Government of India
NATIONAL DISASTER MANAGEMENT AUTHORITY
Policy & Plan Division
NDMA Bhawan, A1 Safdarjung Enclave, New Delhi 110029
Tele-Fax No. +91 11 26701840

No. 1-128/2019-PP(Vol-II) **Dated: 05th February 2020**

Expression of Interest (EoI)

I. National Disaster Management Authority (NDMA), A1 Safdarjung Enclave, New Delhi, invites Expression of Interest (EoI) from eligible agencies[1] for a study on '***Multi-Hazard Vulnerability and Risk (MH-VR) Profiles for 2 States – Kerala and Mizoram***'. The Objectives, Methodology, Scope of Work, Deliverables, Reporting, Supervision, etc., are mentioned in the **Terms of Reference (ToR)** given at clause 3 on page 10.

II. Interested Agency should provide information in proforma given at Annexure 1 at page 21, demonstrating they have the required qualifications and relevant experience to perform the Services. The EoIs will be evaluated and shortlisted for Request for Proposal (RfP) stage. The short listing/eligibility criteria are at Clause 5 of **ToR**. On the basis of responses received from the Bidders, those who meet the requirements shall be shortlisted for RfP Stage and will be informed by post / email to send their technical and financial proposals.

III. Under RfP stage, **the two-bid system** (given in *General Financial Rules, 2017*) shall be adopted by the evaluation committee in evaluating the proposals for selection of the agency. **Quality and Cost Based Selection (QCBS) Method** mentioned in the *Manual of Procurement of Consultancy and Other Services, 2017,* will be used in finalizing the agency.

Further information can be obtained at the address below **during office hours between 1000 hrs to 1700 hrs**.

IV. Interested agency must send their EoI in Performa given at Annexure 1 at page 21, latest by 17:00 hrs on **6th March 2020.** The agency may also send their comments on the objectives and scope of the work projected in the enquiry before the date and time mentioned above. Sealed EoI /comments should be delivered by hand or sent by post to the address given below.

Person to Supervise the Work/Performance of the agency:
Smt. Alice Kujur
Deputy Secretary to the Government of India
Policy & Plan Division, National Disaster Management Authority
Room 326, NDMA Bhawan, A1 Safdarjung Enclave, New Delhi 110029
Email: dspp@ndma.gov.in Phone: +91-11-26701840

[1] An agency means a consulting firm, research institute, etc., but not an academic institute or university.

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1. Information for the Agencies

Client for the Project	National Disaster Management Authority
Brief Description of the Required Services	To prepare a *Multi-Hazard Vulnerability and Risk (MH-VR) Profiles for 2 States – Kerala and Mizoram*
List and Description of Expected Outputs to be Delivered	Please review Clause 3.8 on page 18 for details.
Person to Supervise the Work/Performance of the Agency	Deputy Secretary to the Government of India, Policy & Plan Division, NDMA
Frequency of Reporting	As per deliverables given at Clause 3.8 on page 18
Location of work	Kerala, Mizoram
Expected duration of work	18 Months
Names and Curriculum Vitae of individuals who will be involved	Qualifications required for EoI. Names can be given at the RfP Stage.
Currency of Proposal	Indian Rupees (INR ₹)
Criteria for Preliminary Examination of EoI	• Relevant experience of the Agency • Proposed team leader (TL) and experience of similar nature (TL's name is optional) • Proposed team to carry out this work(s) • Latest Certificate of Registration of the Agency • GST and PAN details of the agency • Over all experience of the Agency (JV is acceptable) • The agency should be registered with the relevant Acts (Societies Act/Companies Act, etc.) • The agency has not been debarred/blacklisted by any of the Govt. Institutions.
Criteria for Contract Award	• Compliance on Preliminary Examination of Proposals • Compliance on Essential Eligibility/Qualification requirements • Highest Combined Score (based on the 70% technical offer and 30% price weight distribution). • Full acceptance of the RfP and the GFR 2017 guidelines. (This is a mandatory criteria and cannot be deleted regardless of the nature of services required. Non acceptance of the NDMA Project Guidelines may be grounds for the rejection of the Proposal).

Criteria for Essential Eligibility/Qualification	a) The Agency must have experience of at least 5 years in conducting similar studies pertaining to the above-mentioned subject with International/State/ Central Government or private sector. Experience of carrying out study/projects with multiple stakeholders will be an added advantage. b) The Agency with prior experience of conducting HVRA/Disaster Risk Atlas(es) at international, national and state level will be given priority. c) The Agency should have a team of experienced professionals from relevant fields relating to the subject matter of the proposed study. The Agency should engage an adequate team of professionals having expertise on, but not limited to, Hazard Analysis, vulnerability and risk assessments, disaster management, economic analysis, etc. d) The agency should have minimum annual average turnover of ₹.100 Lakhs (INR One Hundred Lakhs) for the last three years (i.e., from 2016-17 onwards). This may be exempted for academic, research institutions, etc.
Intellectual Property Rights (IPR)	• NDMA will have the sole proprietary rights over the data collected (from the field, from different agencies through any method), generated (by any method), used (for analysing, visualising and presenting the deliverables) in this project. • All the deliverables belong to NDMA. • The Agency can use the already patented material by itself or other agencies with due permissions.
Guidelines for the RfP	• General Financial Rules (GFR), 2017, shall be adopted by the evaluation committee in evaluating the proposals for selection of the Agency. Please refer to **QCBS Method** mentioned in the *Manual of Procurement of Consultancy and Other Services, 2017*
Who can apply	Proposals are invited from the institutions/organizations only. Joint Ventures or Consortium of Agencies can also apply. Proposal submitted by Individuals will not be accepted.
Last date for Expression of Interest	6th March 2020

For further details, Terms of Reference (ToR) may be referred at section 3 on page 10.

2. Terminology Used in this document

Disaster

A catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area.

Hazards

A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

(a) Geological hazards: Earthquakes, landslides and avalanches are examples of geological hazards caused due to geologic processes of the earth. An earthquake is the shaking of the surface of the earth as a result of seismic waves, and can trigger landslides and avalanches, depending on soil conditions. Data sets needed for understanding these hazards are geology, lithology, faults and lineaments, soil profile, level of water table, etc. But, tsunamis triggered by earthquakes in the middle of the ocean/sea are hard to model and observe.

(b) Hydro-meteorological hazards: Cyclones, floods, droughts, hailstorms, cloudbursts, heat and cold waves, etc. are hydro-meteorological hazards caused by prevalent hydrological and meteorological conditions. In order to understand and quantify the effects of these hazards, we need weather-related data along with data of the ground conditions. Data for understanding the cyclones are usually collected at the country level, in India by the India Meteorological Department (IMD). Other data sets which may be compiled for monitoring the hydro-meteorological hazards are rainfall, temperature, runoff conditions, land use land cover, natural drainage and topography, etc.

(c) Fires (forest fires and urban fires): During the hot periods of the year, dried up leaves and twigs in forest areas catch fire and lead to catastrophe. Additionally, typically after harvesting, crops are burnt to dispose off crop stubble/residue in rural areas. Urban fire data can be obtained from urban fire calls from the fire departments and can be spatially mapped and used for decision making. Forest fires are monitored worldwide through satellites. MODIS (available at http://modis-fire.umd.edu/index.php) provides global level data at 1 km scale.

(d) Anthropogenic hazards: To understand industrial hazards and their extent, it is important to have knowledge on types of chemicals stored in the facility as well as the state and quantum of the chemical that has led to the hazard. Based on the chemical properties and the weather conditions, simulations can be run to ascertain the extent of the disruption.

Risk

It is the combination of the probability of an event and its negative consequences. The term 'risk' refers to the expected losses from a given hazard to a given element at risk over a specified future time period. According to the way in which the element at risk is defined, risk may be measured in terms of expected economic loss, numbers of lives lost or the extent of physical damage to property. The overall task of risk management shall include both an estimation of the magnitude of a particular risk and an evaluation of how important the risk is.

Vulnerability

It is the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.

a) **Population Vulnerability:** The vulnerability of population is the number of people susceptible to an event. It is classified as intrinsic and extrinsic vulnerability. Intrinsic vulnerability is based on the attributes of the population (e.g., fragile age group, social status in the society, and access to resources) while extrinsic vulnerability is lack of capacity to resist the influence (often negative) from external processes (inundation during flood, loss of economic activities because of earthquake, etc.).

b) **Building Vulnerability:** The vulnerability of normal buildings is the potential of the building to be damaged in the event of the disasters expected in the region. This shall be assessed by *Level 1 Pre-Event Rapid Visual Screening (RVS).* If the building stock is non-homogeneous, *Level 2 Pre-Event Detailed Visual Screening (DVS)* is required to understand the parameters that contribute to vulnerability, namely *Soil & Site Features*, *Architectural Form & Material Choices*, *Structural System*, *Construction Details*, and *Maintenance Quality*. These *Level 1 RVS* and *Level 2 DVS Assessments* shall be performed in accordance with the procedures approved by NDMA.

c) **Economic Vulnerability:** The economic vulnerability of a state is the extent of disruption by the hazards innate to an area, in case a hazard manifests itself as a disaster. It is an indicator of the economic vulnerability. For example, in case of a tourist destination, the decrease in tourist arrival observed after a hazardous event is broadly termed as economic vulnerability. The number of man-days lost and opportunity cost of the business lost are to be calculated to assess the economic vulnerability.

Capacity-building

It includes:

a) Identification of existing resources and resources to be acquired or created;
b) Acquiring or creating resources identified under sub-clause (i); and
c) Organisation and training of personnel and coordination of such training for effective management of disasters.

Capacity

It is the combination of all the strengths, attributes and resources available within a community, society or organisation that can be used to achieve agreed goals. Often, capacity is used to define the resilience of society.

a) **Capacity at Household Level:** A household's level of preparedness in the eventuality of a disaster determines its capacity. If the resources available to the household can sustain till external aid arrives, then the household's capacity can be termed as good. Capacity also includes the level of awareness regarding disasters. Data needed to assess the capacity at the household level is the number of households in the given area that are self-reliant and aware of their capacity.
b) **Capacity at Community Level:** If a community has adequate provisions for storage of water, food, fuel, medicines and other resources and can sustain its daily activities till external aid reaches, that community can be termed as a resilient community (or a community with capacity). Community capacity can be assessed based on the community resources; awareness (not just literacy) of people within the community; transmission of early warning messages; access to health facilities; proximity to transport networks; etc.
c) **Capacity at Local Body Level:** Awareness of a local body about the hazards, vulnerabilities and risks faced by the settlement (either city or town) is the key to understanding the capacity of the local body. Capacity of the local body can be assessed by number of officials trained in DRR related activities; existing disaster management plans for the city; building stock analysis; population vulnerability; transport networks; open spaces for assembly and resettlement purposes; effectiveness of the fire service; reach of hospital and medical facilities; places of high density; infrastructure service level; etc.

Elements at Risk

It is the social and material context represented by persons, resources, infrastructure, production processes, goods, services and ecosystems that may be affected by a physical phenomenon.

Prevention

Prevention is defined as those activities taken to prevent a natural phenomenon or potential hazard from having harmful effects on either people or economic assets. Prevention planning is based on two issues: hazard identification (identifying the actual threats facing a community) and vulnerability assessment (evaluating the risk and capacity of a community to handle the consequences of the disaster). Once these issues are put in order of priority, disaster managers can determine the appropriate prevention strategies. Disaster prevention refers to measures taken to eliminate the root causes that make people vulnerable to disaster.

Mitigation

Mitigation refers to reducing the impact of the hazard and reducing vulnerability. Mitigation includes recognizing that disasters will occur; attempts are made to reduce the harmful effects of a disaster, and to limit their impact on human suffering and economic assets.

3. Terms of Reference

Multi-Hazard Vulnerability and Risk (MH-VR) Profiles for the 2 States – Kerala and Mizoram

3.1. Background

Sendai Framework for Disaster Risk Reduction calls all signatory countries to *understand disaster risk*. As part of understanding the multi-hazard disaster risk across the country, preparation of disaster risk profiles is a starting point. India currently does not have designated risk profiles for understanding hazard exposure, vulnerability of various elements at risk and the risk exposure. All hazard-vulnerability studies carried out in India, depend on the Vulnerability Atlas[2] by Building Materials and Technology Promotion Council (BMTPC) of Ministry of Housing and Urban Affairs (MoHUA) and Bureau of Indian Standards (BIS), initially created in 1987. The census data of 2011 in terms of administrative boundaries[3] have been updated and a new series of maps were generated subsequently in 2017. Information regarding the landslides are updated in a 2003[4] publication by BMTPC and Center for Disaster Mitigation and Management (CDMM). This atlas considers various layers of secondary sources and combines into a weighted overlay of landslide hazard zonation. So keeping in view the dynamic nature of the hazards, there is a need to create new and updated hazard information for the country.

Climate change also poses a great threat to Indian economy. India being an agrarian society, will bear the brunt of changing precipitation regime and its influence on agriculture and allied sectors. It is already evident from the floods of Maharashtra, Rajasthan, Bihar and Kerala that the existing rainfall pattern is changing and the impacts are resulting in huge economic and societal losses and damages. For estimating the potential damages and losses that may occur because of the changed climate regime, creation of risk profiles – for varying hazard and vulnerability across the country is important.

The Global Facility for Disaster Reduction and Recovery (GFDRR), a global partnership that helps developing countries better understand and reduce their vulnerabilities to natural hazards and adapt to climate change. The strategy areas of GFDRR for the year 2018 were, Using science and innovation in disaster risk management, Promoting resilient infrastructure, Scaling up engagements for city resilience, Strengthening hydromet services and early warning systems, Deepening financial protection through disaster risk financing and insurance, Building social resilience, Deepening engagements in resilience to climate change and Enabling resilient recovery.

Keeping in line with the objectives of the GFDRR, NDMA proposes to develop disaster risk profiles for the above mentioned states. Understanding the hazard exposure in a geographic location and assessing the vulnerability of the elements at risk, will pave the path for generating the risk profiles. Risk profile is a multi-layered dataset which will give an

[2] BMTPC: Vulnerability Atlas - 3rd Edition: Peer Group, MoHUA, GOI, 2017
[3] Administrative boundaries of Survey of India
[4] Landslide Hazard Zonation Atlas of India

indexed value in terms of overall risk. This risk will be generated out of the multiple hazards and vulnerabilities spread across different geologic, hydrometeorologic and developmental regime.

Risk profiles, expressed on a geographic location help in making many development and disaster risk reduction related decisions. By knowing the risk exposure of a location, the buyer of a house understands how much money s/he has to keep aside to meet with contingencies. One may also decide if they want to buy a house in that location or not. Similarly, urban/rural local authorities, will be enabled for prioritising the locations of investments and developmental activities using the risk information. Risk profiles can be useful for a variety of purposes, as safer schools, risk financing and urban resilience. Apart from these, the following are also envisaged as the areas of application:

a) To mitigate risks to development and strengthen resilience, investment decisions should incorporate information of risk profiles in planning, design and implementation;
b) To advise home-owners about making their homes safer by using retrofitting based on the risk profiles
c) To differentiate between the developable and non-developable areas in terms of hazards and vulnerabilities for future development
d) To help in assessing the risk transfer mechanisms based on the risk profiles, for lives, houses, animals, crops and other economic assets
e) To formulate and implement the risk mitigation measures based on the risk profiles and underlying hazard information
f) To develop a risk-sensitive strategy for urban development
g) To create/improve background information for planning, implementation of future infrastructure in line with CDRI initiative.

So, conduct a multi-hazard based vulnerability and risk assessment for two pilot states – Kerala (in light of floods in 2018, 2019) and Mizoram (continuous threat of hydro-meteorological risk).

3.2. Rationale for selecting the two states

Kerala state has experienced severe floods in which more than 350 people were dead and upside of 1 million were evacuated. The flash floods which were triggered by the release of discharge from more than 44 dams following an incessant rainfall. The state being the riparian has more than 40 rivers and many more streams running through. Multiple wetlands and backwaters add to the complications of water system of the state. Being a state between the Western Ghats and the Arabian Sea, the state has a very dense water network. Dam discharge being lead to the inundation of many settlements, crop lands, infrastructure, this State becomes a good case for understanding the exposure and risk.

On the other hand, Mizoram State has a constant threat from landslides. Being a hill state, it also has an exposure to the seismic hazard. Aizawl, the primate city of the state, estimates that the population of the city will be doubled in next 20 years. When the Mizo lived in the timber homes on top of the ridgelines, the harm caused by earthquakes and landslides was minimal. But, with the change of building material and building techniques that are alien to these tribes, the quality of construction has a major role to play in the increased vulnerability. The soil being contaminated by the innumerable septic tanks leaching moisture into the ground, which is already unstable. So this poses a greater threat – the mix of vulnerable housing stock increasing by the day and the exposure to the seismic and landslide forces. So this state is selected for carrying out the risk profiles atlas.

Apart from the administrative boundaries of the states, it is also envisaged that the storm surge data be generated for the 12 nautical miles from the coast.

3.3. Objectives

1. To create MHVR profiles for the selected states as basis for risk reduction/mitigation and transfer them to a uniform grid in lines with topographic sheets
2. To develop a detailed methodology and manual for replicating this work for other states
3. To create a risk indexing methodology using these hazard-vulnerability-risk profiles
4. To convert the risk information into risk reduction applications and a policy document.

3.4. Scope of the Study

3.4.1. Evaluate the feasibility of a regular grid of 1km × 1km as a basic mapping unit for each State, and transfer spatial data to this grid for use. Methods may be developed to upgrade and use the data.

3.4.2. Development of input datasets for probabilistic and deterministic hazard assessment at State, district, tehsil, taluka, block and village levels for:

a. Geophysical hazards (earthquake and material flow- landslides, tsunami),

b. Hydro-meteorological hazards (cyclone, flood, drought, storm surge and urban flood, Lightning, Thunderstorms, Hailstorms, Cloud burst, Gale, Squall, Tornado, Heavy snowfall, Avalanche, Fog, Heat/Cold waves),

c. Industrial hazards (industrial fire, toxic release and industrial explosion),

d. Heat wave/cold wave, and

e. Fires (forest and urban).

Apart from the above mentioned hazards, freak events – like floods in Rajasthan, Banaskantha (Gujarat) may also be considered, where no historic evidence is available. Hazards to be considered as per the MHA 1999, annexed at Annexure 2 at page 23. The hazards to be considered in this assignment will be finalised in consultation with the agency selected and state specific nature of hazards.

There is a need to develop the climate variability of the above hazards to be considered and documented. Change in climate variability of these hazards in terms of the RCPs – 4.5, 6.0 and 8.5 need to be considered as different scenarios apart from the return period scenarios (refer Table 1).

3.4.3. Development of probabilistic dynamic 1D, 2D and combined models for hydro-meteorological hazard forecasting and inundation due to flood, cyclone and storm surge with inputs from automated weather stations (AWS) or IMD data/predictions and buoy data from Indian National Centre for Ocean Information Services (INCOIS).

3.4.4. Development of exposure datasets and vulnerability at State, district, tehsil/taluka and village level.

3.4.5. Simulation of exposure of the elements at risk for the hazards mentioned at points 2 and 3 above.

3.4.6. Derive a magnitude-frequency relationship for each hazard for various feasible scenarios

3.4.7. Development of a digital '***Risk Information Management System***' for (RIMS) which comprises hazard and risk information for the different hazards.

3.4.8. Develop catastrophe models to project the financial consequences of potential disasters to quantify the financial impacts - Event Loss Table (ELT); Loss Exceedance Curve (LEC) and Annual Average Loss (AAL).

3.4.9. Capacity building and training modules for hand-holding/guiding other states to carry out the process of preparing similar atlas/risk profiles. This training modules may focus on increasing the capacity of the stakeholders to conduct a similar assignment for their own states.

3.5. Return Periods

For the purpose of calculating the annualised risk (damage/loss) and Annual Average Loss (AAL), following return periods need to be considered.

Table 1 Return period scenarios to be considered

S.No	Hazard/event	Return period
1	Earthquakes	20, 50, 500, 2500 and 5000 years
2	Landslides	2, 5, 10, 20, 50, 100 years
3	Riverine Floods, Flash Floods	2, 5, 10, 20, 50, 100, 200 years
4	Cyclone, Drought, Stormsurge, and Tsunami	2, 5, 10, 25, 50, 100 years
5	Urban Floods	2, 5, 10, 20, 50, 100, 200 years
6	Fires (Forest and Urban)	2, 5, 10, 20, 50, 100 years

7	Climate Variability	Scenario for 2030 and 2050

3.6. Expectations from the Agency

3.6.1. The agency must have minimum 5 years of research/consulting experience in consulting/development of frameworks on HRVA from climate change perspective and undertaking Hazard, Risks and Vulnerability Assessments from climate change perspective in a participatory manner. Experience of working across variety of geologic, hydro-climatic conditions will be an added advantage.

3.6.2. Structure of the team is to be proposed by the agency in accordance to their understanding of the ToR

3.6.3. Team Leader should have Master's degree from a recognized institution in disaster management/Geology/Climate Change/ Environmental Science with minimum 10 years of experience in developing frameworks on HRVA from Climate Change Perspective and conducting HRVA.

3.6.4. The Agency is to propose a detailed Methodology and Implementation Plan as per the schedule of deliverables provided at Clause No. 3.8. This has to be prepared by the agency on its own.

3.6.5. With regard to the Earthquake Hazard Assessment, the Agency shall perform Earthquake Macrozonation and Earthquake Microzonation in accordance with the procedures approved by NDMA, which are in keeping with the ongoing hazard assessment effort of the Bureau of Indian Standards.

3.7. Methodology

The agency will have to collect the datasets as much as possible from existing sources first and if any specific data is not available, then attempt to generate the data in consultation with NDMA. NDMA will make efforts to make available the datasets available with various agencies which have developed these datasets. Some primary sources for these data are given below. This list is no way an exhaustive list and the agency is required to make an effort to make it exhaustive.

- It is decided that the hazard, vulnerability and risk information will be depicted on a grid of 10km (i.e. 0.1 degree) for the whole country (rural areas) and for urban areas, a grid of 1km may be used.
- List of hazards are in this document are derived from MHA 1999. However, at the RfP stage, these hazards will be limited to whichever are applicable to the two selected states.

3.7.1. Geophysical Hazards

Geological Survey of India (GSI), Indian Seismological Research (ISR), Swiss Federal Institute of Technology (ETH Zürich)[5], India Meteorological Department (IMD), Central Water Commission (CWC), National Geophysical Research Institute (NGRI), Indian Institutes of Technology (IITs), Indian Institute of Sciences (IISC), Survey of India (SoI), United State Geological Survey (USGS), , CERG – University of Geneva, etc. These global and national datasets need to be cleaned and processed for creating historical earthquake catalogue, seismic sources (fault lines and area sources) that generated events in historical times with information on activity level, depth and traces, other seismic sources (e.g. identified fault lines), strong ground motion records, micro-zonation studies (if available), shear wave analysis, GPS strain measurements, 3D basin model etc. Update and modify earthquake input datasets as necessary to ensure the datasets are complete and harmonized, including potential addition of global datasets such as GEM Faulted Earth, earthquake catalogues from other geophysical monitoring agencies (e.g., Ambraseys EQ catalogue, USGS, IMD catalogue, ASC-India, etc.).

Seismic microzonation may be carried out for selected urban areas for these two states. It was decided that one city (Aizawl) for Mizoram and 2 cities for Kerala (to be decided in consultation with NDMA) will be selected for the microzonation. Methodology for the same will be finalized in consultation with NDMA.

3.7.2. Hydro-Meteorological Hazards

India Meteorological Department (IMD), Indian Institute of Tropical Meteorology (IITM), Indian National Centre for Ocean Information Services (INCOIS), Central Water Commission (CWC), Climate Prediction Center of NOAA, Copernicus, Dartmouth Flood Observatory, etc. For drought, ministry of agriculture and farmer welfare, revenue departments of respective states, concerned KVK and Agricultural Universities, Department of economics and statistics, etc. NRSC's 100 year flood vulnerability index created for Indian railways may also be used where relevant.

3.7.3. Industrial and Chemical Hazards

Chief Inspector of Factories, Dept. of industries, Dept. of MSME, and other related depts. Also information from Ministry of Chemicals and fertilizers, Environmental Planning Agency (EPA) of USA may also be used.

3.7.4. Fires (Forest and Urban)

From Forest Survey of India (FSI), MODIS sensor data, information from the fire calls, etc. This information need to be cross verified with the ground trothing for arriving at the final data.

[5] Eidgenössische Technische Hochschule (ETH Zürich) https://ethz.ch/en.html

3.7.5. Change in Climate Variability

Downscaled models of regional GCPs coupled with IMD data for India, other studies conducted within the country like the 4x4 study by MoEFCC, etc.

3.7.6. Vulnerability indicators

Physical – Population exposure; buildings, critical and lifeline infrastructure

Population vulnerability: It is classified as intrinsic and extrinsic vulnerability. Intrinsic vulnerability is based on the attributes of the population (e.g., fragile age group, social status in the society, and access to resources) while extrinsic vulnerability is lack of capacity to resist the influence (often negative) from external processes (inundation during flood, loss of economic activities because of earthquake, etc.).

Building Vulnerability: The vulnerability of normal buildings is the potential of the building to be damaged in the event of the disasters expected in the region. This shall be assessed by *Level 1 Pre-Event Rapid Visual Screening (RVS)*. If the building stock is non-homogeneous, *Level 2 Pre-Event Detailed Visual Screening (DVS)* is required to understand the parameters that contribute to vulnerability, namely *Soil & Site Features*, *Architectural Form & Material Choices*, *Structural System*, *Construction Details*, and *Maintenance Quality*. These *Level 1 RVS* and *Level 2 DVS Assessments* shall be performed in accordance with the procedures approved by NDMA.

Strategic vulnerability assessment of key sectors including housing, health care, education, dams and reservoirs, communications, power, water supply, sanitation, transport – roads and bridges, electricity and emergency services

Social – access to education and health, gender, SC/ST population, single parent and elderly households, etc.

Economic - inventory of high risk economic centres, dependency of population on each economic sector, etc.

Environmental – biodiversity, ecology, coast, ghats, etc.

3.7.7. Capacity Indicators

Some proxy indicators are to be identified in consultation with NDMA and populate. Much of these indicators are to be collected from the State/District offices. Some of the indicators are: vacancy rate of key professionals at the State/District level, expenditure made by the state in previous years on DRR activities, level of implementation of the DRR/HRVA activities (defined in DRR documents) in State, literacy rate, level of poverty (and other resource constraints), etc. Some of the indicators can be generated from the Census of India, 2011 data.

3.7.8. Risk Indicators

How much investments have been made in the geographical areas, how much economy/GDP is generated from this geographical area, how many jobs are created/located in this area, etc. A detailed list can be evolved with stakeholder consultations.

3.7.9. Elements at risk database

The agency will be given a freehand to propose a methodology for creation of elements at risk database. A brief methodology of the same with pros and cons of each methodology may be presented in the technical proposal stage and a logic why a particular methodology is selected.

The list of indicators and sources of data indicated above are indicative and a detailed account may be finalized in consultation with NDMA.

3.8. Deliverables

3.8.1. **Multi-Hazard Atlas:** Showing the intensity scales of all prevalent hazards with varying return periods (to be finalized in consultation with NDMA). This contains a digital as well as a paper copy of the multi-hazard risk profiles on the scale – Life Threatening, High, Medium and Low Risks.

3.8.2. **Vulnerability Atlas:** Containing a digital as well as a paper copy of the vulnerability atlas showing building stock, distribution of population, economic activities, lifeline infrastructure, and other elements at risk and their vulnerability on a scale – Collapse, High Damage, Medium Damage and Low Damage.

3.8.3. **Risk Atlas:** Develop a methodology for risk indexing with multi-hazard risk profiles coupled with frequency and intensity, arriving at averaged annual cumulative risk index. This shall be examined and approved by NDMA, with due changes.

3.8.4. **Composite Risk:** Develop a methodology for arriving at a Composite Risk Index and develop a Multi-Hazard Risk Profiles atlas in paper as well as digital version. Based on the risk index, areas of strategic importance need to be listed and ranked to enable the administration to prioritise and select areas for risk reduction.

3.8.5. **Detailed list of recommendations:** for each of mitigation, preparedness and response need to be given. These recommendations need to be targeted at various ministries/departments, state/district/local governance, and may include the financial allocation for each. An existing institutional and techno-legal regime need to be kept under consideration while drafting the same.

3.8.6. **Capacity Building and Training Modules** for other States/Stakeholders.

Detailed capacity building and training modules for training/guiding other states to carry out this process. This training material may focus on increasing the capacity of the stakeholders to conduct a similar project for their own states.

3.8.7. **Improvement and Updation process:** A detailed methodology/note on how to improve and update the outcomes/outputs of the study to be provided as a hand-holding process.

Deliverables 3.8.1, 3.8.2, 3.8.3, 3.8.4, 3.8.5, 3.8.6 and 3.8.7 need to be depicted on a regular grid developed for this purpose, as explained in scope of the study, 3.4 on page 12. A detailed methodology for generating this grid may be included in the Technical Proposal stage.

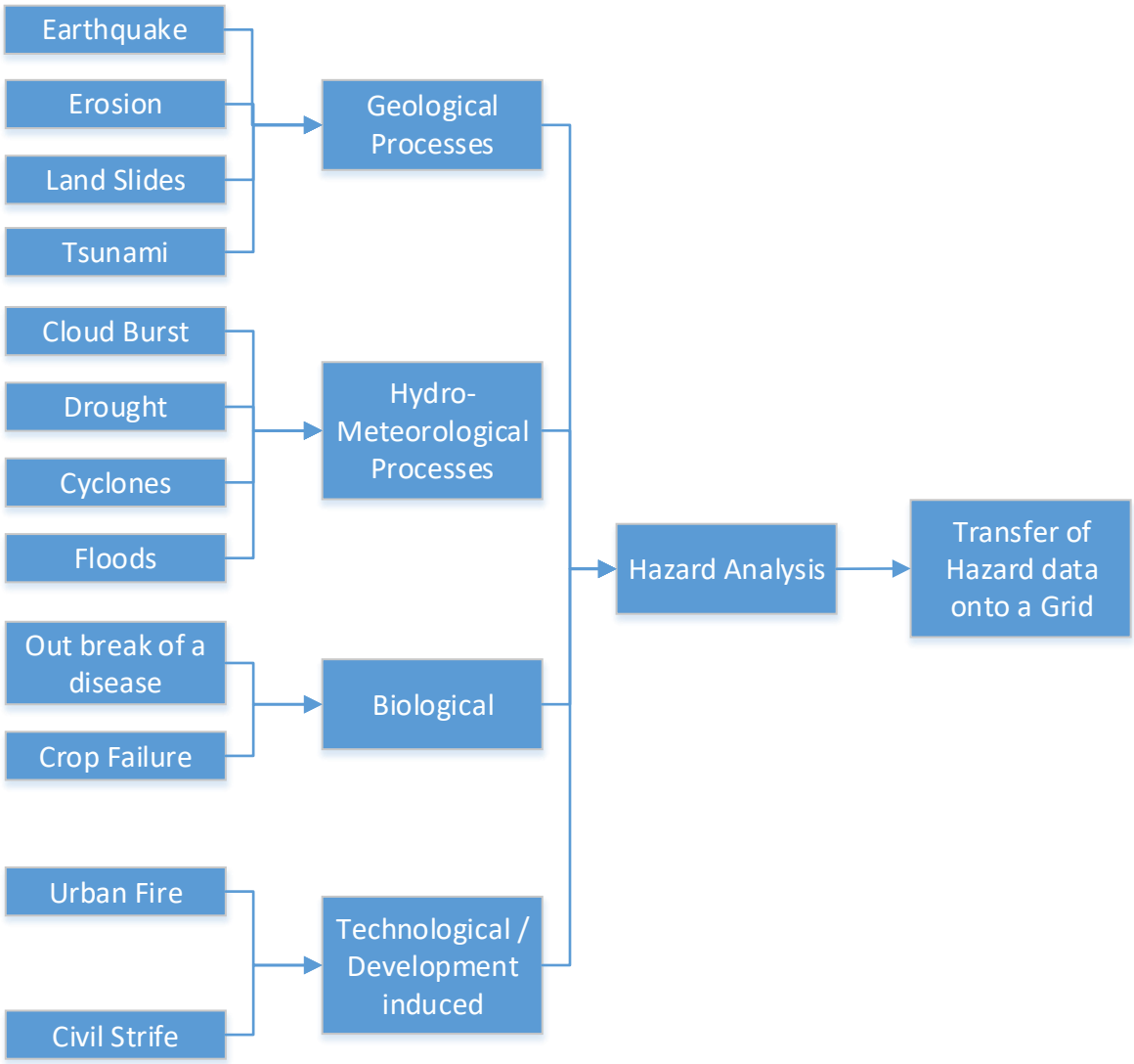

Figure 1 Conceptual framework for generating Hazard Footprints

4. Supervision & Reporting

NDMA will constitute an Expert Committee for reviewing the progress made in the project. Joint Secretary (Policy and Plan) from the NDMA will chair the expert committee. The Expert Committee and other senior officials of NDMA will review and guide all the Inception, Interim, Draft and Final reports. The Agency should attend the meeting of the Expert Committee, as and when needed regarding the project. The Agency will be required to revise the interim and draft reports based on the comments, suggestions and observations of the Committee/NDMA and submit the same to NDMA for acceptance.

It is also decided that in each State, a state level monitoring team will be engaged with SDMA officials and other experts. The selected agency will have to coordinate with that monitoring agency for state level data collection, stakeholder meetings and keep the monitoring team updated with the process of the work, along with the NDMA.

5. Expertise and Qualification for Selection of Agency

5.1. Qualifications of the Agency

a) The Agency must have experience of at least 2 similar projects of undertaking H-V-Risk profiling of a state, district, area or town/city in association with State or Central Governments or with private sector. Experience of carrying out study/projects with multiple stakeholders will be an added advantage.

b) The Agency should have a team of experienced professionals from the relevant fields related to the subject matter of the proposed study. The Agency should engage a complete team of professionals having expertise on, but not limited to, disaster management – hazard analysis, vulnerability assessment, risk assessment, risk communication, etc. In addition, with technical competence in the subject of *conversion of risk information into a policy document*. As the project aims at risk reduction and policy implications, an agency with such experience are encouraged to apply.

c) The team may contain (i) Hazard analyst – Seismic/Hydrologic/Geologic, etc., (ii) Statistician/Mathematic Modeller (iii) Hazard risk modeller, (iv) GIS expert and (v) Geologist/Sociologist, etc. This is an indicative list. This may be improved further. Detailed team composition will be given in the RfP.

5.2. Requirement for Submission of the EoI

a) The agency shall be of Indian ownership and have a GST registration.

b) The agency should be registered with the Central/ State Government.

c) The agency has not been debarred/blacklisted by any of the Govt. Institutions.

d) The agency should have minimum annual average turnover of ₹ 100 Lakhs (INR One Hundred Lakhs) for the last three years (i.e. from 2016-17 onwards). This may be exempted for research institutes (which are not academic institutes).

e) The Agency should not have incurred loss in any of the past three years.

6. Annexures

Annexure 1 PROFORMA FOR SUBMITTING INFORMATION FOR THE PURPOSE OF EXPRESSION OF INTEREST (EOI)

Multi-Hazard Vulnerability and Risk (MH-VR) Profiles for 2 States – Kerala and Mizoram

a) Name of the agency:
f) Address, Phone / Fax, E-mail:
g) Name and contact details of nodal officer for the work:
h) Year of establishment of agency:
i) Registration Details:
j) PAN No./ GST No.:
k) Self-Certification that they have not been debarred / blacklisted by any of the Govt. Institution
l) A brief write up of 200 words about the agency.
m) Year- wise annual turnover details for the last three years (i.e. from 2016-17 onwards) supported by certified copies of balance sheet and profit/loss account, if applicable (refer para 13.2(d) of EOI)
n) Documents in support of above and eligibility criteria mentioned in the Expression of Interest (EoI) may be submitted along with the EoI.

o) ***Team Composition:** CV of the Professionals may be submitted including following details :

Name of the Professional to be involved ***(optional)¥***	Designation	Educational and Professional Qualification & Specialization	Number of years of total work experience after professional qualification/ specialization	Number of years of experience in the relevant field
1	2	3	4	5

p) * List of completed and current projects of similar nature and brief description of the services performed. Proof of relevant experience to be submitted.

Name of the Client	Title of the Project	Sponsoring authority of the project	Cost of Project	Date of award of Project	Date of completion (In case of completed projects/status of ongoing projects)	Remarks/ Brief description of the services performed
1	2	3	4	5	6	7

* Additional sheets may be used to provide required details. ¥ Name of the professional may be optional for EoI

Annexure 2 TYPES OF DISASTERS AND HAZARDS

Table 2 Types of disasters and hazards

S.No	Broad disaster type		Specific disaster	Hazard
I	Water and climate related disasters	1	Floods and drainage management	Inundation, depth of water, velocity of water, duration of the inundation
		2	Cyclones/ hurricanes	Wind-speed, high waves, inundation caused by heavy rain
		3	Tornadoes	Shooting and falling objects
		4	Hailstorm	Damage caused by falling hail
		5	Cloud burst	Extreme rainfall, may cause flash flood, thunder/lightning bolt
		6	Heat wave and cold wave	Severe health impacts, damage to infrastructure, loss of working days
		7	Snow avalanches	Possible life loss, possible material loss, possible loss of transportation and other networks
		8	Droughts	Distress on agriculture and allied activities, health impact on people and animals
		9	Coastal erosion	Loss of soil, damage to roads or other infrastructure
		10	Thunder and lightning	Potential life loss, cause of injuries to humans and animals, loss to electrical appliances
		11	Tsunami	Potential inundation, damage to structures, potential life loss, damage to infrastructure
II	Geological related disasters	1	Landslides and mudflows	Potential damage to lives, infrastructure, ecosystem, transport networks
		2	Earthquakes	Damage to buildings, loss of life, damage to infrastructure, loss of working days, impact on economy
		3	Dam failures/dam bursts	Possible flash flood, inundation of large areas, damage to houses and infrastructure, possible life loss
III	Chemical, industrial and nuclear related disasters	1	Chemical and industrial disasters	Possible explosion, release of chemical gases, impact on health, Boiling liquid expanding vapour explosion (BLEVE), potential life loss
III	Chemical, industrial and nuclear related disasters	2	Nuclear disasters	Exposure to radiation, explosion and fire, burns and injuries, possible loss of life
IV		1	Forest fires	Loss of ecological diversity, loss of wild

	Accident related disasters			life, degradation in quality of air, poor visibility, loss of forest land
IV V	Accident related disasters Biological related disasters	2	Urban fires	Loss of life, damage to buildings, economic loss
		3	Mine flooding	Loss of life due to asphyxiation, contamination of soil and ground water, contamination of surface water by chemicals
		4	Oil spills	Possible contamination of food supply, loss of fauna, long term effects
		5	Major building collapse	Loss of life, potential damage to adjacent buildings, economic loss
		6	Serial bomb blasts	Damage to buildings, loss of life, civil unrest
		7	Religion/Festival related disasters	Civil strife, potential life loss
		8	Electrical disasters and fires	Life loss, loss of equipment/appliances, loss of work-days, damage to structures
		9	Air, road and rail accidents	Loss of life, disruption of traffic, loss to economy
		10	Boat capsizing	Loss of life
		11	Village fire	Loss to agricultural produce, damage to houses, potential life loss
		1	Biological warfare/disasters and epidemics	Potential loss of life, incidence of disease, exposure to pathogenic micro-organisms, exposure to toxins and bioactive substances, environmental degradation
V	Biological related disasters	2	Pest attacks	Damage to crops, economic losses
		3	Cattle epidemics	Loss of cattle, loss of food production, exposure to effected food, food poisoning
		4	Food poisoning	Loss of life, impact on health (long terms as well as short term)

Source: Modified from "The Report of the High Powered Committee on Disaster Management in India, National Centre for Disaster Management, Indian Institute of Public Administration.1999"

For further details, contact:

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