

## Annexures

### Strengthening India’s Disaster Preparedness with Technology A Case for Effective Early Warning Systems

Shreya Wadhawan | July 2023

#### Approach and methodology adopted:

1. Identifying districts exposed to extreme flood and cyclone events from CEEW’s report *Mapping India’s Climate Vulnerability: A district level assessment*
2. Selecting indicators to assess the availability, accessibility and effectiveness of EWS/MHEWS from secondary literature and stakeholder consultations
3. Scoring the indicators:
  - 3.1 Availability:
    - Presence of EWS/MHEWS in exposed state<sup>1</sup> = 1
    - Absence of EWS/MHEWS in exposed state<sup>2</sup> = 0
  - 3.2 Accessibility:
    - Presence of wireline/wireless data based on TRAI subscriber’s list in exposed state = 1
    - Absence of wireline/wireless data based on TRAI subscriber’s list in exposed state = 0
  - 3.3 Effectiveness:
    - Financial Mechanisms for flood EWS  
Allocated fund under SDMP<sup>3</sup> → Expenditure under SDMP → Percentage of funds utilized under SDMP → Score
    - Financial Mechanisms for cyclone MHEWS  
Total Outlay of funds under NCRMP<sup>4</sup> → Released Amount of Funds → Expenditure mentioned in SDMPs → Unspent Balances → Percentage of funds utilised of funds released

% Utilisation of funds	Score
0-20	0
21-40	0.25
41-60	0.5
61-80	0.75
81-100	1

<sup>1</sup> District for flood EWS

<sup>2</sup> District for flood EWS

<sup>3</sup> SDMP: State disaster management plan

<sup>4</sup> NCRMP: National Cyclone Risk Mitigation Project

- Governance (Administrative frameworks) for flood and cyclone EWS
    - **Identify** the hazards (0 = No, 0.5 = Identification of single hazard, 1 = Identification of multiple hazards)<sup>5</sup>
    - **Acknowledge** the importance of EWS/ MHEWS (0 = No, 0.5 = Either the scope or the allocation is mentioned, 1 = Both scope and allocation are mentioned)
    - **Establish** mechanism for different hazard warnings and dissemination (0 = No, 0.5 = Either the scope is mentioned or the organisational structure, 1 = Scope + Organisational structure mentioned)
    - **Mention** implementation strategies and mechanisms for the deployment of EWS and EWDS for information dissemination (0 = Not Mentioned, 0.25 = One of the 4 requirements, 0.5 = 2 of the requirements, 0.75 = 3 of the requirements, 1 = All 4 of the listed requirements)
  - Total effectiveness = Average score of [financial mechanism + governance frameworks]
4. Normalisation of all 3 scores using linear scale method from a scale of 0 to 1.
5. Resilience: Average [Availability + Accessibility + Effectiveness]

Normalised score	Category
0-0.33	Low
0.34-0.66	Moderate
0.67-1.00	High

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<sup>5</sup> If a state is only exposed to one hazard and identifies it in its disaster management plan, then a score of 1 is provided.

ANNEXURE -I

**Table A1: State-wise comparative scoring of availability of flood EWS vs exposure.**

State	Exposure	Availability of Flood EWS (Normalised score)	% population to which flood EWS is available	Score
Assam	High	0.75	0-20	0
Bihar	High	0.75	21-40	0.25
Uttar Pradesh	High	0.75	41-60	0.5
Odisha	High	0.5	61-80	0.75
Jharkhand	High	0.25	81-100	1
West Bengal	High	0.25		
Andhra Pradesh	High	0.25		
Tamil Nadu	High	0.25		
Himachal Pradesh	High	0		
Goa	High	0		
Karnataka	High	0		
Telangana	High	0		
Sikkim	Moderate	1		
Tripura	Moderate	1		
Uttarakhand	Moderate	0.5		
Arunachal Pradesh	Moderate	0.5		
Kerala	Moderate	0.25		
Maharashtra	Moderate	0.25		
Gujarat	Moderate	0.25		
J & K	Moderate	0.25		
Mizoram	Moderate	0		
Nagaland	Moderate	0		
Rajasthan	Moderate	0		
Madhya Pradesh	Moderate	0		
Delhi	Moderate	0		
Haryana	Moderate	0		
Chhattisgarh	Low	0.25		
Manipur	Low	0		
Meghalaya	Low	0		
Punjab	Low	0		
Puducherry	Low	0		
Chandigarh	Low	0		

**Table A2: State-wise comparative scoring of availability of cyclone EWS vs exposure.**

State	Exposure	Availability of Cyclone MHEWS (Normalised score)	Availability of CWC/ACWC in the state	Score
Andhra Pradesh	High	1	No	0
Goa	High	1	Yes	1
Karnataka	High	1		
Kerala	High	1		
Odisha	High	1		
Tamil Nadu	High	1		
West Bengal	High	1		
Bihar	High	0		
Maharashtra	Moderate	1		
Gujarat	Moderate	1		
Assam	Moderate	0		
Jharkhand	Moderate	0		
Rajasthan	Moderate	0		
Delhi	Moderate	0		
J & K	Moderate	0		
Manipur	Low	0		
Meghalaya	Low	0		

**Table A3: State-wise comparative scoring of accessibility of flood EWS vs availability of flood EWS.**

State	Exposure	Availability of Flood EWS (Normalised score)	Accessibility through tele-density ratio (Normalised score)
Assam	High	0.75	0.75
Bihar	High	0.75	0.75
Uttar Pradesh	High	0.75	1
Odisha	High	0.5	1
Jharkhand	High	0.25	1
West Bengal	High	0.25	1
Andhra Pradesh	High	0.25	1
Tamil Nadu	High	0.25	1
Himachal Pradesh	High	0	1
Goa	High	0	1
Karnataka	High	0	1
Telangana	High	0	1
Sikkim	Moderate	1	1
Tripura	Moderate	1	1
Uttarakhand	Moderate	0.5	1
Arunachal Pradesh	Moderate	0.5	1
Kerala	Moderate	0.25	1
Maharashtra	Moderate	0.25	1
Gujarat	Moderate	0.25	1
J & K	Moderate	0.25	1
Mizoram	Moderate	0	1
Nagaland	Moderate	0	1
Rajasthan	Moderate	0	1
Madhya Pradesh	Moderate	0	1
Delhi	Moderate	0	1
Haryana	Moderate	0	1
Chhattisgarh	Low	0.25	1
Manipur	Low	0	1
Meghalaya	Low	0	1
Punjab	Low	0	1
Puducherry	Low	0	Data NA
Chandigarh	Low	0	Data NA

**Table A4: State-wise comparative scoring of accessibility of cyclone EWS vs availability of cyclone EWS.**

State	Exposure	Availability of Cyclone MHEWS (Normalised score)	Accessibility through tele-density ratio (Normalised score)
Andhra Pradesh	High	1	1
Goa	High	1	1
Karnataka	High	1	1
Kerala	High	1	1
Odisha	High	1	1
Tamil Nadu	High	1	1
West Bengal	High	1	1
Bihar	High	0	1
Maharashtra	Moderate	1	1
Gujarat	Moderate	1	1
Assam	Moderate	0	1
Jharkhand	Moderate	0	1
Rajasthan	Moderate	0	1
Delhi	Moderate	0	1
J & K	Moderate	0	1
Manipur	Low	0	1
Meghalaya	Low	0	1

**Table A5: State-wise comparative scoring of effectiveness of flood EWS.**

State	Exposure to floods and associated events	Administrative Framework (Normalised score)	Percentage of fund utilisation (Normalised score)	Effectiveness of flood EWS (Normalised score)	Effectiveness based on normalised score
Jharkhand	High	1	0.25	1	High
Tamil Nadu	High	1	0.25	1	High
Assam	High	0.875	0.25	0.9	High
Kerala	Moderate	0.875	0.25	0.9	High
Himachal Pradesh	High	0.812	0.25	0.85	High
Chhattisgarh	Low	1	0	0.8	High
Goa	High	1	0	0.8	High
Maharashtra	Moderate	1	0	0.8	High
Manipur	Low	1	0	0.8	High
Mizoram	Moderate	1	0	0.8	High
Odisha	High	1	0	0.8	High
Uttarakhand	Moderate	1	0	0.8	High
West Bengal	High	1	0	0.8	High
Karnataka	High	0.937	0	0.75	High
Nagaland	Moderate	0.875	0	0.7	High
Puducherry	Low	0.875	0	0.7	High
Rajasthan	Moderate	0.875	0	0.7	High
Uttar Pradesh	High	0.875	0	0.7	High
Madhya Pradesh	Moderate	0.812	0	0.65	Moderate
Meghalaya	Low	0.812	0	0.65	Moderate
Arunachal Pradesh	Moderate	0.75	0	0.6	Moderate
Delhi	Moderate	0.75	0	0.6	Moderate
Sikkim	Moderate	0.75	0	0.6	Moderate
Bihar	High	0.625	0	0.5	Moderate
Chandigarh	Low	0.562	0	0.45	Moderate
Andhra Pradesh	High	1	0	0.4	Moderate
Gujarat	Moderate	0.5	0	0.4	Moderate
J & K	Moderate	0.437	0	0.35	Moderate
Haryana	Moderate	0	0.25	0.2	Low
Punjab	Low	0.25	0	0.2	Low
Telangana	High	0	0	0	Low
Tripura	Moderate	0	0	0	Low

**Table A6: State-wise comparative scoring of effectiveness of cyclone EWS.**

State	Exposure to cyclones and associated events	Administrative Framework (Normalised score)	Percentage of funds utilisation under NCRMP Phase I and II (Normalised score)	Effectiveness of cyclone EWS (Normalised score)	Effectiveness based on normalised score
Andhra Pradesh	High	1	1	1	High
West Bengal	High	1	0.75	0.84	High
Odisha	High	1	0.75	0.84	High
Goa	High	1	0.25	0.52	Moderate
Maharashtra	Moderate	1	0.25	0.52	Moderate
Karnataka	High	0.937	0.25	0.48	Moderate
Kerala	High	0.875	0.25	0.44	Moderate
Tamil Nadu	High	1	NA	0.36	Moderate
Jharkhand	Moderate	1	NA	0.36	Moderate
Manipur	Low	1	NA	0.36	Moderate
Rajasthan	Moderate	0.875	NA	0.28	Low
Assam	Moderate	0.875	NA	0.28	Low
Meghalaya	Low	0.812	NA	0.24	Low
Delhi	Moderate	0.75	NA	0.2	Low
Gujarat	Moderate	0.5	0.25	0.2	Low
Bihar	High	0.625	NA	0.12	Low
J & K	Moderate	0.437	NA	0	Low