further, as a professional member of the Santiago Network on Loss and Damage, ICARS contributes technical expertise on climate-induced loss and damage, including institutional capacity assessment, risk-informed planning, and implementation support, thereby strengthening India's engagement with global mechanisms addressing climate impacts beyond adaptation (UNFCCC, 2022). Through these integrated roles, ICARS reinforces coherence across biodiversity conservation, climate adaptation, disaster risk reduction, strategic knowledge generation, and loss and damage response, while supporting India's leadership across national, regional, and global resilience agendas.

ICARS functions as a national knowledge, research, and capacity-building platform, supporting evidence-

based policymaking, localized resilience planning, and human capacity development across sectors and governance levels. The Centre plays a catalytic role in translating national and global commitments such as the NDMP, NAPCC, SAPCCs, NDCs, and the Sendai Framework—into actionable strategies, tools, and competencies at state, district, urban, and community scales. ICARS operationalizes its mandate through four interlinked strategic pillars, which together provide a comprehensive and integrated approach to resilience-building.

First, under Policy Planning & Tools, ICARS undertakes policy-oriented and action-linked research to strengthen strategic planning, regulatory instruments, and implementation frameworks at national and sub-national levels. This includes the development of sectoral strategies and toolkits for mainstreaming disaster risk reduction (DRR) and climate change adaptation (CCA) into development planning, as well as flagship analytical products such as the Disaster Risk, Resilience and Recovery Report (DRRR), National Adaptation Dossier (NAAD), and Integrated Resilience – Localization Prototypes. Through policy briefs, working papers, and direct technical support to ministries and state governments, ICARS helps bridge persistent gaps between national policy frameworks—such as the NDMP, NAPCC, SAPCCs, and India’s NDCs—and operational realities on the ground, thereby enabling risk-informed development and adaptive governance (UNDRR, 2015; Government of India, 2019; UNDP, 2021).

Second, under Research & Case Studies, ICARS advances long-term, vision-driven inquiry through a Disaster Research Agenda & Framework (2030–2050), complemented by applied research and systematic case-based learning. Priority thematic areas include the Water–Food–Energy–Health nexus, flash and urban droughts, urban heatwaves, nature-based solutions for urban climate resilience, multi-hazard and compound risk analysis, climate–DRR–health linkages, integrated water resilience in mountain cities, and adaptation and DRR in industrial and infrastructure systems. This pillar also emphasizes the compilation and synthesis

of national and international case studies to examine the science and technology (S&T)–policy–practice interface, identify scalable resilience approaches, and strengthen research–policy translation in collaboration with national and international research institutions (IPCC, 2022; UNDRR, 2022).

Third, through Human Capacity Building, ICARS addresses one of the most critical constraints in DRR and CCA implementation: limited and uneven human resource capacity across governance levels. The Centre conducts Capacity and Needs Assessments (CNA/CAN) and Training Needs Assessments (TNA) across institutions, sectors, and regions, and supports the formulation of Professional Competency Strategies (PCS) and human resource plans tailored to specific geographic contexts such as Himalayan regions, coastal zones, and rapidly urbanizing systems. By designing blended training methodologies that combine classroom learning, field-based exposure, and digital platforms, and by undertaking impact evaluations of capacity-building interventions, ICARS ensures that training is demand-driven, performance-oriented, and aligned with evolving climate and disaster risk profiles, particularly in high-risk and multi-hazard settings (OECD, 2019; World Bank, 2022).

Finally, through Knowledge Integration, ICARS acts as a national knowledge broker, synthesizing insights from research, policy processes, and field implementation across DST Centres of Excellence and partner programmes. Key initiatives include the ADRES (Adaptation, Resilience and Sustainability) Knowledge Network Platform, the DST Climate Research Compendium (DCRC), and the establishment of a National Integrated Academy for Adaptation, DRR and Sustainability (NAADI) to promote professional excellence, research collaboration, and international cooperation. By integrating knowledge across sectors and scales, this pillar strengthens governance, supports localization of resilience action, and ensures that evidence generated through research and practice informs policy formulation, capacity building, and global engagement at scale (UNESCO, 2021; UNDP, 2023).

1.3 Rationale for CNA & TNA

Despite robust policy architecture, significant gaps persist between policy intent and implementation. Many institutions lack the technical skills, operational systems, and Despite India's robust policy architecture for Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA), significant gaps persist between policy intent and effective implementation, largely due to uneven and inadequate human and institutional capacities across governance levels. Many institutions continue to face constraints related to limited technical expertise, weak operational systems, insufficient coordination mechanisms, and inadequate exposure to emerging climate and compound disaster risks. In this context, Capacity and Needs Assessments (CNA) and Training Needs Assessments (TNA) provide a critical, evidence-based foundation for systematically diagnosing capacity gaps and designing targeted, context-specific capacity development interventions.

Through its Human Capacity Building pillar, the Integrated Centre for Adaptation to Climate Change, Disaster Risk Reduction and Sustainability (ICARS) at the Indian Institute of Technology Roorkee directly addresses one of the most critical constraints in DRR and CCA implementation, limited and uneven human resource capacity. ICARS conducts CNA and TNA across institutions, sectors, and regions, and supports the development of Professional Competency Strategies (PCS) and human resource plans tailored to specific geographic contexts such as Himalayan regions, coastal zones, and rapidly urbanizing systems. By designing blended training methodologies that integrate classroom-based learning, field-based exposure, and digital platforms, and by undertaking impact evaluations of capacity-building interventions, ICARS ensures that capacity development remains aligned with evolving climate and disaster risk profiles. This approach strengthens individual competencies, institutional performance, and inter-agency coordination, particularly in high-risk and multi-hazard settings, thereby enhancing the effectiveness of DRR and CCA implementation (OECD, 2019; World Bank, 2022).

1.4 Objectives of the CNA & TNA

The CNA–TNA process aims to achieve the following objectives:

- Capacity Assessment - Systematically assess institutional, technical, and human capacities related to DRR, CCA, and sustainability across policy, supervisory, and operational levels in key sectors and governance tiers of the State, using structured tools, stakeholder consultations, and workshops.
- Stakeholder and Institutional Mapping- Identify and map all relevant DRR and CCA stakeholders, clearly defining their roles, mandates, coordination mechanisms, and required competencies within the State's disaster management and climate governance architecture.
- Risk, Vulnerability, and Priority Gap Analysis - Identify key disaster and climate risks, assess sectoral and geographic vulnerabilities, and diagnose priority gaps in knowledge, skills, systems, and inter-agency coordination that constrain effective implementation of DRR and CCA policies.
- Training Needs and Learning Demand Identification- Structured TNA workshop and targeted consultations, assess current levels of understanding among stakeholders and identify demand-driven, role-specific learning needs and thematic priority areas for DRR and CCA across sectors and risk contexts.
- Training Landscape and Partnership Review - Map and review existing training programmes, learning platforms, institutions, and networks (within and outside the State), and identify potential agencies and partnerships for developing contextualised DRR/CCA learning modules and tools.
- Systemic Review and stocktaking of existing CNA and TNA initiatives on DRR and CCA since 2015, enabling institutional learning, avoidance of duplication, and alignment of future capacity-building investments with evolving risk profiles, policy priorities, and global commitments.

- Actionable Capacity Development Planning - Develop evidence-based recommendations to address identified human, institutional, and financial capacity gaps, informing the preparation of a structured Capacity Development Plan and Professional Competency Strategy, with clear linkages between training investments and improved preparedness, decision-making, and resilience outcomes.

1.5 Scope and Coverage

The Capacity Needs and Gaps Analysis (CNA) and Training Needs Assessment (TNA) cover a comprehensive thematic, geographic, institutional, and stakeholder scope to reflect the multidimensional nature of climate and disaster risks in India. The thematic scope encompasses Climate Change Adaptation (CCA), Disaster Risk Reduction (DRR), and Sustainability, with a focus on their integration into development planning, infrastructure resilience, environmental management, and socio-economic systems. The assessment addresses the full disaster risk management cycle including prevention, mitigation, preparedness, response, recovery, and long-term adaptation. While incorporating cross-cutting themes such as risk-informed planning, nature-based solutions, climate finance, data and technology, governance, and inclusion.

The geographic and institutional scope spans multiple governance levels, including national level sectoral ministries, state departments, district, urban local bodies (ULBs), Panchayati Raj Institutions (PRIs), and selected industrial and Special Economic Zone (SEZ) contexts. Recognizing India's diverse risk geographies, the assessment explicitly considers region-specific hazard profiles and capacity needs across Himalayan, coastal, arid/semi-arid, and plains/central regions. Institutionally, the scope includes line ministries, state departments, disaster management authorities, urban and rural local governments, technical agencies, academic and training institutions, and sectoral bodies responsible for planning, infrastructure development, and service delivery.

The stakeholder coverage is intentionally broad and inclusive, encompassing policymakers and planners, engineers and technical professionals, disaster management practitioners, local government functionaries, academic and research institutions, training providers, civil society organizations, private sector entities, and community representatives. Particular attention is given to frontline responders and local-level actors, whose capacities are critical for last-mile implementation and community resilience. By engaging diverse stakeholder groups, the CNA–TNA ensures that capacity development recommendations are context-specific, demand-driven, and responsive to the needs of those responsible for translating policy into action on the ground.

1.6 Training Needs Assessment (TNA) and Capacity Needs Assessment (CNA) Initiatives on DRR and Climate Change in India

Training Needs Assessment (TNA) for disaster management in India can be traced back to the mid-1990s, following the adoption of the Yokohama Strategy and Plan of Action for a Safer World (1994), which marked a global shift from reactive, relief-centric approaches toward prevention, preparedness, and capacity building (UN, 1994). The Yokohama Strategy explicitly emphasized strengthening human and institutional capacities through training, awareness, and knowledge sharing, providing an early impetus for systematic assessment of training and capacity needs in disaster-prone countries, including India.

In the post-Yokohama period, India gradually began institutionalising disaster management training and capacity development, initially through sectoral and administrative training institutions and subsequently through dedicated disaster management structures. This process was significantly strengthened following the enactment of the Disaster Management Act (2005) and the establishment of the National Institute of Disaster Management (NIDM), which formalised structured and periodic TNA and CNA processes at the national level. NIDM-led assessments have systematically identified capacity gaps among disaster management authorities,

line departments, and first responders, informing national training frameworks, standard operating procedures, and thematic programmes across the disaster risk management cycle (NIDM, 2017).

Since the adoption of the Sendai Framework for Disaster Risk Reduction (2015–2030) and India’s enhanced climate commitments under the Paris Agreement, India has undertaken multiple Training Needs Assessments (TNA) and Capacity Needs Assessments (CNA) to strengthen institutional, technical, and human capacities for Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). These initiatives—led by national and state institutions with support from development partners and academic bodies—have focused on improving preparedness, response, recovery, and long-term resilience across sectors and governance levels (UNDRR, 2015).

At the national level, the National Disaster Management Authority (NDMA) and NIDM have played a central role in identifying capacity gaps and training needs among disaster management authorities, line departments, and first responders. CNA and TNA exercises undertaken by these institutions have informed national training frameworks, standard operating procedures, and thematic capacity-building programmes on early warning systems, incident response, urban flooding, heatwaves, earthquakes, and multi-hazard risk management. Periodic institutional assessments linked to the implementation of the National Disaster Management Plan (NDMP) have consistently highlighted gaps in applied technical expertise, inter-agency coordination, and last-mile service delivery at sub-national levels (Government of India, 2019).

At the state and district levels, State Disaster Management Authorities (SDMAs) and District Disaster Management Authorities (DDMAs) have undertaken sector- and hazard-specific TNAs and CNAs, frequently supported by development partners such as the United Nations Development Programme (UNDP), the World Bank, and bilateral agencies. These assessments have focused on strengthening capacities for local disaster management planning, Emergency Operations Centre (EOC) functioning, community-based disaster

risk management, and mainstreaming DRR into development programmes. Findings consistently indicate uneven technical capacity across districts, limited familiarity with risk analytics and climate information, and insufficient emphasis on field-based, simulation-oriented, and scenario-driven training (World Bank, 2021).

In the climate change domain, several CNAs and TNAs have been conducted to support the preparation and implementation of State Action Plans on Climate Change (SAPCCs) and sectoral adaptation strategies, under the coordination of the Ministry of Environment, Forest and Climate Change (MoEFCC) and the Department of Science and Technology (DST). These assessments have examined capacities related to climate data interpretation, vulnerability and risk assessment, integration of adaptation into sectoral planning, monitoring and evaluation, and access to climate finance. While national-level technical capacity has improved, assessments repeatedly identify persistent gaps at state and urban local body levels, particularly in translating climate science into actionable plans, projects, and investment decisions (DST, 2010; World Bank, 2021).

Administrative Training Institutes (ATIs) have played a sustained role in conducting TNAs for disaster management since the late 1990s and early 2000s, particularly through civil services induction, mid-career training, and governance reform programmes. ATI-led TNAs have focused on identifying competency gaps among state and district officials related to disaster preparedness, emergency response coordination, district disaster management planning, and integration of DRR into development processes. Over time, these assessments have expanded to include climate change adaptation, urban risks, and compound hazards, reflecting evolving risk profiles and policy priorities (Government of India, 2019).

Methodologically, ATI-led TNAs rely on structured questionnaires, training feedback analysis, consultation workshops, and interactions with SDMAs and line departments. Across states, findings consistently highlight gaps in applied risk assessment skills, use

of climate and disaster data, inter-departmental coordination during emergencies, and integration of climate risks into routine planning and budgeting processes, underscoring the need for more specialised, scenario-based, and field-oriented training.

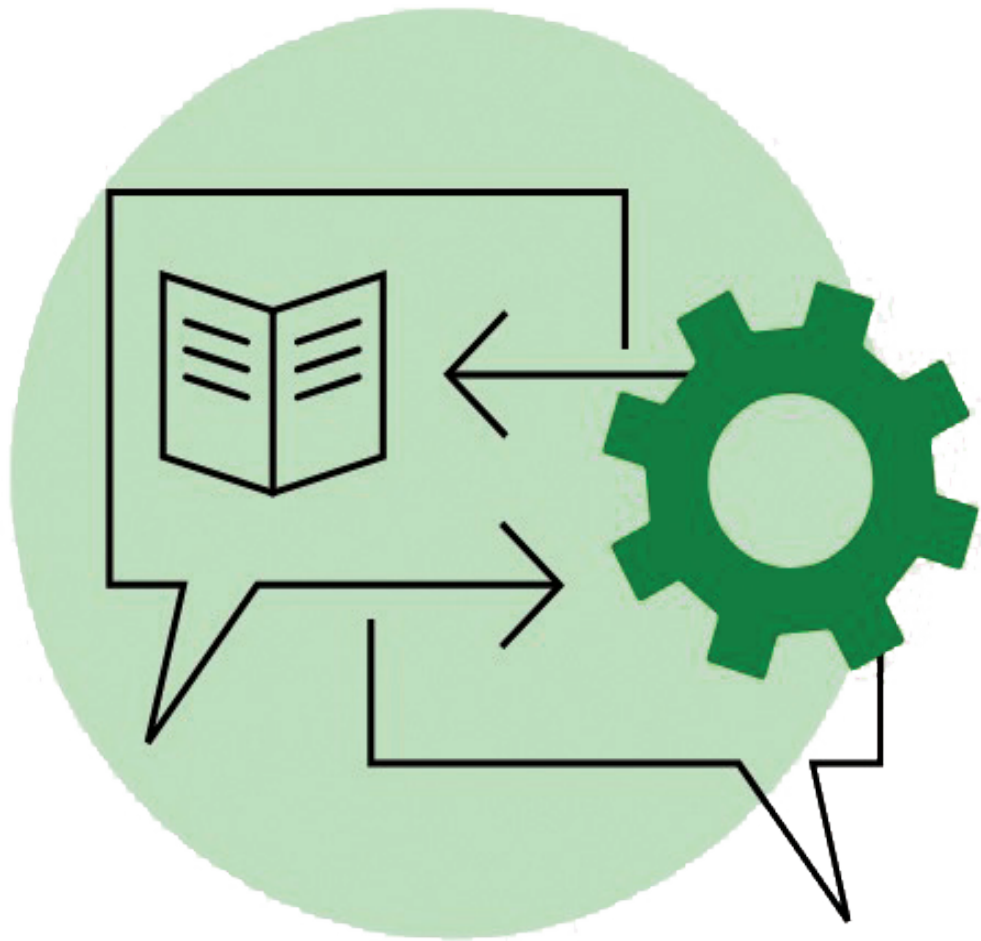
NIDM has played a pivotal role in organising structured TNA workshops at national, state, and district levels, typically in collaboration with NDMA, SDMAs, line ministries, and development partners. These workshops employ participatory methodologies including stakeholder mapping, functional role analysis, group exercises, and self-assessment tools to identify training needs related to hazard-specific preparedness, incident response systems, EOC management, early warning dissemination, post-disaster recovery planning, and integration of climate change considerations into DRR practice (NIDM, 2017).

Evidence from NIDM-led TNA workshops since 2015 indicates recurring challenges, including uneven

capacity across districts, limited exposure of officials to simulation-based and scenario-driven training, and weak linkage between training outcomes and institutional performance or career progression. While these findings have informed national curricula and e-learning platforms, they also highlight the need for systematic follow-up, impact evaluation, and alignment with long-term human resource and competency strategies (UNDRR, 2022).

Overall, India's experience demonstrates a progressive evolution of TNA and CNA from early capacity-building efforts influenced by the Yokohama Strategy to more structured, institutionalised assessments aligned with the Sendai Framework—while underscoring the need for a systemic stocktaking of CNA and TNA initiatives undertaken since the mid-1990s to strengthen institutional learning, avoid duplication, and align future capacity-building investments with evolving risk profiles and global commitments.





2

Conceptual Framework

2.1 Definitions and Key Concepts

Capacity refers to the ability of individuals, organisations, and systems to perform functions effectively, efficiently, and sustainably in pursuit of defined objectives. In the context of climate change adaptation (CCA), disaster risk reduction (DRR), and sustainability, capacity encompasses not only technical skills and knowledge, but also institutional arrangements, governance mechanisms, and enabling policy environments.

Capacity development is the process through which these abilities are strengthened, adapted, and sustained over time. It involves enhancing human competencies, improving organisational systems and processes, and reinforcing the broader enabling environment including policies, regulations, incentives, and coordination mechanisms that shape decision-making and implementation. Resilience refers to the capacity of individuals, communities, institutions, and systems to anticipate, absorb, adapt to, and recover from climate-related hazards and disasters, while maintaining or improving essential functions and development outcomes.

A clear distinction is made between Capacity Needs Assessment (CNA) and Training Needs Assessment (TNA). CNA is a broader diagnostic process that identifies gaps in capacities across human, institutional, and systemic levels, while TNA focuses specifically on translating identified capacity gaps into targeted training requirements. CNA provides the strategic evidence base, whereas TNA operationalises this evidence into structured learning interventions. Together, CNA and TNA form an integrated continuum rather than

standalone exercises. Within this framework, skills refer to specific abilities acquired through learning and practice; competencies denote the integrated application of knowledge, skills, and attitudes within professional roles; systems encompass organisational structures, processes, and tools; and the enabling environment includes the policy, regulatory, financial, and governance context that allows capacities to be effectively exercised.

2.2 CNA and TNA

Capacity Needs Assessment (CNA)

Capacity Needs Assessment (CNA) is a strategic and diagnostic process used to identify gaps in capacities at individual, institutional, and system levels that affect the effective implementation of policies, programmes, and mandates related to Disaster Risk Reduction (DRR), Climate Change Adaptation (CCA), and sustainability. CNA examines not only skills and knowledge, but also organisational structures, coordination mechanisms, legal and policy frameworks, data systems, financing arrangements, and the enabling environment. Its primary purpose is to understand why performance gaps exist and what systemic, institutional, and human factors constrain effective action. CNA therefore informs broader capacity development strategies, including institutional reforms, policy alignment, system strengthening, and investment priorities, of which training is only one component.

Training Needs Assessment (TNA)

Training Needs Assessment (TNA) is a more focused and operational process that translates identified

capacity gaps primarily at the individual and functional levels into specific learning and training requirements. TNA determines who needs training, on what topics, at what level, and using which delivery methods, based on roles, responsibilities, and performance expectations. It focuses on identifying gaps in knowledge, skills, and competencies that can be effectively addressed

through training interventions such as courses, workshops, simulations, field exercises, or digital learning. TNA therefore informs the design of curricula, training modules, delivery modalities, and evaluation frameworks, ensuring that training investments are demand-driven, role-specific, and performance-oriented.

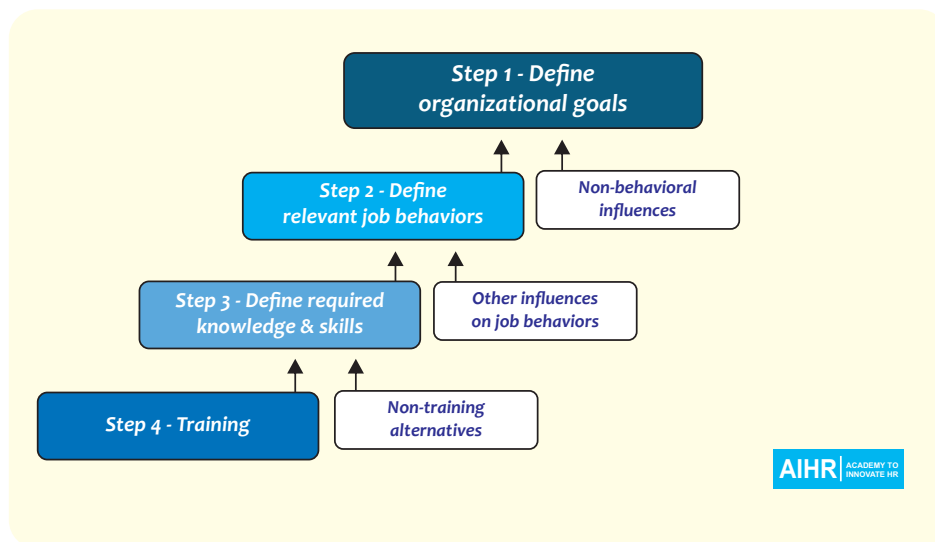


Figure 1: TNA Steps (Source: AIHR)

Commonality and Relationship between CNA and TNA

CNA and TNA are complementary and sequential rather than standalone exercises. CNA provides the evidence base by identifying where and why capacities are insufficient, while TNA operationalises this evidence by defining targeted training solutions. In the context of DRR and CCA, CNA ensures that training is not treated as a generic solution to systemic problems, and TNA ensures that training investments directly contribute to improved preparedness, decision-making, coordination, and resilience outcomes.

Capacity Needs Assessment (CNA) and Training Needs Assessment (TNA) share several core principles and functions, as both are designed to strengthen the effectiveness of institutions and individuals engaged in Disaster Risk Reduction (DRR), Climate Change Adaptation (CCA), and sustainability. At their core, both CNA and TNA are diagnostic, evidence-based processes

that rely on systematic data collection, stakeholder consultation, and structured analytical tools to identify gaps between existing capacities and desired performance levels. Each seeks to improve outcomes by grounding capacity development interventions in a clear understanding of needs rather than assumptions.

Both approaches are performance-oriented, focusing on enhancing the ability of individuals, organisations, and systems to fulfil mandated roles and responsibilities effectively. They are aligned with policy and institutional objectives, ensuring that capacity development efforts support the implementation of national and sub-national frameworks, strategies, and regulatory mandates. In addition, CNA and TNA are demand-driven and context-specific, recognising that capacity requirements vary across sectors, governance levels, risk contexts, and geographic settings.

CNA vs TNA: Key Differences at a Glance

Aspect	Capacity Needs Assessment (CNA)	Training Needs Assessment (TNA)
Purpose	Diagnose why capacity gaps exist	Identify what training is required
Level of analysis	Individual, insituional, and systemic	Primarily individual and funcional
Scope	Broad (policies, insituions, systems, skills)	Narrower (knowledge, skills, competencies)
Focus	Performance constraints and enabling environment	Learning gaps and training design
Outputs	Capacity development strategy, insituional reforms, system strengthening acions	Training plans, curricula, modules, delivery methods
Time horizon	Medium to long term	Short to medium term
Role in planning	Strategic foundaion	Operaional implementaion

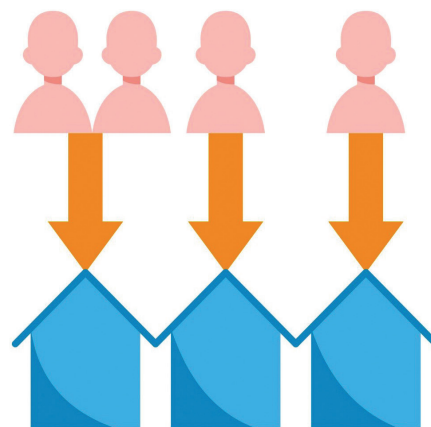
Core Principles of CNA and TNA

Both Capacity Needs Assessment (CNA) and Training Needs Assessment (TNA) are grounded in a shared set of core principles that ensure capacity development efforts are relevant, effective, and impactful:

- **Performance-oriented** – Both CNA and TNA focus on improving actual performance and outcomes, not merely identifying gaps. They link capacity development directly to enhanced preparedness, decision-making, coordination, and resilience results in DRR and CCA practice.
- **Stakeholder engagement and participation** – CNA and TNA rely on inclusive and participatory processes, engaging policymakers, technical staff, practitioners, and other stakeholders to ensure accuracy, ownership, and contextual relevance of findings.
- **Action-oriented** – Both assessments are designed to lead to concrete actions, whether strategic capacity development measures (CNA) or targeted training programmes and learning interventions (TNA), rather than remaining purely analytical exercises.

- **Demand-driven** – CNA and TNA are responsive to real, context-specific needs arising from roles, mandates, risk profiles, and institutional priorities, ensuring that capacity-building investments address genuine demand rather than generic training supply.

Together, these principles ensure that CNA and TNA function as integrated, results-focused tools within a coherent capacity development framework for Disaster Risk Reduction and Climate Change Adaptation.



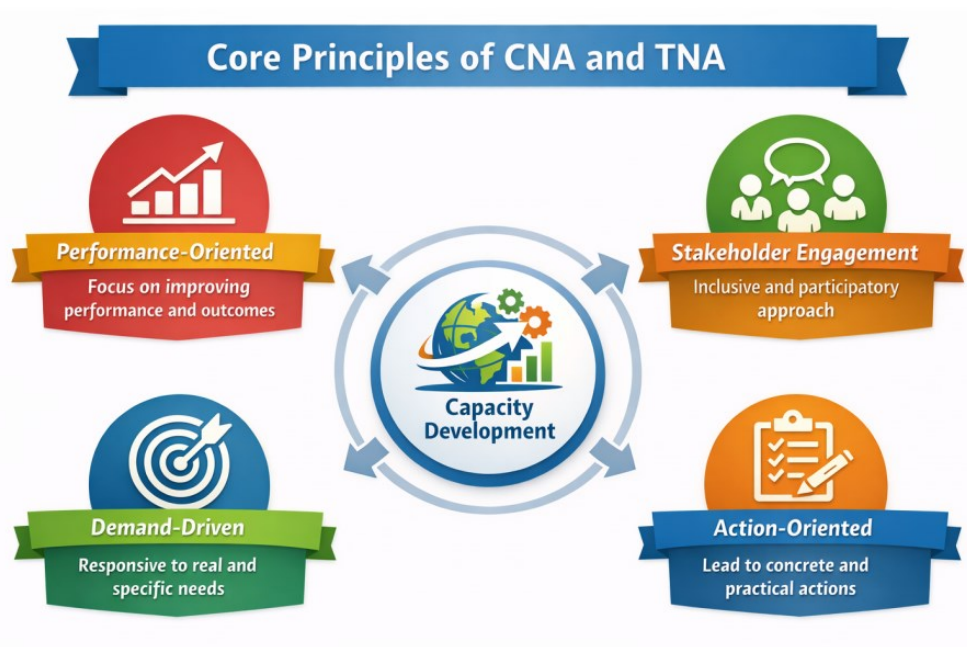


Figure 2: Core Principles of CNA and TNA

2.3 Overall Approach and Methodology

The CNA–TNA methodology adopted under the Integrated Centre for Adaptation to Climate Change, Disaster Risk Reduction and Sustainability (ICARS) is grounded in a mixed-methods and participatory approach, combining qualitative and quantitative techniques to ensure analytical rigour, contextual relevance, and stakeholder ownership. Mixed-methods approaches are widely recognised as effective for capacity assessment as they allow triangulation of institutional diagnostics with lived professional experiences and stakeholder perceptions (OECD, 2006; UNDP, 2009). The methodology is explicitly stakeholder-driven, ensuring that training needs reflect operational realities across governance levels and sectors rather than prescriptive or supply-driven training models.

The study is anchored in a structured Capacity Needs Assessment (CNA) and Training Needs Assessment (TNA) conceptual framework that integrates Climate Change Adaptation (CCA), Disaster Risk Reduction (DRR), and sustainability within a unified analytical lens. The framework recognises capacity as a multi-dimensional

construct encompassing individual competencies, institutional systems, and the enabling policy and governance environment. It applies internationally recognised capacity development principles, focusing on five core capacities: the capacity to commit and act, achieve results, relate and attract, adapt and learn, and maintain internal coherence. By linking these capacity dimensions to the disaster risk management cycle and sectoral development processes, the framework ensures that capacity gaps are identified not only in training needs but also in organisational arrangements, coordination mechanisms, and systemic enablers. This integrated approach enables the translation of policy commitments into operational capacities across governance levels.

Data Collection and Analysis

Data collection adopted a mixed-methods approach, combining qualitative and quantitative techniques to ensure analytical rigour, triangulation, and contextual relevance. Secondary data were gathered through a comprehensive desk review of national and sub-national policies, legislation, strategies, programme

documents, training curricula, and previous assessments related to DRR, CCA, and capacity development. Primary data collection involved key informant interviews, focus group discussions, and structured questionnaires administered to stakeholders across policy, supervisory, and operational levels. Institutional mapping was undertaken to examine mandates, roles, coordination mechanisms, and functional overlaps among key agencies. Data analysis involved systematic synthesis of findings using structured capacity scoring matrices, enabling comparison across sectors and institutions, prioritisation of capacity gaps, and identification of critical constraints affecting implementation effectiveness.

TNA Workshops and Stakeholder Consultations

Training Needs Assessment workshops and stakeholder meetings formed a central component of the methodology, providing a participatory platform for validating assessment findings and identifying demand-driven learning priorities. These workshops brought together representatives from government departments, disaster management authorities, technical agencies, academic institutions, civil society organisations, and local governance bodies. Through facilitated group discussions, role-based exercises, and thematic break-out sessions, participants assessed existing competencies, reflected on operational challenges, and articulated priority training needs aligned with their functional responsibilities. The consultative process ensured ownership of findings, strengthened inter-agency dialogue, and enabled the identification of context-specific training themes, delivery modalities, and potential institutional partnerships.

Drafting and Review Process

The drafting process involved systematic consolidation of findings from the CNA, TNA workshops, and stakeholder consultations into a coherent analytical narrative. Draft outputs were structured to clearly link identified capacity gaps with recommended training and capacity development interventions. An iterative review process was undertaken, involving technical

validation by subject matter experts and feedback from key stakeholders to ensure accuracy, relevance, and policy alignment. Revisions were incorporated to strengthen clarity, consistency, and applicability, resulting in a final report that provides an evidence-based foundation for strategic capacity development planning, implementation, and monitoring.

2.4 Capacity Needs Assessment (CNA) Methodology

The Capacity Needs Assessment (CNA) methodology under ICARS is designed to systematically diagnose human, institutional, and systemic capacity gaps that affect the effective planning and implementation of Climate Change Adaptation (CCA), Disaster Risk Reduction (DRR), and sustainability interventions. The CNA adopts a triangulated and evidence-based approach, combining document analysis, stakeholder consultations, and structured assessment tools to ensure robustness and contextual relevance (UNDP, 2009).

The assessment begins with a comprehensive desk review of relevant national, sectoral, and institutional documents, including policies, legislation, strategies, programme reports, training materials, and previous capacity assessments. This review establishes the baseline understanding of existing mandates, institutional arrangements, policy coherence, and formally articulated capacity requirements for CCA and DRR. Desk review findings also inform the design of subsequent consultation tools and analytical frameworks.



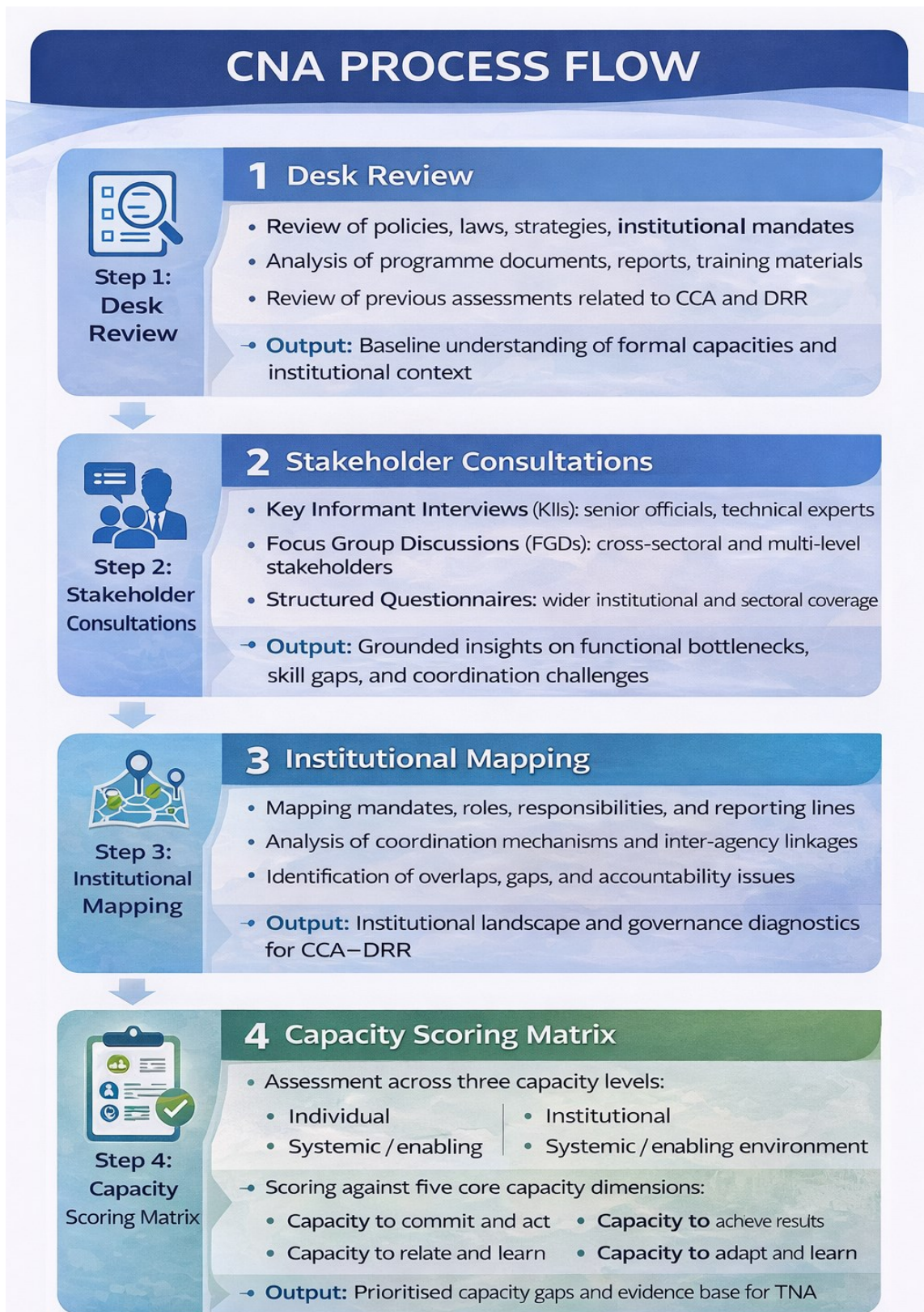


Figure 3: CNA Process flow

Primary data collection is undertaken through a combination of key informant interviews (KIIs), focus group discussions (FGDs), and structured questionnaires, enabling engagement with stakeholders across governance levels and sectors. KIIs with senior officials, technical experts, and institutional leaders provide in-depth insights into functional bottlenecks, coordination challenges, leadership constraints, and systemic issues. FGDs facilitate collective reflection on operational realities, cross-sectoral coordination, and shared capacity challenges, while questionnaires support the collection of comparable, quantitative information on roles, competencies, and perceived capacity gaps across a larger respondent base. The use of multiple consultation tools allows for triangulation of perspectives and enhances the reliability of findings (OECD, 2006).

Institutional mapping is undertaken as a core analytical step to examine organisational mandates, roles and responsibilities, reporting relationships, and coordination mechanisms among key stakeholders involved in CCA and DRR. This process helps identify overlaps, fragmentation, gaps in accountability, and opportunities for improved institutional coherence and collaboration across sectors and administrative levels. Institutional mapping is particularly critical in complex risk governance contexts where responsibilities are distributed across multiple agencies (World Bank, 2019).

The findings from the desk review, consultations, and institutional mapping are synthesised using a structured capacity scoring matrix. The matrix assesses capacity performance across defined analytical dimensions and the five core capacity dimensions guiding the ICARS framework: capacity to commit and act; achieve results; relate and attract; adapt and learn; and maintain internal coherence and across individual, institutional, and systemic levels and the enabling environment for Climate Change Adaptation (CCA), Disaster Risk Reduction (DRR), and Sustainability. Capacity scoring enables systematic comparison across sectors and institutions, supports prioritisation of capacity gaps, and provides a transparent evidence base for subsequent

Training Needs Assessment (TNA) and training design (UNDP, 2010).

2.5 Elaborated Steps for Developing a TNA–CNA Framework (DRR–CCA)

Step 1: Scoping and Framework Design

This step establishes the foundation of the assessment. It defines the purpose, scope, and boundaries of the TNA–CNA, including thematic focus areas (DRR, CCA, sustainability), governance levels (state, district, local), sectors, and competency domains. Relevant national and state policies, strategies, and legal mandates are reviewed to ensure alignment. A common assessment framework, indicators, and scoring logic are finalised to ensure consistency and comparability.

Step 2: Stakeholder and Institutional Mapping

Key institutions, departments, agencies, academia, civil society, and private sector actors involved in DRR and CCA are systematically identified. Their roles, mandates, interdependencies, and coordination mechanisms are mapped across policy, supervisory, and operational levels. This step also identifies who should be assessed, trained, or engaged, and clarifies expected competencies for each function.

Step 3: Risk, Vulnerability, and Context Analysis

The State's hazard profile, climate risks, exposure, and vulnerabilities are analysed using available data, plans, and expert inputs. Sector-specific and geographic vulnerabilities are identified, ensuring that capacity needs are risk-informed and context-specific. Emerging risks (e.g., climate extremes, cascading hazards) and development pressures are also considered.

Step 4: Capacity Assessment and Gap Analysis

Existing human, institutional, technical, and system capacities are assessed through desk reviews, interviews, and baseline tools. The analysis focuses on knowledge, skills, tools, processes, resources, and coordination arrangements. Capacity gaps are identified not only in training needs but also in systems, mandates, and enabling conditions that affect performance.

Step 5: Training Needs Assessment (TNA) and Validation

Based on identified gaps, thematic and role-based groups are constituted. Focus Group Discussions, workshops, customised TNA questionnaires, and

hands-on exercises are conducted to assess current understanding, practical competencies, and learning demand. This step validates earlier findings and ensures that training needs are demand-driven, role-specific, and performance-oriented.



Figure 4: Capacity and training needs assessment Framework for CCA and DRR capacity development

Step 6: Synthesis and Capacity Development Planning

Findings from all steps are consolidated and prioritised. Capacity gaps are translated into actionable recommendations, including training pathways, institutional strengthening measures, partnerships, and resource requirements. The outputs inform a Capacity Development Plan and Professional Competency Strategy, clearly linking learning investments to improved preparedness, decision-making, service delivery, and resilience outcome.

2.6 CNA–TNA Integration Framework

The CNA–TNA framework under ICARS adopts a three-

level capacity lens to ensure comprehensive and scalable capacity development:

- **Individual level:** focusing on knowledge, skills, competencies, and professional behaviours of personnel engaged in CCA and DRR.
- **Institutional level:** addressing organisational mandates, structures, processes, coordination mechanisms, and operational systems.
- **Systemic / enabling environment level:** encompassing policies, legal frameworks, financing mechanisms, inter-sectoral governance, and national–subnational coherence.

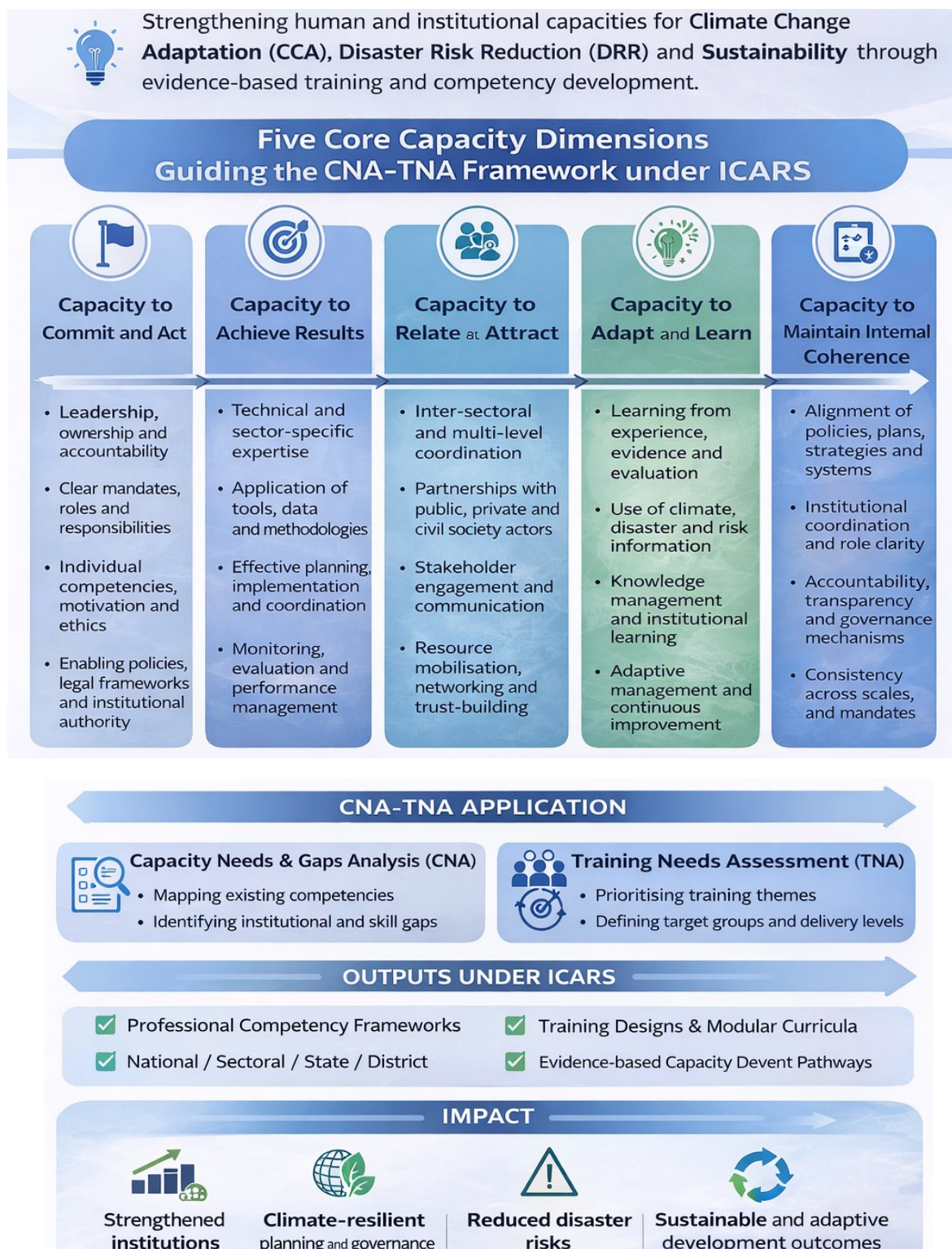


Figure 5: Core Capacity Dimensions of the CNA TNA Framework under ICARS

Capacity development is conceptualised along a results chain that links learning inputs to real-world outcomes:

Knowledge → Skills → Practice → Outcomes

This results chain ensures that capacity-building interventions move beyond information dissemination to measurable improvements in professional practice, institutional performance, and resilience outcomes.

The Capacity Needs Assessment (CNA) and Training Needs Assessment (TNA) framework systematically strengthens the Human Capacity Building pillar of the Integrated Centre for Adaptation to Climate Change, Disaster Risk Reduction and Sustainability (ICARS) at the Indian Institute of Technology Roorkee. Anchored in internationally recognised capacity development principles, the framework addresses five interrelated core capacities: (i) capacity to commit and act, by enhancing individual and institutional competencies, leadership, and role clarity; (ii) capacity to achieve results, through improved technical skills, application of tools, and evidence-based decision-making; (iii) capacity to relate and attract, by strengthening collaboration, partnerships, and stakeholder engagement across sectors and governance levels; (iv) capacity to adapt, learn and innovate, by fostering continuous learning, use of climate and disaster data, and adaptive management practices; and (v) capacity to maintain internal coherence, by aligning organisational mandates, policies, systems, and accountability mechanisms.

By mapping existing competencies against these capacity dimensions and identifying gaps across national, sectoral, state, district, and local levels, the CNA–TNA framework ensures that training designs and curricula are strategically aligned, evidence-based, and context-specific. This approach enables ICARS to develop targeted training modules, professional competency strategies, and learning pathways that are responsive to India’s evolving climate risks, increasing frequency of extreme events, and complex disaster risk landscape, while supporting long-term institutional resilience and sustainable development outcomes.

2.7 Analytical Dimensions

To operationalise CNA and TNA, the framework applies a set of interrelated analytical dimensions that reflect the functional requirements of climate and disaster risk governance:

- **Policy and regulatory capacity:** ability to formulate, interpret, and implement policies, laws, standards, and guidelines related to CCA and DRR.
- **Technical and analytical capacity:** competencies in risk assessment, climate analysis, modelling, data interpretation, and sector-specific adaptation planning.
- **Operational and implementation capacity:** ability to plan, execute, monitor, and evaluate programmes, projects, and response actions.
- **Coordination and governance capacity:** mechanisms for horizontal and vertical coordination, stakeholder engagement, accountability, and leadership.
- **Data, technology, and knowledge systems:** access to, and effective use of, climate and disaster data, digital platforms, decision-support tools, and institutional knowledge management systems.

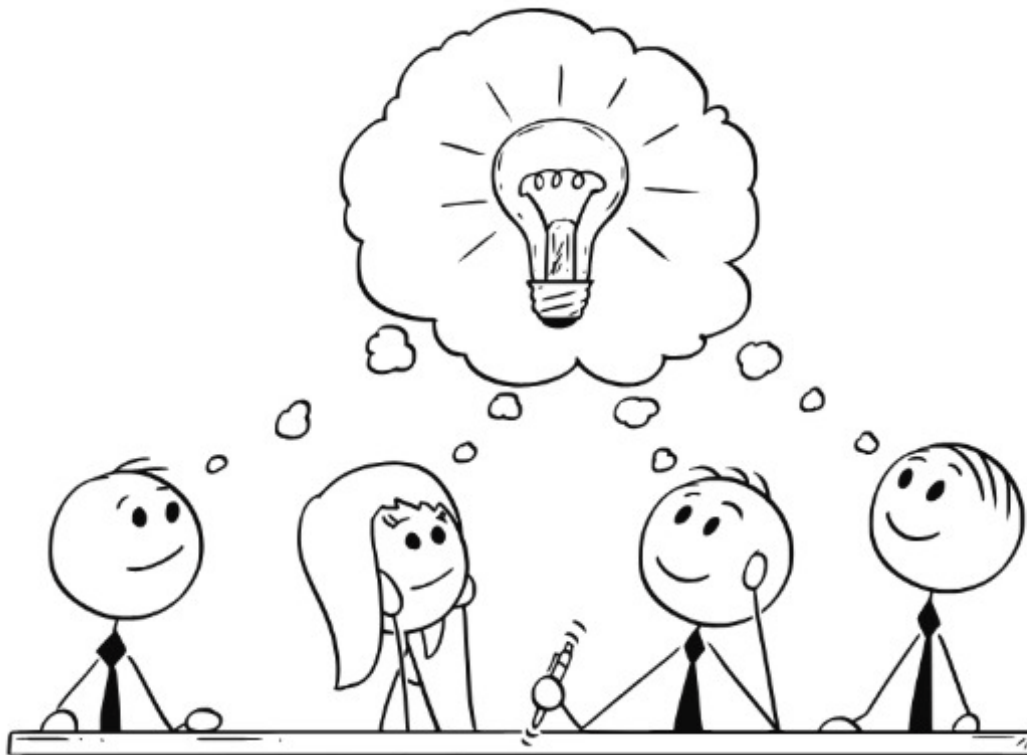
These dimensions enable systematic identification of capacity gaps across sectors and governance levels, providing a robust basis for targeted training design.

2.8 Theory of Change

The CNA–TNA framework under ICARS is underpinned by a theory of change that posits that strengthening capacities across five core capacity dimensions i.e. capacity to commit and act, achieve results, relate and attract, adapt and learn, and maintain internal coherence—leads to sustained improvements in climate and disaster resilience outcomes (Refer Figure 1: Core Capacity Dimensions of the CNA TNA Framework under ICARS) By systematically diagnosing capacity gaps across individual, institutional, and

systemic levels, and translating these gaps into evidence-based training and competency development pathways, the framework ensures that learning interventions are strategically aligned with real-world functional needs. Enhanced knowledge and skills, when embedded within supportive institutional systems and enabling policy environments, lead to improved

professional practice, more effective coordination and governance, and stronger implementation of CCA and DRR measures. Over time, these improvements contribute to reduced disaster losses, climate-resilient planning and infrastructure, adaptive governance, and sustainable development outcomes in the face of India's evolving climate and disaster risk landscape.





3

Current Status of Training and Capacity Building

3.1 DRR Governance Structure

India's disaster risk management and climate adaptation framework is predominantly government-led, with clearly defined institutional mandates and multi-level coordination mechanisms. While the primary responsibility for disaster risk reduction (DRR), preparedness, response, and recovery rests with public institutions, non-governmental actors—including civil society organizations, the private sector, academic institutions, and local communities—play an essential complementary role, particularly in preparedness, response support, and recovery.

Evolution of the Institutional Framework

India's disaster management approach has evolved significantly over the past three decades. Earlier arrangements were largely reactive and relief-centric, guided by the Emergency Preparedness Planning and Response Rules (1996) under the Environment (Protection) Act, 1986, and administered mainly through revenue and relief departments at the state and union territory levels. Disaster management was initially housed under the Ministry of Agriculture until 2003.

A paradigm shift occurred with the enactment of the Disaster Management Act (DM Act), 2005, which established a comprehensive, proactive, and institutionalized framework emphasizing prevention, mitigation, preparedness, and resilience-building.

Under the Act, disaster management was placed under the Ministry of Home Affairs (MHA), designating it as the nodal ministry for disaster risk governance in India.

Institutional Architecture

At the national level, the **National Disaster Management Authority (NDMA)** serves as the apex body responsible for formulating national disaster management policies, guidelines, and plans, including the National Disaster Management Plan (NDMP). NDMA provides strategic direction for integrating disaster risk reduction with development planning and increasingly aligns its guidance with climate change adaptation (CCA) priorities.

The **National Institute of Disaster Management (NIDM)**, functioning under the Ministry of Home Affairs and guided by NDMA, plays a central role in capacity development, training, research, and knowledge management. NIDM supports national and sub-national institutions through standardized training curricula, applied research, and human resource development for disaster management and climate resilience.

At the sub-national level, **State Disaster Management Authorities (SDMAs)** are responsible for policy formulation, coordination, and implementation of disaster risk reduction and response strategies at the state level, aligned with national frameworks.

District Disaster Management Authorities (DDMAs) operationalize these strategies at the district level,

playing a critical role in localized risk assessment, preparedness planning, response coordination, and recovery implementation.

This multi-tiered governance structure ensures vertical integration from national to local levels, while enabling decentralized decision-making based on local hazard, vulnerability, and exposure contexts.

Integration of CCA and DRR

In response to increasing climate variability, extreme weather events, and environmental degradation, India's disaster management framework has progressively integrated climate change adaptation principles. Disaster management plans at national, state, and district levels now incorporate hazard, risk, and vulnerability assessments, and link them with prevention, mitigation, preparedness, response, sustainable recovery, and resilient reconstruction strategies.

Multiple line ministries—including those responsible for water resources, agriculture, urban development, housing, transport, environment, health, and energy—act as technical and implementation partners. These ministries support both disaster response operations and the design and execution of long-term adaptation strategies. Centralized coordination through NDMA is complemented by interdisciplinary expertise across sectors, enabling a whole-of-government approach to managing climate and disaster risks.

A key feature of India's CCA–DRR integration is the preparation of **Sectoral and Departmental Disaster Management Plans and sector-specific climate adaptation action plans**, led by line ministries at the national level and implemented through corresponding ministries and departments at the state level. These institutions function as both technical authorities and implementing agencies, ensuring vertical integration of disaster risk governance.

Major sectors and responsible ministries/departments include:

- **Water Resources and Flood Management**

At the national level, this sector is led by

the Ministry of Jal Shakti, focusing on flood forecasting, river basin management, drought preparedness, and climate-resilient water infrastructure.

At the state level, responsibilities are typically vested in the State Water Resources Department / Irrigation Department, often supported by State Flood Control Departments, Groundwater Departments, and State Water Supply and Sanitation Missions.

- **Agriculture and Allied Sectors**

National leadership rests with the Ministry of Agriculture and Farmers Welfare, integrating drought risk management, climate-resilient crops, agro-meteorological advisories, and livelihood diversification. At the state level, implementation is carried out by the Department of Agriculture, along with allied departments such as Horticulture, Animal Husbandry, Fisheries, and State Agricultural Universities.

- **Urban Development and Housing**

This sector is guided nationally by the Ministry of Housing and Urban Affairs, emphasizing urban flood management, heat action plans, resilient infrastructure, and risk-informed land-use planning.

At the state level, corresponding responsibility lies with the Department of Urban Development / Municipal Administration, working through Urban Local Bodies (ULBs), Development Authorities, and State Town and Country Planning Departments.

- **Transport and Critical Infrastructure**

National coordination is led by the Ministry of Road Transport and Highways, along with allied infrastructure ministries, focusing on climate-resilient roads, bridges, and logistics corridors.

At the state level, this function is undertaken by the Public Works Department (PWD), State Highways Authorities, Rural Roads Agencies, and Transport Departments.

- **Environment, Forests, and Ecosystems**

At the national level, leadership is provided by the Ministry of Environment Forest and Climate Change, promoting ecosystem-based adaptation, coastal regulation, afforestation, and nature-based solutions. At the state level, implementation is managed by the Department of Environment, Forest Department, and State Coastal Zone Management Authorities (where applicable).

- **Health Systems**

The Ministry of Health and Family Welfare leads nationally on heatwave preparedness, climate-sensitive disease surveillance, and resilient health infrastructure.

At the state level, this role is performed by the Department of Health and Family Welfare, State Health Missions, and Public Health Directorates, including disease surveillance units.

- **Energy and Power**

National responsibility lies with the Ministry of Power, addressing climate risks to power generation, transmission, and distribution, including renewable energy resilience.

At the state level, implementation is carried out by the Department of Energy / Power, State Electricity Boards, Transmission Utilities, and Distribution Companies (DISCOMs).

Internationally Sendai framework also emphasised on enhancing “technical, financial, and administrative capabilities of institutions, governments, and communities to deal with the identified risks at different levels”.

NDMP 2019 outlined seventeen thematic areas for Capacity Development in Disaster Risk Reduction (DRR) at both the Centre and State levels, with multiple agencies assigned key responsibilities for each theme. These areas and the associated agencies will be discussed in detail in the final TNA/CNA report including financial arrangements. The national disaster management plan also envisages the education sector to enhance capacity building for disaster risk reduction. The Department of Personnel & Training (DoPT) supports training and capacity-building programs under the State Category Training Programme (SCTP) for Disaster Management, Environment, and Climate Change⁵.

NDMA, the national agency, has undertaken various initiatives to enhance capacity building not only at the national level through workshops, conferences, brainstorming sessions, and intergovernmental MOUs but also at the local level by supporting schemes such as Apada Mitra. NIDM, the apex training and capacity-building institute established by the Government of India, conducts hundreds of trainings and capacity-building programs each year. Currently in India there are several government and non-governmental organisations engaged in training and capacity building in DRR.

Some Notable institutes are in given the table with their key areas of work except the academic and higher education organisation. This report also does not contain at this stage resource mapping of non-governmental organisations who are active in this sector. These can prove a valuable untapped report but require extensive verification.

3.2 Institutions for Capacity Building and Training

Building disaster resilience has been a focus of India’s Five-Year Plans, which were in place until 2017. These were later replaced by NITI Aayog’s Three-Year Action Agenda and longer-term strategies, ensuring continued emphasis on disaster resilience. The 12th Five-Year Plan (2012–2017) prioritized climate resilience and disaster risk reduction, laying the foundation for future frameworks. Strengthening institutional capacity, advancing research, and integrating disaster risk reduction into development planning remain key to enhancing India’s resilience against disasters.

⁵ Annual Report 2023-24. Ministry Personnel, Public Grievances and Pensions. Government of India

Table 1 Major Training and Capacity Building Organisations (THREE TYPES, Core training institutes, Research involved in Training, Academia Involved in training).

Category	Institute / Organization	Location	Key Focus Areas
National Level	National Institute of Disaster Management (NIDM)	New Delhi	Disaster management training, research, policy development, international cooperation
National Level	National Civil Defence College (NCDC)	Nagpur, Maharashtra	Emergency response, civil defence, search & rescue, industrial & chemical disasters
National / Regional(south)	NIDM South Campus	Vijayawada, Andhra Pradesh	Regional DM training, state & district capacity building
National / Regional (SAARC)	SAARC Disaster Management Centre (Interim Centre)	Gandhi Nagar, Gujarat	Regional DM training
National	National Institute of Rural Development and Panchayati Raj (NIRDPR)	Rajendra Nagar, Hyderabad	Training, Academic Courses research, policy development, Mainstreaming
National Level	Lal Bahadur Shastri National Academy of Administration (LBSNAA)	Mussoorie, Uttarakhand	Civil services training, governance, public administration, disaster management modules
National Level	National Institute of Rural Development – North Eastern Regional Centre (NIRDPR-NERC)	Guwahati, Assam	Rural development and Panchayati Raj capacity building for North Eastern states
National Level	Indian Institute of Public Administration (IIPA)	New Delhi	Public administration, governance, policy research, training
National Level	National Centre for Good Governance (NCGG)	New Delhi	Governance reforms, capacity building, public policy training
National Level	National Institute of Public Finance and Policy (NIPFP)	New Delhi	Public finance, fiscal policy, development economics
National Level	National Disaster Response Force Academy / Training Institutions	Nagpur & other locations	Disaster response, search and rescue, emergency preparedness
National Level	National Civil Defence College (NCDC)	Nagpur, Maharashtra	Civil defence, disaster response, emergency preparedness
National Level	Administrative Staff College of India (ASCI)	Hyderabad, Telangana	Public policy, governance, leadership, disaster resilience training
National Level	Indian Agricultural Research Institute (IARI)	New Delhi	Education, Agricultural research, climate resilience, food security
National Level	National Statistical Academy (NSA)	Greater Noida, Uttar Pradesh	Official statistics, data systems, evidence-based policy
National Level	Central Arid Zone Research Institute (CAZRI)	Jodhpur, Rajasthan	Arid zone research, drought, land degradation

Category	Institute / Organization	Location	Key Focus Areas
National Level	National Centre for Earth Science Studies (NCESS)	Thiruvananthapuram, Kerala	Earth systems science, hazards, climate research
National Level	National Institute of Ocean Technology (NIOT)	Chennai, Tamil Nadu	Ocean technology, coastal hazards, tsunami research
National Level	National Institute of Hydrology (NIH)	Roorkee, Uttarakhand	Hydrology, floods, water resources, climate impacts
National Level	Central Building Research Institute (CBRI)	Roorkee, Uttarakhand	Building materials, disaster-resilient construction
National Level	Central Road Research Institute (CRRI)	New Delhi	Transport infrastructure, resilience, road safety
National Level	North Eastern Regional Institute of Water and Land Management (NERIWALM)	Tezpur, Assam	Research, Integrated water & land management, watershed management
National Level	Water and Land Management Institute (WALMI – National Network)	Multiple States	Irrigation, watershed management, water governance
National Level	Central Research Institute for Dryland Agriculture (CRIDA)	Hyderabad, Telangana	Dryland agriculture, drought risk, climate adaptation
National Level	Central Agro-Forestry Research Institute (CAFRI)	Jhansi, Uttar Pradesh	Agroforestry, land use, climate resilience
National Level	Indian Grassland and Fodder Research Institute (IGFRI)	Jhansi, Uttar Pradesh	Grassland management, fodder security
National Level	National Institute of Urban Affairs (NIUA)	New Delhi	Urban policy, resilience, governance, planning
National Level	Integrated Centre for Adaptation, Disaster Risk Reduction and Sustainability (ICARS), IIT Roorkee	Noida, Uttar Pradesh	Climate change adaptation, disaster risk reduction, sustainability research, capacity building, policy support
State Administrative Training Institutes (ATIs) and Disaster Management Institutes			
State Level (DM)	Disaster Management Institute (DMI)	Bhopal, Madhya Pradesh	DM training, research, consultancy, chemical accident management
State Level (DM)	Institute of Land and Disaster Management (ILDM)	Thiruvananthapuram, Kerala	Disaster management, land administration, revenue –DM integration
State Level (DM)	Gujarat Institute of Disaster Management (GIDM)	Gandhinagar, Gujarat	DRR training, applied research, mainstreaming DRR
State Level	Development Management Institute (DMI)	Patna, Bihar	DRR training, applied research, mainstreaming DRR

Category	Institute / Organization	Location	Key Focus Areas
State ATI	Andhra Pradesh Human Resource Development Institute (APHR DI)	Andhra Pradesh	Civil service training, governance, leadership, public policy
State ATI	Administrative Training Institute Arunachal Pradesh	Itanagar	State administration & capacity building
State ATI	Assam Administrative Staff College (AASC)	Guwahati	Governance, administrative reforms
State ATI	Goa Institute of Public Administration and Rural Development (GIPARD)	Goa	Public administration, rural development
State ATI	Sardar Patel Institute of Public Administration (SPIPA)	Ahmedabad	Administrative training, policy & governance
State ATI	Haryana Institute of Public Administration (HIPA)	Gurgaon	Civil service & governance training
State ATI	Himachal Pradesh Institute of Public Administration (HPIPA)	Shimla	State governance & administrative capacity
State ATI	Jammu and Kashmir Institute of Management Public Administration and Rural Development (JKIMPA & RD)	J&K	Governance, rural development
State ATI	Sri Krishna Institute of Public Administration (SKIPA)	Ranchi	Administrative & leadership training
State ATI	Administrative Training Institute Mysuru	Mysuru	Civil services, e-governance
State ATI	Institute of Management in Government (IMG)	Kerala	Public management, governance reforms
State ATI	RCVP Noronha Academy of Administration and Management (RCVP NAAM)	Bhopal	Administrative & management training
State ATI	Yashwantrao Chavan Academy of Development Administration (YASHADA)	Pune	Governance, leadership, development administration
State ATI	State Administrative Training Institute Manipur	Imphal	State civil service training
State ATI	Meghalaya Administrative Training Institute (MATI)	Shillong	Governance & capacity development
State ATI	Administrative Training Institute Mizoram	Aizawl	Public administration training

Category	Institute / Organization	Location	Key Focus Areas
State ATI	Administrative Training Institute Nagaland	Kohima	State governance & administration
State ATI	Gopabandhu Academy of Administration (GAA)	Bhubaneswar	Administrative training, governance
State ATI	Mahatma Gandhi State Institute of Public Administration (MGSIPA)	Chandigarh	Civil service & governance training
State ATI	HCM Rajasthan State Institute of Public Administration (HCM - RIPA)	Jaipur	Governance, policy & leadership
State ATI	Administrative Training Institute Sikkim	Gangtok	State administration
State ATI	Anna Institute of Management	Chennai	Public administration & governance, Training
State ATI	State Institute of Public Administration and Rural Development Tripura (SIPARD)	Agartala	Governance, rural development
State ATI	Dr MCR HRD Institute of Telangana	Hyderabad	Human resource development, governance
State ATI	Uttar Pradesh Academy of Administration and Management (UPAAM)	Lucknow	Civil services, policy training
State ATI	Uttarakhand Academy of Administration	Nainital	Administrative & leadership training
UT ATI	Administrative Training Institute Lakshadweep	Lakshadweep	UT administration training
Technical Institutions (others)			
State Level	State Remote Sensing Application Centres	Multiple States	Research, Publication
Regional	Regional Remote Sensing Application Centres	8 Centres	Research, Training, Publication
Universities (Academic)			
University	Guru Gobind Singh Indraprastha University	Delhi	MBA Disaster Management, PhD Programmes
University	Jamia Millia Islamia	New Delhi	Disaster Management (PG & Certificate)
University	Punjab University	Chandigarh	Disaster Management, risk reduction, environmental management
University	Tata Institute of Social Sciences	Mumbai, Maharashtra	M A Disaster Management

Category	Institute / Organization	Location	Key Focus Areas
Open University	Indira Gandhi National Open University	New Delhi (Pan-India)	Certificate & Diploma in Disaster Management, distance & blended learning
University	Dr. Bhimrao Ambedkar University	Agra, Uttar Pradesh	Disaster Management (PG & PG Diploma), development & governance
University	Tripura University	Agartala, Tripura	M.A. Disaster Management
University	Annamalai University	Chidambaram, Tamil Nadu	M.A. Disaster Management
University	TERI SAS	Delhi	Course on Climate Change Adaptation and Disaster Risk Reduction

This report's list is not exhaustive; rather, it is indicative and illustrative, supplementing the information found in the earlier reports by various key departments and institutes.

3.3 Climate Change Governance Structure

India has a multi-layered governance structure that includes local, state, and federal institutions. The main organization in charge of developing policies, managing global obligations under the UNFCCC and Paris Agreement, and carrying out climate adaptation and mitigation programs at the national level is the Ministry of Environment, Forests, and Climate Change (MoEFCC). State-level climate projects receive funding from a number of supporting organizations, including the National Adaptation Fund for Climate Change (NAFCC), and environmental restrictions are enforced by the Central Pollution Control Board (CPCB). In the international arena, India works with partners like the Asian Development Bank (ADB), Global Environment Facility (GEF), and the World Bank, G20, and International Solar Alliance (ISA). It also obtains climate finance through the Green Climate Fund (GCF).

National development planning incorporates climate-related policies through NITI Aayog, the nation's principal policy advising organization. While the Ministry of Finance (MoF) is essential in raising money and

creating fiscal policies for climate change, the Ministry of Power and the Ministry of New and Renewable Energy (MNRE) spearhead clean energy. The main foundation for the nation is the National Action Plan on Climate Change (NAPCC), which was introduced in 2008 and consists of eight National Missions with the goals of advancing renewable energy, increasing energy efficiency, and boosting water resource management, is part of India's climate policy framework. State Action Plans on Climate Change (SAPCCs), which are designed to address regional environmental concerns, are in line with national policy at the state level. In addition, India has committed to generating 50% of its power from non-fossil fuels and reducing the carbon intensity of its GDP by 45% by 2030 (relative to 2005 levels) as part of its Nationally Determined Contributions (NDCs) under the Paris Agreement. India's policies are moving towards a more sustainable energy system aided by the Energy Conservation Act and other renewable energy legislation.

Urban local bodies (ULBs) concentrate on sustainable urban planning and climate-resilient infrastructure, state environment and climate change departments are in charge of regional climate policies. The growth of solar, wind, and other clean energy sources is encouraged by state renewable energy agencies. National Green Tribunal (NGT) is the agency involved

in resolving conflicts pertaining to climate change and development projects.

India has incorporated climate adaptation into several important sectors, even beyond policy frameworks. Water resource management is the focus of initiatives like Namami Gange and Jal Shakti Abhiyan. Sustainable agriculture is promoted by programs like the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY). The Coalition for Disaster Resilient Infrastructure (CDRI) and the National Disaster Management Plan (NDMP) both aim to reduce the hazards associated with climate change. India is an important player in international climate talks. It spearheads initiatives like the International Solar Alliance (ISA) to encourage the use of renewable energy. India keeps bolstering climate resilience with these multi-level initiatives. The objectives of sustainable development are still in line with adaptation tactics.

3.4 Institutional Connections Between DRR and Climate Governance

India's institutional framework for climate governance and disaster risk reduction (DRR) is interconnected. Several key ministries, agencies, and policy mechanisms have been working together to integrate climate adaptation and disaster preparedness (see below Figure 6: Overview of Disaster Management and Climate Change Governance in India).

Change (MoEFCC), while catastrophe risk reduction initiatives are spearheaded by the Ministry of Home Affairs (MHA)'s National Disaster Management Authority (NDMA). These institution's seamless coordination is the key for disaster management and adaptation to climate change to be in sync. In order to create synergies between disaster risk reduction and climate adaptation, the National Action Plan on Climate Change (NAPCC) integrates sectoral approaches from the fields of energy, forestry, agriculture, and water resources.

Building resilience to climate-induced disasters is the goal of several NAPCC missions, including the National Water Mission, National Mission for Sustainable Agriculture, and National Mission on

Strategic Knowledge for Climate Change. In a similar vein, State Action Plans on Climate Change (SAPCCs) guarantee localized solutions by combining climate risk assessments with state-level disaster preparedness plans.

By supplying scientific data, early warning systems, and climate forecasting—all of which are critical for disaster risk reduction and climate change adaptation—the Ministry of Earth Sciences (MoES) serves as a vital bridge between the two fields. MoES keeps an eye on climate variability and provides vital forecasts on extreme weather events like cyclones, heatwaves, floods, and droughts through organizations like the Indian Meteorological Department (IMD), National Centre for Medium-Range Weather Forecasting (NCMRWF), and Indian National Centre for Ocean Information Services (INCOIS). These projections influence long-term climate adaption plans and encourage proactive preparedness for disasters. For example, the IMD's Monsoon Mission directly supports disaster resilience and climate adaptation by assisting in the management of agricultural risks related to unpredictable monsoon patterns. MoES's studies on atmospheric and oceanic changes contribute to our understanding of long-term trends. Projects that improve climate resilience and disaster preparedness are supported by the Ministry of funding through channels like the National Adaptation Fund for Climate Change (NAFCC) and global climate funding sources like the Green Climate Fund (GCF).

Urban local bodies (ULBs) and state disaster management authorities (SDMAs) carry out emergency response plans, early warning systems, and climate-resilient urban planning at the local level. Initiatives for climate-resilient infrastructure and programs like the Smart Cities Mission lessen the effects of disasters in urban areas. In order to obtain technical assistance, financial resources, and international best practices for combining climate change adaptation with disaster risk management, India also works with international organizations like the World Bank, the Global Environment Facility (GEF), and the United Nations Office for Disaster Risk Reduction (UNDRR).

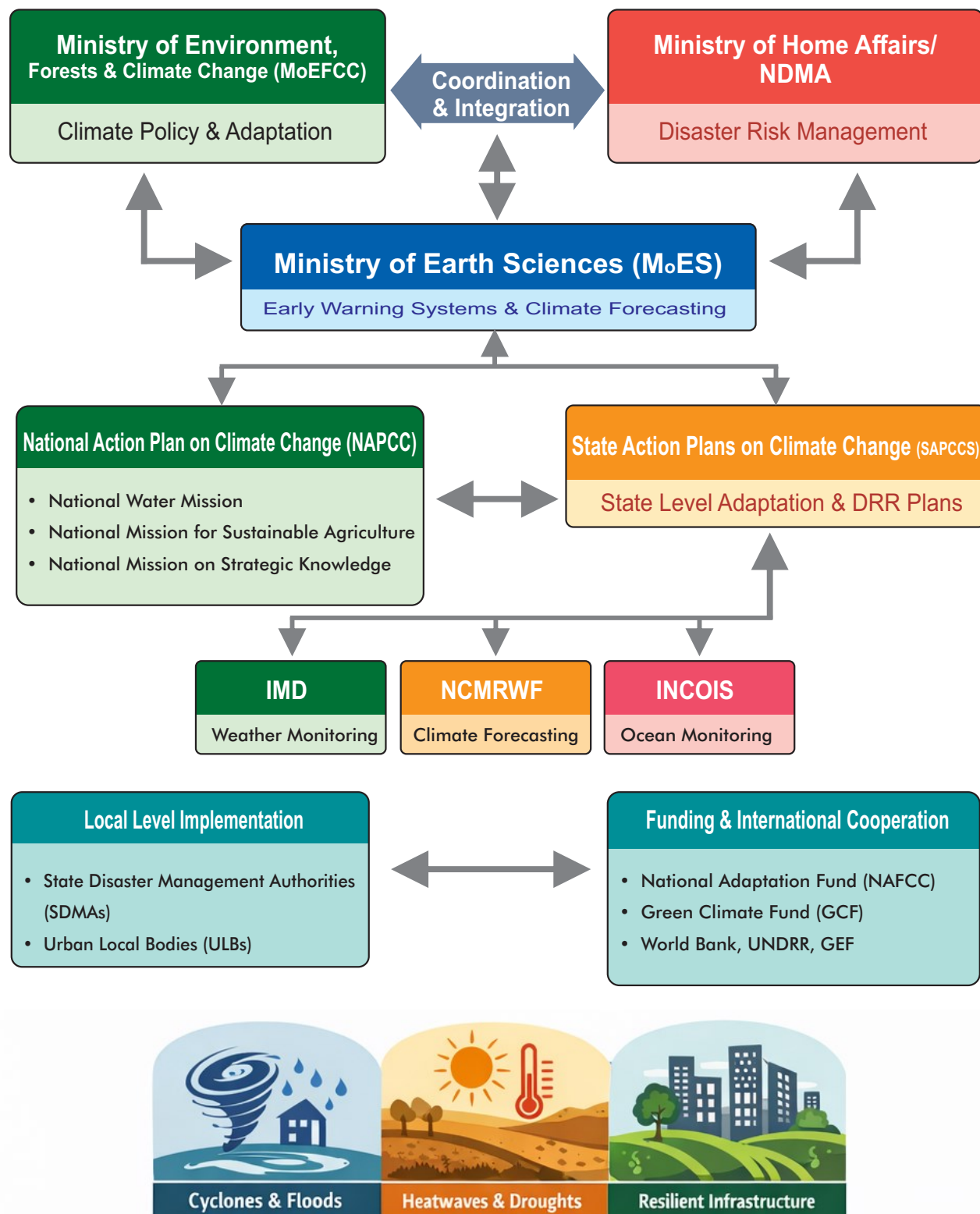


Figure 6: Overview of Disaster Management and Climate Change Governance in India

Climate policy is developed at the national level by the Ministry of Environment, Forests, and Climate Change. Strong institutional ties between disaster risk reduction and climate governance can help India better adapt to and manage the increasing challenges posed by climate change, ensuring sustainable development while safeguarding ecosystems and populations that are at risk. Indian capacity to anticipate, prepare for, and effectively respond to climate-related calamities can be strengthened by the incorporation of scientific and technological breakthroughs, especially through various Ministries that currently are already engaged in this pipeline as line departments. Furthermore, the NAPCC's framework for combining catastrophe risk reduction and adaptation can guarantee India's climate resilience by enhancing the nation's readiness for both short-term and long-term climate problems through effective coordination between multiple agencies.

3.5 Gap, Key challenges for Capacity Building

India's diverse terrain, dense population, and socioeconomic inequalities present significant challenges in Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). During the inception stakeholder meeting at the ICARS Centre, a panellist from UNDRR highlighted both India's progress and existing gaps in these areas.

Over the years, India's efforts in mitigation have yielded positive results, particularly in establishing governance mechanisms within the country and fostering international cooperation although not at an optimal level. While early warning systems have improved significantly, leading to a 70% reduction in the number of affected people over the last 30 years, challenges remain. India has not been as successful in reducing economic losses, infrastructure damage, and disruption, which continue to pose serious risks. Additionally, the country is lagging in meeting its emission targets and keeping global temperature rise within the 1.5°C limit.

Another crucial point raised was the projected increase in climate risks for India. The intensity of cyclones is anticipated to rise by 2.5 times, while drought periods may extend by up to three months by 2030. Furthermore,

extreme precipitation events are projected to increase by 7% in intensity, exacerbating flood risks. Heatwaves, rapid urbanization, industrialization, and the expansion of the built environment will further intensify these challenges.

Given these realities, it is imperative for India to develop a comprehensive national policy for disaster training and capacity building that integrates climate risk assessments, mitigation strategies, and resilience-building measures.

Challenges and gaps can be identified across three key domains:

1. **Policy Frameworks** – The need for well-structured policies that effectively address disaster risk reduction and climate adaptation.
2. **Implementation and Capacity Enhancement** – Strengthening the ability of communities, institutions, and governments to execute action plans and guidelines outlined in policies.
3. **Financial Aspects** – Ensuring adequate funding to enhance the capacity of policymakers to develop actionable plans and enabling governments, institutions, and communities to implement them by imparting the necessary skills.

Additionally, capacity development of financial institutions is crucial to effectively support the first two domains. Without financial backing and institutional capacity, implementation efforts will remain ineffective.

From high level deliberations and questionnaire survey exercises conducted with experts and researchers some of the key gaps are

1. Lack of Policy Synergy

Lack of synergies between national policies (NDMP, SAPCCs, NAPCC) integrated into disaster risk management and climate change adaptation. Experts highlighted gaps in coordination not only at the policy level but also in financing. Most respondents also felt that stronger alignment is needed between Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) policies. (see below Figure 5)

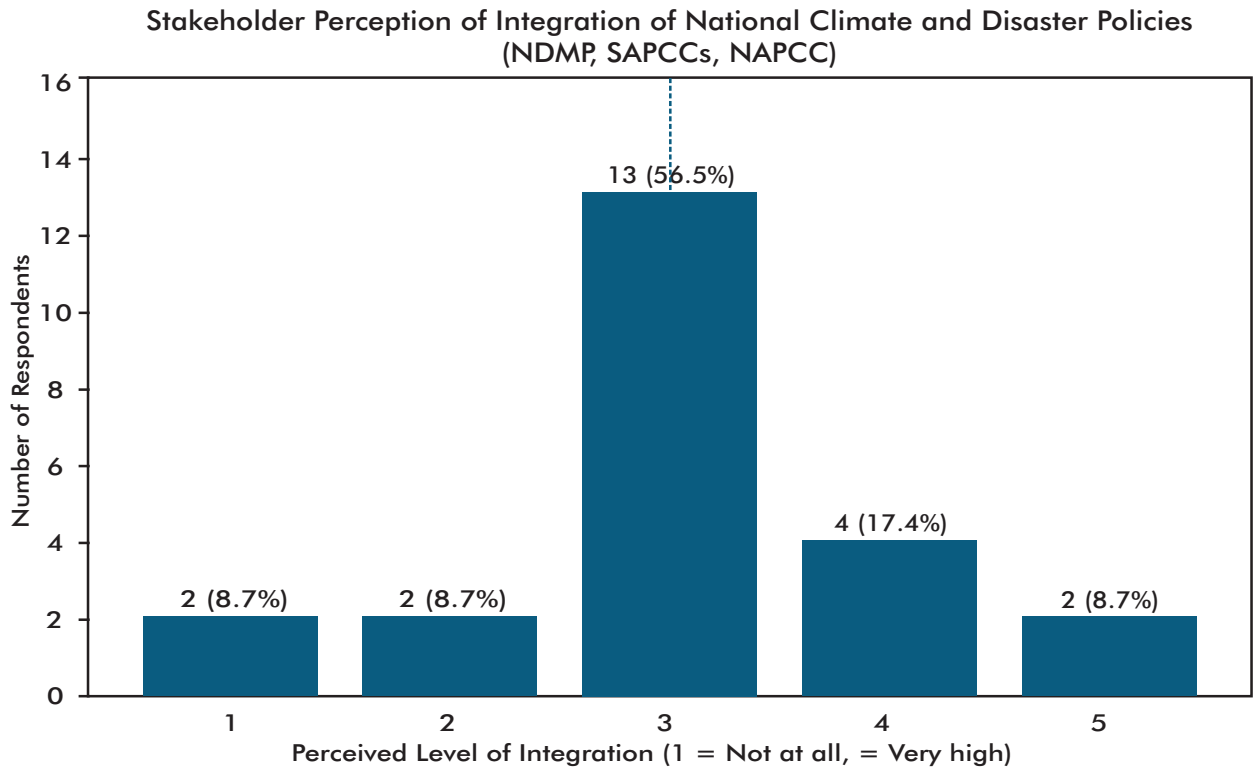


Figure 7: Stakeholder Perception of Integration of National Climate and Disaster Policies in NDMP, SAPCC and NAPCC (Rate on a scale of 1 to 5, where 1 = Not at all and 5 = Very)

The majority of respondents perceive a lack of synergy between climate change and DRR policies. Key challenges include weak enforcement mechanisms, insufficient integration between DRR and climate policies, and poor coordination among government agencies.

2. Co-Ordination Gap : Multiple agencies multiple channels

India faces on-ground coordination gaps in disaster risk reduction (DRR) due to disjointed institutional roles, weak interagency cooperation, and limited local governance capacity. Disaster response is affected by fragmented efforts between national, state, and local authorities, despite existing policies. Gaps in early warning systems, low community participation, and lack of DRR integration into development planning further increase risks. Addressing these issues requires strengthening early warning systems, incorporating risk

planning into development, improving interagency coordination, and supporting local organizations with financial and technical resources. Thus, institutional capacity at each level must be assessed to develop decentralized, technology-based, and community-focused training programs that enhance preparedness and resilience.

3. Data literacy : Data Fragmentation and Lack of High Resolution Scientific Data

Significant obstacles to disaster risk reduction (DRR) and climate change adaptation are presented by data fragmentation and a dearth of high-resolution scientific data. Despite the publication of a large number of technical papers, training materials, and research studies, the lack of a centralized, consolidated information system has left them dispersed and underutilized. Accurate risk assessment and decision-making are further hampered by inconsistent data

collection, little interagency collaboration, and a lack of defined frameworks. Access to high-resolution climate and catastrophe data is still restricted, despite the fact that it is crucial for early warning systems, infrastructure planning, and focused mitigation initiatives. For greater risk resilience, data governance may be strengthened, existing research can be synthesized, and AI, GIS, and remote sensing technologies can be used to increase data accuracy, improve risk modelling, and promote evidence-based policymaking. Proper training in data governance are key to success in this digital era

4. Training Frequency and Lack of Field Exposure & Trainers

The frequency of training and lack of field exposure in DRR and climate change adaptation require urgent attention. Short training sessions are not effective at the national level, as they fail to provide hands-on experience. Conference participants strongly emphasized the need for more field-based training to bridge the gap between theoretical knowledge and practical application in real-world disaster and climate resilience efforts. Majority of respondents highlighted a lack of technical expertise in DRR and climate change at the local level (see below Figure 6-7).

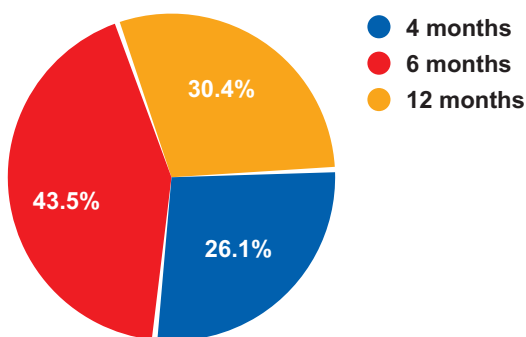


Figure 8 a Optimum Training Gap Required

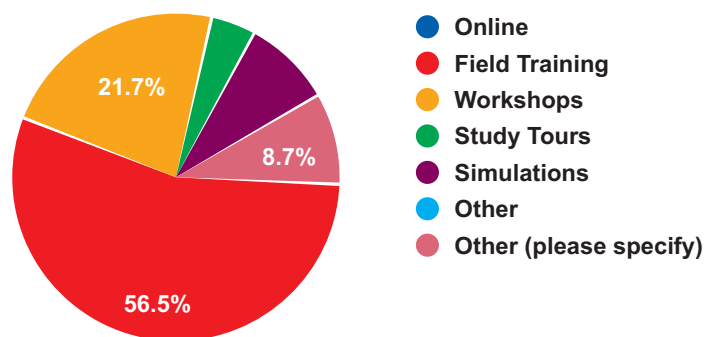


Figure 8 Training Mode Preference

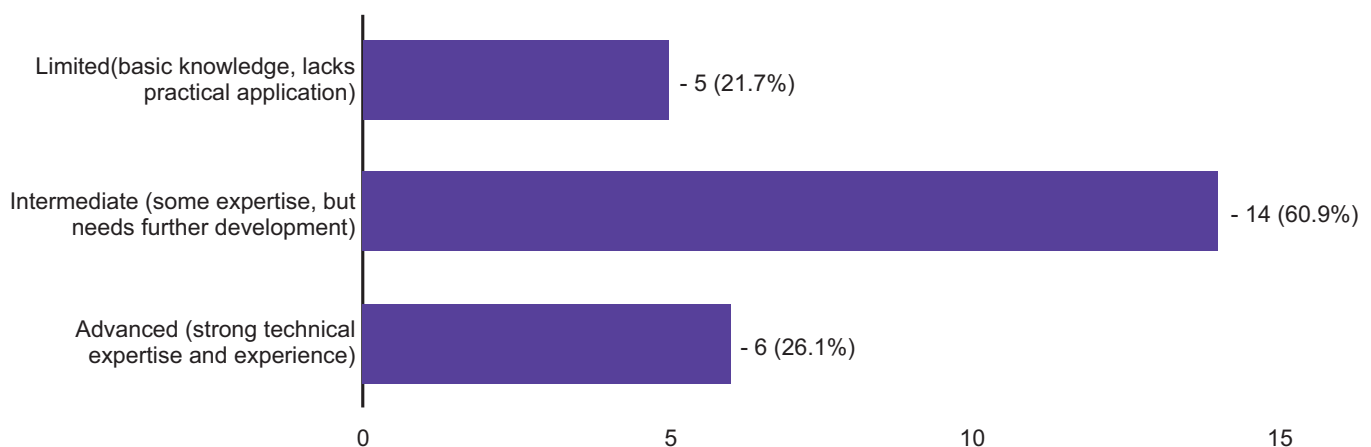


Figure 9 India's national level of expertise regarding DRR and CCA

5. Community Participation and Inclusion at Household Level

Capacity gaps in community participation and household-level inclusion in disaster risk reduction (DRR) stem from low awareness, limited access to training, and inadequate local engagement. Many households lack the knowledge and skills to respond effectively to disasters, leading to increased vulnerability. Training programs must focus on building risk awareness, promoting local leadership, and integrating traditional knowledge into preparedness efforts. Strengthening grassroots participation, enhancing inclusive early warning systems, and ensuring tailored training program for marginalized groups can improve community resilience and household-level disaster preparedness.

6. Geographic and Localized Capacity Building

Geographic and localized capacity-building programs in DRR and climate change must be tailored to the specific hazards and vulnerabilities of different regions. For example, in cyclone-prone coastal areas like Odisha, training programs should focus on early warning systems, resilient infrastructure, and community-based evacuation planning, while in drought-affected regions like Rajasthan, they should emphasize water conservation, climate-resilient agriculture, and drought mitigation strategies. Both officials and communities need targeted training programs, especially in multi-hazard zones, to enhance preparedness and response. By involving traditional knowledge in these training

programs, disaster preparedness can be imparted more efficiently, ensuring that scientific approaches align with local practices. This not only enhances the effectiveness of training but also fosters stronger community participation and ownership of resilience-building efforts.

7. Urbanization & Infrastructure Deficiencies

Rapid urbanization has increased exposure to climate-related risks such as flooding, heatwaves, and water scarcity. Poor urban planning, encroachment on floodplains, and unregulated construction further exacerbate disaster risks. As highlighted in a panel discussion, these activities also lead to the blockage of drainage channels due to the improper disposal of construction debris. Aging infrastructure and the lack of climate-resilient investments further worsen the situation, especially in India’s diverse geographic settings, including coastal, mountainous, and desert cities. To address these challenges, it is crucial to involve experts, architects, and designers specializing in climate-resilient techniques and nature-based solutions. Capacity-building workshops and training programs should be designed to equip urban planners, engineers, and local authorities with the necessary skills to integrate resilience into infrastructure development and disaster risk reduction strategies. Below Table 2 provide a summary of Key Gaps Identified through expert deliberations and questionnaire survey and Table 3 provides the summary of key topics suggested by experts.



Table 2 Key Gaps Identified through expert deliberations and questionnaire survey

Category	Key Barriers	Details
Institutional Barriers	Lack of financial resources	Limited budget allocations hinder implementation of DRR and CCA programs.
	Limited technical expertise	Shortage of trained professionals in disaster risk management, climate adaptation, and technology use.
	Weak coordination among agencies	Overlapping mandates and fragmented efforts lead to inefficiencies in disaster preparedness.
	Insufficient policies & regulatory frameworks	Existing policies lack clear implementation strategies and enforcement mechanisms.
	Low stakeholder engagement	Lack of participation from local communities, private sector, and civil society organizations.
Financial Barriers	Inconsistent financial support	DRR and CCA programs suffer from irregular funding cycles and reliance on short-term projects.
	Unclear funding policies	Uncertainty on allocation methods and sources of funding for risk reduction initiatives.
	Low private sector investment	Limited incentives for private entities to contribute to resilience-building efforts.
	High initial investment costs	Large capital required for resilient infrastructure and long-term adaptation plans.
	Poor coordination among ministries	Fragmented financial programs lead to inefficiencies and duplication of efforts.
	Lack of localized funding	Inadequate financial resources for community-driven disaster resilience projects.
Implementation barriers	Lack of trained field personnel at local level	Inadequate skilled workforce to implement DRR strategies effectively.
	Technology adoption challenges	Slow integration of AI, GIS, and remote sensing in risk management.
	Poor integration with local governance	Weak linkages between national strategies and district-level execution due lack of mid-level trained personnel
	Inadequate early warning dissemination	Systems exist but fail to reach vulnerable communities in time, lack in last mile connectivity
	Limited public awareness programs	Lack of targeted outreach, especially in high-risk regions.
	Insufficient community participation	Lack of community involvement in planning, monitoring, and implementation leads to inadequate context-based training and capacity-building programs, and vice versa

	Fragmented response mechanisms	Lack of coordination among disaster response agencies at different levels.
--	--------------------------------	--

Table 3 Training program Topics recommended by experts in stakeholder meeting.

Recommended Training Programs	Technical Training	GIS, remote sensing, risk assessment, and data analysis for better decision-making.
	Policy & Governance Training	Capacity-building for policymakers on DRR and CCA integration into development plans.
	Communication & Awareness	Strategies to improve risk communication, early warning dissemination, and stakeholder engagement.
	Community-Based DRR Training	Capacity building for grassroots organizations, first responders, and local leaders.
	First Aid & Emergency Response	Practical disaster response skills, medical aid, and evacuation planning.
	Financial & Risk Management	Training on climate finance, investment planning, and sustainable funding mechanisms.



4

Competency Framework

4.1 About the Framework

A structured competency framework is proposed to systematically assess and strengthen institutional capacities for Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). The framework is anchored around four interrelated dimensions: task-specific technical skills, management and coordination capabilities, alignment of competencies with defined job roles, and preparedness for contingency and emergency response. Together, these dimensions enable a comprehensive evaluation of both individual and institutional readiness to plan, implement, and sustain effective DRR and CCA interventions. This competency framework serves as a foundation for designing targeted training, professional development, and institutional strengthening initiatives. By identifying gaps across each dimension, it supports the development of needs-based capacity-building programmes, facilitates better role clarity and accountability, and helps prioritize investments in skills and systems that are critical for enhancing resilience outcomes.

4.2 Competency – Knowledge and Skills Gap

Competency assessments are critical instruments for systematically identifying knowledge, skills, and attitude gaps within institutions engaged in Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). In a risk environment increasingly shaped by climate change and compound hazards, such assessments play a pivotal role in strengthening disaster preparedness by ensuring that institutional capacities remain aligned

with evolving and complex challenges (UNDRR, 2015; IPCC, 2022). Regular competency evaluations enable institutions to continuously update training programmes, recalibrate functional roles, and better equip stakeholders to respond effectively to both existing and emerging hazards.

This report emphasizes the role of institutional competency evaluation in enhancing organizational effectiveness, strengthening coordination mechanisms, and supporting the achievement of resilience-oriented development outcomes. The systematic acquisition and assessment of competencies serve two primary purposes. First, they enable the validation of institutional competencies, ensuring that existing knowledge and skills are aligned with national mandates, operational objectives, and international frameworks such as the Sendai Framework for Disaster Risk Reduction 2015–2030 (UNDRR, 2015). Second, they support a structured gap analysis, identifying discrepancies between current performance levels and desired competencies, thereby highlighting priority areas for targeted intervention (OECD, 2019).

Despite the presence of established institutional structures at national, state, and local levels, significant gaps persist in technical expertise, managerial capacity, and inter-institutional coordination (Government of India, 2023). To address this, the Institutional Competency Evaluation Tool adopts a four-dimensional assessment framework. Task-specific skills evaluate the ability of individuals and teams to perform designated technical functions effectively and efficiently.

Management and coordination capabilities assess leadership, institutional coordination, and resource optimization required to achieve strategic goals. Job-role alignment examines whether assigned responsibilities are commensurate with individual competencies

and organizational mandates. Finally, contingency management capacity measures preparedness to respond to shocks, crises, and uncertainty, reflecting institutional adaptability and resilience (UNDRR, 2022).

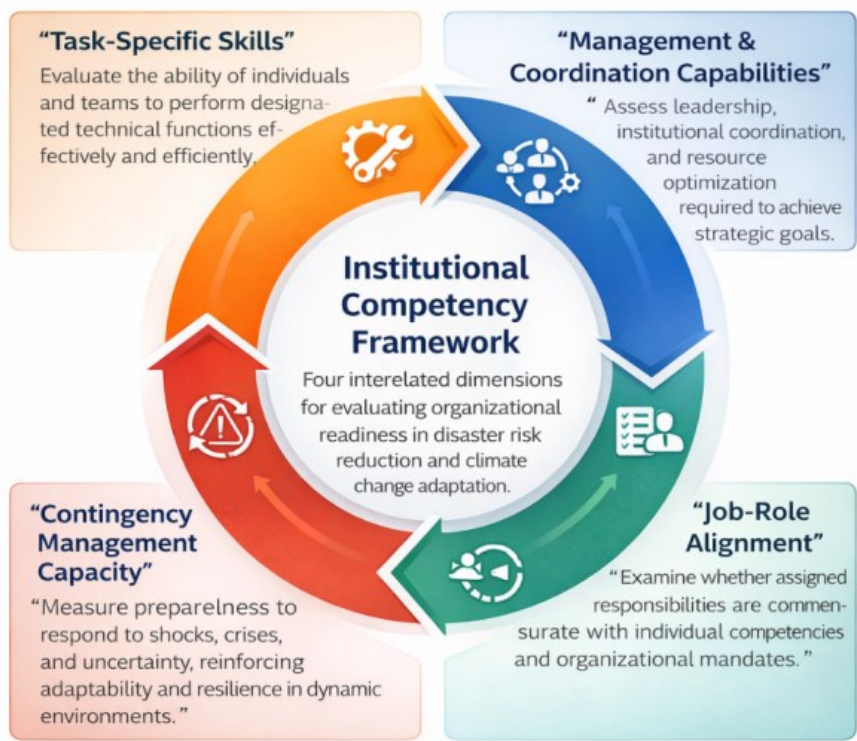


Figure 10: Four dimensions of Institutional Competency Framework

Based on assessment findings, a structured training and development plan is essential to strengthen institutional competencies. Training interventions should focus on enhancing technical expertise, leadership and coordination skills, and crisis and contingency management capacities. Post-training evaluations are necessary to ensure that learning outcomes translate into improved operational performance. Regular competency assessments yield multiple benefits, including enhanced organizational efficiency, improved decision-making through evidence-based resource allocation, and stronger talent management through targeted professional development (OECD, 2019).

By integrating structured evaluations with tailored training programmes, institutions can strengthen resilience, optimize performance, and ensure long-term sustainability.

4.3 Methodology

A structured, multi-dimensional methodology was adopted to develop a robust competency framework for Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR). The methodology integrates literature review, stakeholder engagement, institutional resource mapping, and competency assessment tools to ensure analytical rigor and practical applicability.

This approach aligns with international best practices for institutional capacity development and governance reform in disaster and climate risk management (UNDRR, 2017; World Bank, 2021).

The process began with a comprehensive literature review, drawing on academic research, global frameworks, and national policy instruments—including the Sendai Framework for Disaster Risk Reduction, NPDRR 2023 outcomes, and relevant IPCC Assessment Reports—to establish a strong conceptual foundation (UNDRR, 2015; Government of India, 2023; IPCC, 2022). This was complemented by stakeholder consultations with government agencies, non-governmental organizations, research institutions, and practitioners to capture diverse perspectives and operational realities. In parallel, institutional resource mapping was undertaken to identify key actors at national, state, and district levels, with the objective of promoting coordination and reducing fragmentation. Due to time constraints, this phase relied primarily on

publicly available and online sources, with plans for expansion in subsequent phases.

To assess existing competencies, the methodology proposes the use of surveys and structured questionnaires to capture stakeholder perceptions and self-assessed capacity levels, supported by key informant interviews and observational methods to provide deeper alignment with institutional workflows and governance practices (UNDP, 2018). Following data collection, a systematic gap analysis will be conducted to identify divergences between existing and desired competencies. This will include data synthesis, root-cause analysis to identify underlying constraints, and prioritization to focus on high-impact capacity gaps. It is important to note that this report presents the methodological framework rather than a comprehensive analysis of findings; the framework will guide subsequent detailed assessments and the design of targeted capacity development interventions.





5

Recommendations and Role of ICARS

India's evolving risk landscape characterised by increasing climate variability, urbanisation pressures, infrastructure expansion, and socio-economic vulnerabilities—demands a more coordinated, resilient, and forward-looking approach to Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). Expert consultations and stakeholder deliberations underline the urgent need for greater policy coherence, institutional strengthening, and sustainable financing mechanisms to enhance national and sub-national capacities. A multi-sectoral and multi-level strategy is essential to mainstream DRR and CCA across national development planning, infrastructure investments, and economic policies. This chapter outlines strategic directions to strengthen governance, capacity development, technology integration, community engagement, and long-term sustainability of India's DRR-CCA framework.

5.1 Recommendations

Experts and stakeholders consistently emphasise that strengthening India's Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) framework requires enhanced policy coordination, institutional capacity, and long-term financial sustainability. As climate-induced hazards increase in frequency and intensity, a fragmented approach to disaster and climate governance is no longer adequate. A multi-sectoral and multi-level strategy is therefore essential to integrate DRR and CCA into national development planning, infrastructure investments, and broader

economic policies, ensuring that risk considerations are systematically embedded across sectors rather than treated as standalone interventions (UNDRR, 2015; Government of India, 2021).

Strengthening the legal and institutional architecture is a critical first step in this process. Amendments to the Disaster Management Act, 2005 can play a pivotal role in improving governance, accountability, and inter-institutional coordination by explicitly incorporating climate risk considerations, clarifying roles across ministries, and reinforcing compliance mechanisms for risk-informed development (Government of India, 2005). Greater alignment between disaster management institutions and climate change authorities particularly at the policy formulation and implementation stages would reduce overlaps, address coordination gaps, and enable more coherent decision-making. Such integration is especially important at sub-national levels, where State Disaster Management Authorities (SDMAs), Panchayati Raj Institutions (PRIs), and Urban Local Bodies (ULBs) are responsible for translating national priorities into local action (MoEFCC, 2018).

Capacity strengthening at state, district, and local levels remains central to effective implementation. While national frameworks and guidelines are well established, their effectiveness ultimately depends on the technical, managerial, and financial capacity of sub-national institutions. SDMAs require enhanced analytical and operational capabilities to lead risk

assessments, preparedness planning, and recovery processes, while PRIs and ULBs must be empowered to address last-mile challenges through targeted training, tools, and resources (NIDM, 2020). Community-based capacity building programmes are particularly critical, as they ensure that vulnerable populations are not only protected but actively engaged in risk reduction and preparedness efforts.

Training systems themselves require reform and standardisation. The development of a National Training Policy on Disaster Management is essential to ensure consistency and quality across institutions, governance levels, and disaster phases. Such a policy should clearly define competency requirements, delivery mechanisms, accreditation standards, and command structures, while fostering a diverse pool of trainers drawn from government agencies, academia, technical institutions, civil society, and the private sector. Standardised training frameworks would help bridge persistent knowledge and skill gaps while enabling scalability and institutional continuity (NIDM, 2019).

In parallel, digital pedagogies must be prioritised to move beyond traditional classroom-based training models. Platforms such as MOOCs, SWAYAM, and GIAN provide opportunities for flexible, scalable learning and access to global expertise, particularly for officials and practitioners who are unable to participate in extended residential programmes. However, digital learning must be complemented by field-based training and joint simulation exercises to strengthen practical skills, inter-agency coordination, and real-time decision-making under emergency conditions (World Bank, 2022). Courses should be designed based on systematic training needs and competency assessments to ensure relevance and applicability.

Technology-driven preparedness is another critical pillar of future DRR and CCA strategies. Strengthening skills in Remote Sensing (RS), Geographic Information Systems (GIS), Artificial Intelligence (AI), IoT, and satellite-based monitoring can significantly enhance early warning systems, hazard mapping, and response planning. Although national-level technical capabilities

are well developed, local-level expertise remains uneven, limiting the effective use of these tools in district and community contexts. Targeted capacity-building initiatives are therefore required to ensure that technological advancements translate into operational improvements on the ground (IMD, 2021; MoES, 2020).

Knowledge management and systematic learning are equally important. Online resource portals and national data platforms offer valuable repositories of best practices, tools, and global experiences. Training stakeholders in their effective use can facilitate evidence-based decision-making and promote the adoption of proven approaches, such as hazard zoning and risk-informed infrastructure planning demonstrated in countries like Japan and the Philippines (UNDRR, 2019). Structured knowledge-sharing mechanisms can help institutionalise learning and innovation across sectors.

Community involvement and the integration of traditional knowledge must remain central to resilience-building efforts. Local communities possess context-specific knowledge of hazards, coping strategies, and adaptation practices that are often overlooked in formal planning processes. Establishing two-way data-sharing systems can enable communities to contribute this knowledge while benefiting from scientific and technical information. Training community volunteers in data collection, monitoring, and early warning dissemination can further strengthen preparedness and response capacities at the grassroots level (IFRC, 2020).

The education system also has a vital role to play in mainstreaming DRR and CCA. Integrating disaster risk concepts into school and higher education curricula can foster a culture of preparedness and risk awareness from an early age. Academic institutions and research centres should streamline complex scientific information to improve communication with policymakers, practitioners, and communities, ensuring that knowledge is both accessible and actionable (UNESCO, 2021).

Improving multi-hazard early warning systems and last-

mile connectivity remains a priority. Citizen networks facilitated through panchayats and local institutions can enhance the timely dissemination of warnings and ensure that alerts translate into appropriate action. Such networks build trust, strengthen accountability, and reduce response times during emergencies (IMD, 2021).

Nature-based solutions (NbS) offer sustainable and cost-effective pathways for climate resilience and disaster risk reduction. Community-level water storage structures, watershed interventions, and urban greening initiatives can simultaneously address flood, drought, and heat risks while delivering co-benefits for ecosystems and livelihoods. Mainstreaming NbS into local and regional planning frameworks is therefore essential for long-term resilience (IUCN, 2020).

Financial sustainability underpins all capacity-building efforts. Disaster risk financing, insurance mechanisms, and climate resilience funds must be strengthened, alongside targeted financial literacy programmes for institutions and communities. Public–Private Partnerships (PPPs) can play a transformative role by leveraging private sector resources, innovation, and technology. NGOs such as ICIMOD and WWF already contribute significantly to community resilience and ecosystem-based adaptation, and their collaboration with government and private actors can help bridge gaps in knowledge, infrastructure, and capacity. Corporate Social Responsibility (CSR) initiatives further offer opportunities to support training, pilot innovations, and technology transfer (World Bank, 2021).

Finally, stakeholder deliberations and participant feedback highlight the importance of evidence-based planning. To this end, additional targeted questionnaires are being developed for departments operating at different governance levels to generate high-resolution assessments of training and capacity needs. These findings will be consolidated in the Final Report, providing a robust foundation for phased, demand-driven, and sustainable DRR and CCA capacity development in India.

5.2 Role of ICARS

The Integrated Centre for Adaptation, Disaster Risk Reduction and Sustainability (ICARS) at the Indian Institute of Technology Roorkee plays a strategic role as a national centre of excellence bridging science, policy, and practice in the domains of Climate Change Adaptation (CCA), Disaster Risk Reduction (DRR), and sustainability. Positioned within one of India's leading technical institutions, ICARS is uniquely placed to translate advanced research and technological innovation into actionable tools, methodologies, and capacity-building programmes that support national and sub-national resilience-building efforts (IIT Roorkee, 2023).

A core contribution of ICARS lies in applied, policy-relevant research that integrates climate science, hydrology, geotechnical engineering, infrastructure resilience, and socio-economic risk assessment. Through interdisciplinary research, ICARS supports evidence-based decision-making for risk-informed development, infrastructure planning, and climate-resilient investments, aligning closely with national priorities under the Sendai Framework for Disaster Risk Reduction and India's Nationally Determined Contributions (UNDRR, 2015; MoEFCC, 2018). Its work strengthens the analytical foundation required for hazard assessment, vulnerability mapping, and climate risk screening across sectors.

ICARS also plays a critical role in capacity development and training, complementing the mandates of national training institutions such as the National Institute of Disaster Management (NIDM) and the National Institute of Rural Development and Panchayati Raj (NIRDPR). By leveraging IIT Roorkee's technical expertise, ICARS contributes advanced training modules on Remote Sensing, GIS, climate modelling, hydrological extremes, landslide and flood risk, and the application of Artificial Intelligence and decision-support systems for disaster preparedness. These programmes are particularly valuable for building technical capacities of SDMAs, line departments, engineers, planners, and researchers, addressing gaps that traditional administrative training institutions are often unable to fill (NIDM, 2020).

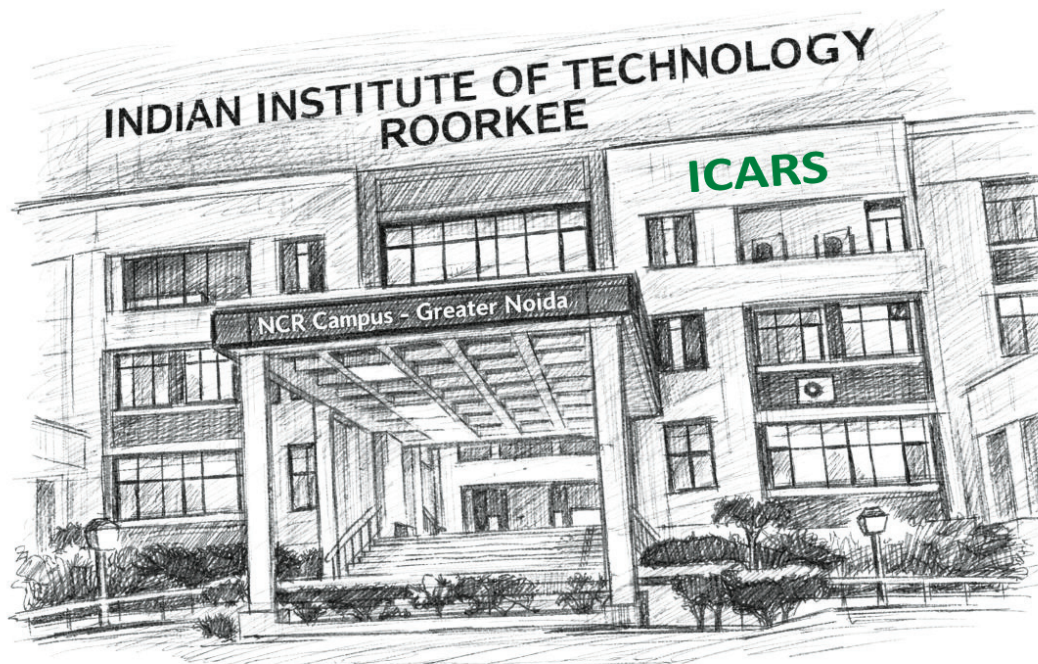
Another important function of ICARS is its role as a knowledge and innovation hub (ADRES Network). The centre supports the development of tools, frameworks, and pilot applications that demonstrate how cutting-edge research can be operationalised at state and local levels. By working with government agencies, academic institutions, and technical organisations, ICARS facilitates knowledge exchange, supports the co-creation of solutions, and promotes the use of technology-driven approaches in early warning systems, risk assessment, and resilience planning (World Bank, 2022). This positions ICARS as a critical intermediary between research institutions and implementing agencies.

ICARS further contributes to institutional integration of DRR and CCA, supporting coordination between climate change and disaster management stakeholders. Its interdisciplinary orientation enables it to engage with multiple ministries, state governments, and sectoral agencies, helping align climate adaptation strategies with disaster risk management objectives. This role is

particularly relevant in the context of strengthening system-level coherence, where scientific evidence must inform policy formulation, programme design, and investment decisions (Government of India, 2021).

Finally, ICARS has the potential to support long-term sustainability and future-ready capacity development by contributing to curriculum development, mentoring young professionals, and fostering a new generation of DRR–CCA experts. By embedding DRR and sustainability thinking within higher education, research, and professional training, ICARS helps institutionalise resilience as a core development principle rather than a reactive response to disasters.

In summary, ICARS serves as a national, regional and global level catalyst for integrating advanced science, technology, and policy in DRR and CCA. Its role complements existing governance and training institutions by strengthening analytical depth, technical capacity, and innovation, thereby supporting India's transition towards risk-informed, climate-resilient development.



References

- Academy to Innovate HR (AIHR). (n.d.). *Training needs analysis (TNA): Steps, methods, and examples*. <https://www.aihr.com/blog/training-needs-analysis/>
- Government of India. (2005). *The Disaster Management Act, 2005*. Government of India, New Delhi. <https://www.ndma.gov.in/sites/default/files/PDF/DM%20Act%202005.pdf>
- Government of India. (2021). *National Disaster Management Plan*. Ministry of Home Affairs. <https://www.ndma.gov.in/sites/default/files/PDF/NDMP-2019.pdf>
- Government of India (2023). *National Platform for Disaster Risk Reduction (NPDRR): Outcomes and Recommendations*. Ministry of Home Affairs.
- Gupta, A. K. (n.d.). Profile and roles: Integrated Centre for Adaptation, Disaster Risk Reduction and Sustainability (ICARS). Indian Institute of Technology Roorkee. Retrieved from <https://iitr.ac.in/Departments/Water%20Resources%20Development%20and%20Management%20Department/People/Faculty/101076.html>
- LinkedIn Post (Anil Kumar Gupta). (2024). *ICARS at IIT Roorkee Greater Noida Campus and resilience collaboration*. LinkedIn. Retrieved from https://www.linkedin.com/posts/envirosafeanilg_icars-at-iit-roorkee-gr-noida-campus-and-activity-7272183190834823169-En8Z
- India Meteorological Department. (2021). *Early warning systems in India*. Ministry of Earth Sciences, Government of India. https://mausam.imd.gov.in/imd_latest/contents/early_warning.php
- Intergovernmental Panel on Climate Change. (2022). *Climate change 2022: Impacts, adaptation and vulnerability (Sixth Assessment Report, Working Group II)*. IPCC. <https://www.ipcc.ch/report/ar6/wg2/>
- International Federation of Red Cross and Red Crescent Societies. (2020). *Community-based disaster risk reduction*. IFRC. <https://www.ifrc.org/document/community-based-disaster-risk-reduction>
- International Union for Conservation of Nature. (2020). *Nature-based solutions for climate change and disaster risk reduction*. IUCN. <https://www.iucn.org/resources/issues-brief/nature-based-solutions-climate-change>
- Ministry of Earth Sciences. (2020). *Earth system science for disaster risk reduction*. Government of India. <https://moes.gov.in/earth-system-science>
- Ministry of Environment, Forest and Climate Change. (2018). *National action plan on climate change*. Government of India. https://moef.gov.in/wp-content/uploads/2018/07/NAP_E.pdf
- National Disaster Management Authority. (2019). *National disaster management plan*. Government of India. <https://www.ndma.gov.in/>
- National Institute of Disaster Management. (2019). *National training strategy for disaster management*. NIDM, New Delhi. <https://nidm.gov.in/PDF/pubs/TrainingStrategy.pdf>
- National Institute of Disaster Management. (2020). *Capacity development framework for disaster risk reduction*. NIDM, New Delhi. <https://nidm.gov.in/PDF/pubs/CapacityDevelopmentFramework.pdf>
-

Organisation for Economic Co-operation and Development. (2006). *The challenge of capacity development: Working towards good practice*. OECD Publishing.

<https://www.oecd.org/development/governance/thechallengeofcapacitydevelopmentworking-towardsgoodpractice.htm>

Organisation for Economic Co-operation and Development. (2019). *Aligning development co-operation and climate action*. OECD Publishing. https://www.oecd.org/en/publications/aligning-development-co-operation-and-climate-action_5099ad91-en.html

Organisation for Economic Co-operation and Development. (2019). *Innovation for Development Impact: Lessons from Competency-Based Capacity Development*. OECD Publishing.

United Nations Development Programme. (2009). *Capacity development: A UNDP primer*. UNDP. <https://www.undp.org/publications/capacity-development-undp-primer>

United Nations Development Programme. (2010). *Measuring capacity*. UNDP.

<https://www.undp.org/publications/measuring-capacity>

United Nations Development Programme. (2021). *Climate change adaptation knowledge platform*. UNDP. <https://www.adaptation-undp.org/>

United Nations Development Programme. (2023). *Capacity development for climate action: Climate change and resilience resources*. UNDP. <https://www.undp.org/asia-pacific/climate-change-adaptation>

United Nations Educational, Scientific and Cultural Organization. (2021). *Education for disaster risk reduction and climate resilience*. UNESCO. <https://www.unesco.org/en/education/sustainable-development/disaster-risk-reduction>

United Nations Office for Disaster Risk Reduction. (2015). *Sendai framework for disaster risk reduction 2015–2030*. United Nations. <https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030>

www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030

United Nations Office for Disaster Risk Reduction. (2022). *Global assessment report on disaster risk reduction*. United Nations. <https://www.undrr.org/gar>

United Nations Office for Disaster Risk Reduction (2017). *Words into Action: National Disaster Risk Assessment*. United Nations Office for Disaster Risk Reduction.

United Nations Office for Disaster Risk Reduction (2022). *Global Assessment Report on Disaster Risk Reduction*. United Nations.

World Bank. (2019). *Building regulatory capacity for managing disaster risk*. World Bank Group. <https://openknowledge.worldbank.org/handle/10986/31804>

World Bank. (2021). *Disaster risk finance and insurance in developing countries*. World Bank Group. <https://www.worldbank.org/en/topic/disasterriskmanagement/brief/disaster-risk-finance>

World Bank. (2022). *Building resilient institutions for climate and disaster risk management*. World Bank Group. <https://openknowledge.worldbank.org/>

World Bank. (2022). *Technology and digital learning for disaster resilience*. World Bank Group. <https://www.worldbank.org/en/topic/digitaldevelopment/publication/digital-technologies-for-disaster-risk-management>

DST (2024). *District-Level Climate Risk Assessment for India: Mapping Flood and Drought Risks Using IPCC Framework*. Department of Science & Technology, Govt. of India. <https://dst.gov.in/district-level-climate-risk-assessment-india-mapping-flood-and-drought-risks-released?utm>

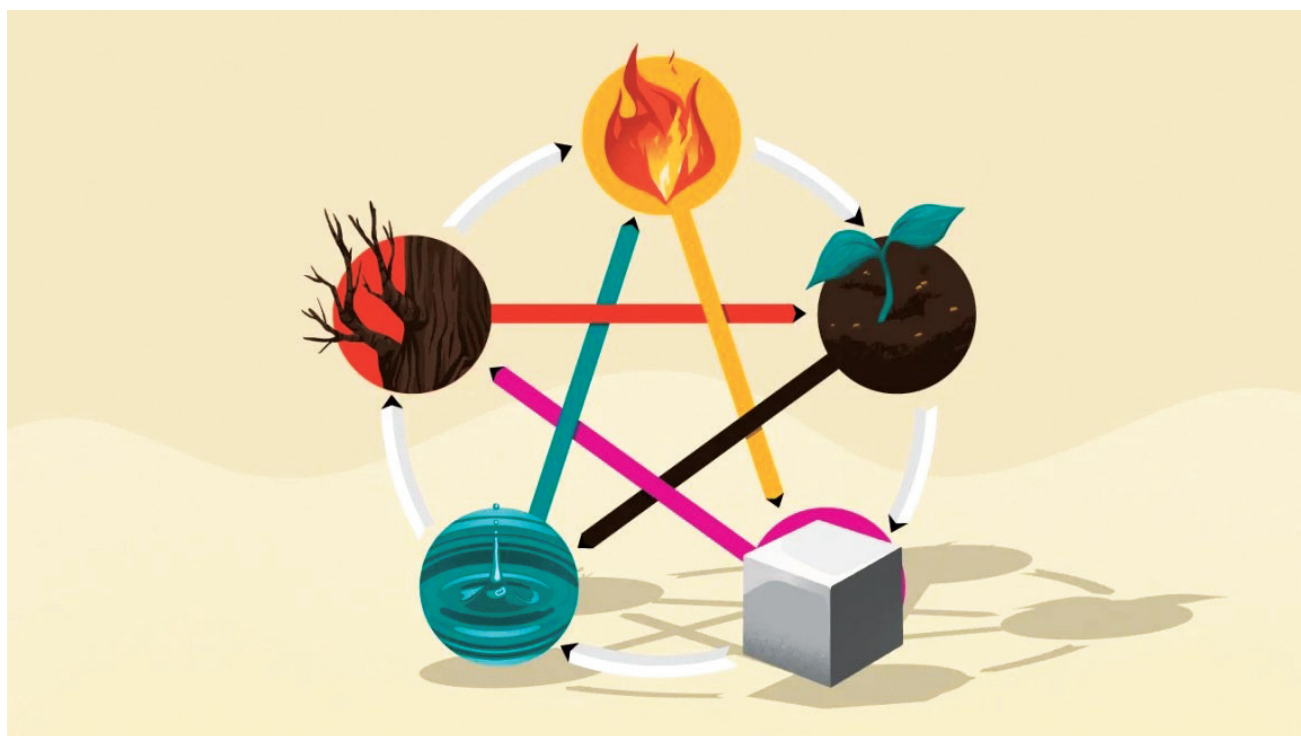
BMTPC (2019). *Vulnerability Atlas of India – Third Edition*. Building Materials & Technology Promotion Council. <https://vai.bmtpc.org/ttr.html?utm>

Ranjan, R. & Karmakar, S. (2024). Compound hazard mapping for cyclone-induced extremes. *npj Natural Hazards*. <https://www.nature.com/articles/s44304-024-00013-y?utm>

Prabhu, S., Suresh, K. A., Mandal, S., Sharma, D. & Chitale, V. (2021). Mapping India's Climate Vulnerability. Council on Energy, Environment

and Water. <https://www.ceew.in/publications/mapping-climate-change-vulnerability-index-of-india-a-district-level-assessment?utm>

IITM, MoES. Climate projections and extreme event assessments for India. https://www.tropmet.res.in/277-news_details





Annexure I

Names and organisation of the members of Working Group and Consultation Meeting

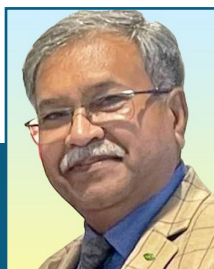
Dr. Abhinav Walia, Senior Consultant, NDMA	Dr. Rajasree Ray, Economic Advisor, MoEFCC
Shri Akil Ahmad, SE (S&R), MoRTH	Shri Rajesh Kumar, Advocate, Supreme Court, India
Dr. Akhilesh Gupta, Distinguished Professor, CDMM, IITR	Dr. Rakesh Kumar, PS (Agro), NRM Division, ICAR
Dr. Akshay Dvivedi, Dean SRIC, IITR	Dr. Raman Sharma, Principal Scientist, CSIR-NEERI
Dr. Akshaya Verma, Scientist C, NIH, Roorkee	Dr. Ratnesh Kumar, Lead Specialist- Knowledge Management, CDRI
Dr. Albert Chiang, Officer on Special Duty, MBDA, Govt of Meghalaya	Dr. Ritesh Khattar, Director, FMP, CWC
Dr. Amrita Gupta, Expert, Public Health Policy, NCDC	Dr. Ruchika Drall, Deputy Secretary, Climate Change, MoEFCC
Dr. Ananda Kumar Das, Scientist – F, IMD, Gol	Dr. Sameer Saran, Dy. General Manager (DGM) & Regional Remote Sensing Centre – North, NRSC/ISRO
Dr. Anish Chatterjee, Advisor – Climate Change, GSDP, GIZ India	Dr. Sandeep Gaur, Superintending Engineer, MoRTH
Dr. Anita Gupta, Sr. Advisor & Head CEST, DST-Gol	Col. Sanjay Shrivastava, Founder & Chairman, CROPC
Dr. Anjan Prushti, Professor, Berhampur University	Shri Sarbjit Singh Sahota, Senior DRR Specialist, UNICEF India
Dr. Ankit Gupta, Principal Scientist, CSIR-NEERI	Dr. Saurabh Dalal, National Professional Officer, WHO
Ms. Bedoshruti Sadhukhan, Associate Director, ICLEI South Asia	Mr. Shashikant Chopde, Senior Advisor, TARU
Dr. Ga. Dheebakaran, Associate Professor (Agronomy) Agro Climate Research Centre, Tamil Nadu Agricultural University	Dr. Sonali Chauhan, Assistant Professor, Rishihood University
Dr. Jrajeswar, Head - Climate Change & training Divisions, EPTRI, Hyderabad	Dr. Sudha Shukla, Delhi University
Dr. Kala Venkata Uday, Associate Professor, Geotech., IIT Mandi	Ms. Sutanuka Sarkar, Deputy Director, MoEFCC
Prof. Kamal Kishore Pant, Director, IITR	Dr. Swati Jain, Scientist-D, CEST-DST Gol
Dr. Kapil Kesarwani, Scientist D, NIH, Roorkee	Ms. Swati Sharma, Consultant, MoEFCC
Ms. Kim Arora, Knowledge Management Advisor, GIZ	Mr. Utkarsh Dwivedi, Deputy Manager- Advocacy and Information Management, Sphere India
Shri Kirtiman Awasthi, Director-CAFRI & Sr. Advisor, GIZ	Dr. Vandana Singh, Scientist-F, CEST-DST Gol
Shri Krishna Vatsa, Member, NDMA	Mr. Vijay Khadgi, DRR Specialist, ICIMOD
Dr. Mrutyunjay Mohapatra, Director General, IMD, Gol	Dr. Vijay Teotia, Joint Commissioner (LH), MoFAH&D Gol
Dr. Manish K Goyal, Chair Professor (BIS & Standardization), IIT Indore	Dr. Vishal Chaudhary, Scientist-F, PSA Office Gol
Ms. Meekha Hannah Paul, Project Manager, GIZ India	Mr. Vishnu P, Program Coordinator, Sphere India
Ms. Nidhu Jamwal, Environmental Journalist, Mumbai	Shri Vivek Anand, Advisor, Rural Development, GIZ India
Ms. Nupur Tyagi, Manager- Program Implementation, Sphere India	Prof. V. K. Sharma, Vice Chair, Sikkim SDMA & Senior Professor, IIPA

Photo Gallery





About the Authors



Prof. Anil Gupta, Full Professor at IIT Roorkee, is a renowned Disaster Resilience and Adaptation Policy Strategist. He is dedicated to strengthening the link between policy, research, and practice to advance disaster resilience, climate adaptation, and sustainable development. With over three decades of experience, including roles at IIT Roorkee and NIDM, he has guided policy, led capacity-building initiatives, and translated research into policy and practical solutions for governments and international organizations.



Richa Srivastava has over 22 years of experience in climate change, DRR, environment, sustainability, and agriculture, with expertise in policy research, project management, and knowledge leadership. She has led key National Disaster Management Plans for MoAFW and MoEFCC, Government of India, and currently heads the ADRES Network at ICARS, IIT Roorkee. A graduate of Wageningen University, she is a NUFFIC and BMUB fellow committed to advancing integrated, science-based resilience solutions.



Dr Sreeja Nair is an experienced professional with over 25 years of work across government, United Nations agencies, non-profits, and the private sector at national and international levels. Her expertise includes hazard, vulnerability and risk assessments, post-disaster assessments, loss and damage analysis, and developing climate change adaptation and DRR policies and strategies. She also specializes in capacity building, project leadership, knowledge management, and mainstreaming DRR and CCA into development programmes, including legal and ESIA frameworks.



Sonali Chauhan is an Assistant Professor at Rishihood University and a PhD candidate in Human Ecology at Dr. B.R. Ambedkar University Delhi. She has previously worked with Azim Premji University and as a Senior Researcher at the Centre for Urban Ecology & Sustainability. Her work focuses on urban ecology, ecological restoration, plant biodiversity, and sustainability, with expertise in GIS (ArcGIS, QGIS), R programming, field research, and science communication.



Indian Institute of Technology Roorkee, Greater Noida Campus (NCR)