ASEAN REGIONAL RVA

Guidelines for the Implementation of an ASEAN Disaster Risk Index

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ACRONYMS

AADMER	ASEAN Agreement on Disaster Management and Emergency Response
ABS	Absolute value
AHA Centre	ASEAN Centre for the Coordination of Humanitarian Assistance
AMS	Association of Southeast Asian Nations (ASEAN) Member States
ASEAN	Association of Southeast Asian Nations
CHRR	Center for Hazards and Risk Research
CIESIN	Center for International Earth Science and Information Network
DMRS	Disaster Monitoring and Response System
DRG	Disaster Risk Governance
DRR	Disaster Risk Reduction
DRM	Disaster Risk Management
DRMC	Disaster Risk Management Capacity
EM-DAT	Emergency Events Database
ESA	European Space Agency
FAO	Food and Agriculture Organization of the United Nations
GAR	Global Assessment Report on Disaster Risk Reduction
GAUL	Global Administrative Unit Layers
GDP	Gross Domestic Product
GIS	Geographic Information Systems
GPW	Gridded Population of the World
HFA	Hyogo Framework for Action
IFRC	International Federation of Red Cross and Red Crescent Societies
LGSAT	Local Government Self Assessment Tool
LR	Lack of Resilience

MDG	Millennium Development Goals
MHE	Multi-hazard Exposure
MMI	Modified Mercalli Intensity
NDMO	National Disaster Management Organization
PDC	Pacific Disaster Center
RAA	Risk Assessment and Awareness
RAEWM	Risk Assessment, Early Warning and Monitoring
RVA	Risk and Vulnerability Assessment
SFDRR	Sendai Framework for Disaster Risk Reduction
SDG	Sustainable Development Goals
UN	United Nations
UNDP	United Nations Development Programme
UN-ISDR	United Nations International Strategy for Disaster Reduction
WG	Working Group
WRI	World Resources Institute

CONTENTS

1. INTRODUCTION

PURPOSE AND STRUCTURE

The purpose of this document is to provide high level guidance to the National Disaster Management Organizations (NDMOs) of Association of Southeast Asian Nations (ASEAN) Member States (AMS) on the implementation of a regionally consistent approach to Risk and Vulnerability Assessment (RVA) at the national level. It is not intended as a training manual.

The Guidelines comprise one of three documents related to ASEAN Regional RVA. The others include a summary for policy makers and a supplementary handbook containing additional detail and materials supporting RVA implementation within ASEAN. Auxiliary resources include an Excel template that will facilitate data management and calculation of the Societal Risk Index described in the Guidelines, as well as an exercise manual that leads users through several key steps of the assessment process.

It is assumed that users of these Guidelines have moderate familiarity with and access to Excel (or a similar spreadsheet program) and some form of Geographic Information Systems (GIS) software (e.g., ArcGIS or QGIS). All basic data management and analyses outlined here can be performed on a personal computer. However, the institutional and technical requirements associated with collecting, managing, storing, analyzing, and disseminating the underlying data are much greater. More advanced analyses will also require specialized software and technical capacity.

This document is made up of four major sections. The first provides background and outlines the general goals of the Regional RVA. The second describes the concepts and framework which underpin the Guidelines. The third highlights data that support analysis and decision making across multiple phases and communities of practice. The fourth outlines the data, methods, and specific calculations that will be employed in the construction of a Societal Risk Index.

BACKGROUND

RVA is recognized by the United Nations International Strategy for Disaster Reduction (UN-ISDR) as one of the most important elements of long-term Disaster Risk Reduction (DRR) and Disaster Risk Management (DRM). RVA is prominent in the Hyogo Framework of Action (HFA) 2005-2015 and further emphasized in the Sendai Framework for Disaster Risk Reduction (SFDRR). Within the regional context, the former recommends “development of methodologies and standards for hazard and vulnerability monitoring and assessment” and “undertaking and publishing regional and sub-regional baseline assessments.” Regional contributions related to coordination and guidance are also highlighted in the Sendai Framework. The Sendai Framework emphasizes the importance of collecting, managing, sharing, analyzing, and applying appropriate risk information for improved decision making and outcomes and shifts focus to addressing the multi-dimensional drivers of risk.

Affirming ASEAN’s commitment to the Hyogo Framework of Action (HFA) for disaster risk reduction, the ASEAN Agreement on Disaster Management and Emergency Response (AADMER) sets “a regional

framework for cooperation, coordination, technical assistance, and resource mobilization in all aspects of disaster management."[1] This agreement was ratified by all ten (10) Member States and entered into force on 24 December 2009. In AADMER, risk assessment is viewed as a necessary step in identifying risks, devising mitigation strategies, and ultimately reducing disaster losses. Highlighted here are a few specific Articles of AADMER to help demonstrate the policy background and rationale for the approach.

AADMER Article 2 establishes the objective of the Agreement "to provide effective mechanisms to achieve substantial reduction of disaster losses in lives and in the social, economic and environmental assets of the Parties" while Article 3.4 clearly prioritizes "prevention and mitigation." These two Articles provide the context for Article 4.a, which sets "identification of disaster risk" and "development of monitoring, assessment and early warning systems" as explicit General Obligations of the Parties.

AADMER Part II, Article 5.1, specifically outlines responsibilities related to risk identification and assessment: identifying hazards, conducting risk assessment, and monitoring vulnerabilities and disaster management capacities. While these assessments are of primary benefit to the Member States themselves, AADMER highlights regional responsibilities as well. For example, in section 5.3, each Party (AMS) is to "ensure that its National Focal Point, at agreed regular intervals, communicates the above information" to the authorities designated by the Agreement. Finally, in section 5.4, the Article highlights consolidation and integration of the results, while considering the need to "conduct analysis on possible regional-level implications," which would also benefit AMS. HFA and Article 5 of AADMER motivate development of regionally consistent national level assessment guidelines to help establish consistent methodologies, methods, measurements, and data that can facilitate decision making at both the national and regional levels.

[1] http://www.asean.org/resources/publications/asean-publications/item/asean-agreement-on-disaster-management-and-emergency-response-aadmer-work-programme-2010-2015-4th-reprint

PART II. DISASTER RISK IDENTIFICATION, ASSESSMENT AND MONITORING

Article 5

Risk Identification and Monitoring

1. Each Party shall take appropriate measures to identify disaster risks in its respective territories covering, among others, the following aspects:

a. natural and human-induced hazards;

b. risk assessment;

c. monitoring of vulnerabilities; and

d. disaster management capacities.

2. The Parties shall assign risk levels to each identified hazard according to agreed criteria.

3. Each Party shall ensure that its National Focal Point, at agreed regular intervals, communicates the above information to the ASEAN Co-ordinating Centre for Humanitarian Assistance on disaster management, hereinafter referred to as "the AHA Centre", established in accordance with Article 20 of this Agreement.

4. The AHA Centre shall receive and consolidate data as analysed by and recommendations on risk level from the National Focal Points. On the basis of such information, the AHA Centre shall disseminate to each Party, through its National Focal Point, the analysed data and risk level arising from the identified hazards. The AHA Centre may also, where appropriate, conduct analysis on possible regional-level implications.

In order to help implement AADMER's spirit and intent of risk reduction, ASEAN defined a concrete set of actions and initiatives in the AADMER Work Programme 2010-2015. The Work Programme, launched in 2010, recognized Risk Assessment, Early Warning and Monitoring (RAEWM) as one of four (4) strategic components for the implementation of AADMER, and assigned a Working Group (WG) to help prioritize related activities and milestones. The working groups established for all strategic components then evaluated their respective areas, agreed on major milestones, and a series of "flagship" projects and activities were identified. Regional risk and vulnerability assessment (RVA) was one of two (2) priority projects for which the RAEWM WG had responsibility. One key objective was to develop a set of guidelines for the implementation of regional RVA. Risk assessment continues to be a priority under the recently adopted AADMER Work Programme 2016-2020; the name of the Working Group has been changed to Risk Assessment and Awareness to match the language and focus of the new document.

A series of activities was undertaken to begin making progress on technical and institutional requirements for regional risk assessment. These included a regional Risk Assessment Scoping Workshop; development of a Disaster Terminology document; publication of the ASEAN Strategy on Disaster Risk Assessment; a Capacity Building Forum on Risk Assessment; a Regional Workshop on Disaster Database and Information Sharing; and a number of technical activities such as initiation of the ASEAN Earthquake Model.

The results of the Scoping Workshop and other early activities, as well as the results of an initial desk study, were presented in the Formalization and Coordination Workshop on RVA Guidelines, in April 2015, in Phnom Penh, Cambodia. This workshop helped to reaffirm the purpose and the goals, to reach

consensus on key themes and priorities, and to establish the principles for the guidelines. The Formalization Workshop also served as a conduit to gather more complete information on capabilities, constraints, and priorities related to data, methods and tools, applications, and institutional mechanisms. The Formalization Workshop, in addition to surveys and a desk study, provided inputs to a gap analysis.

The gap analysis was used to develop preliminary recommendations on the approach, data, outputs, and institutional mechanisms required to implement a reasonable, useful, and consistent RVA. The gap analysis and preliminary recommendations were presented at a second Workshop on Regional RVA Guidelines. This provided an opportunity to gather additional input from AMS, the AHA Centre, the ASEAN Secretariat, and other regional stakeholders on constraints, practices, and priorities. Representatives of NDMOs from all AMS but Singapore participated in at least one of the workshops. Most attended both.

Guidelines in this document were developed considering input from all of the above activities and participating bodies.

GENERAL GOALS

The purposes and goals of the Regional Risk Assessment were captured in the ASEAN Strategy on Disaster Risk Assessment and confirmed at the Formalization Workshop.

At the regional level, these included:

- Supporting cross-boundary response planning;
- Helping to anticipate potential impacts and relative ability to cope at the national level;
- Helping to identify high risk areas; and
- Supporting cross-boundary risk governance initiatives.

At the national level, these included:

- Providing a starting point for national assessment and disaster risk information initiatives;
- Helping to anticipate potential impacts and relative ability to cope at the subnational level; and
- Supporting prioritization and resource allocation.

At the community level, the identified purpose was to encourage consistent and actionable local-level assessments.

RESOURCE ALLOCATION MUST ADDRESS MORE THAN RESPONSE

NDMOs are the primary audience for these guidelines. At the national level, “supporting prioritization and resource allocation” is conceived of broadly, applying to planning and implementation activities in all phases of Disaster Risk Management and across communities of practice. RVA is seen as a means by which to enhance decision making processes and outcomes by facilitating access and application of relevant information. Information deemed “relevant” or “high priority” for decision makers spanned physical, social, economic, institutional, and environmental dimensions.

2. CONCEPTS AND FRAMEWORK

RISK ASSESSMENT

UN-ISDR has defined risk assessment as "A methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend." Risk assessments, and associated assessments of exposure, vulnerability, and various capacities provide evidence for decision making when considering mitigation and development strategies, and when planning and implementing preparedness, response, and recovery activities. The risk and vulnerability assessment (RVA) process focuses attention on areas most in need by evaluating to what extent mortality, economic losses, general disruption, and secondary impacts may occur.

Data and results obtained during the risk assessment process can help identify service and infrastructure gaps, develop realistic exercise scenarios, deliver appropriate help to those who are likely to need it most, serve as a baseline for monitoring development and recovery activities, and identify the most effective structural and non-structural mitigation measures. The RVA process provides context and visibility, and can help describe how future events might unfold and what intervention points might be most effective in reducing losses and suffering.

Disasters can be defined in a variety of ways and depend on the level of analysis. What is a disaster for a community may not greatly affect a nation as a whole. At the most basic level, disasters are the result of a hazardous set of conditions coming into contact with a set of elements that are susceptible to negative impacts associated with that hazard. For communities or societies, disasters occur when impacts cause disruption that cannot be addressed through internal capacities. Figure 1 provides a basic illustration of the components of disaster. The risk and vulnerability assessment process may examine each of these components individually and then in combination.

In general, the assessment process may include:

- Review of the location, intensity, frequency, and probability of hazards to which the region or community is susceptible;
- Analysis of exposure and vulnerability including the physical, social, health, economic, and environmental dimensions;
- Evaluation of the effectiveness of prevailing and alternative coping capacities in respect to likely risk scenarios[2]; and
- The potential losses and patterns of disruption that will ultimately drive mitigation strategies and priorities, and what AMS should plan for in order to address future disaster impacts.

[2] Adapted from ASEAN Disaster Terminology document and UN-ISDR Terminology on Disaster Risk Reduction: http://www.unisdr.org/we/inform/terminology

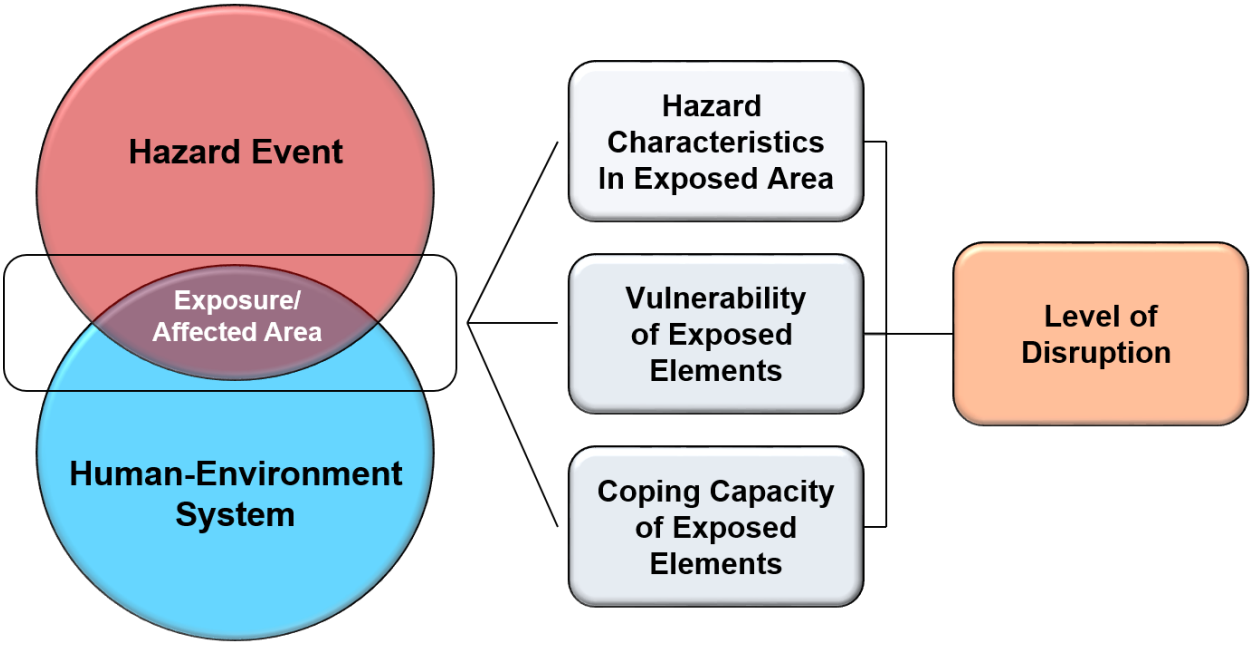


Figure 1: Basic components of disaster

However, there are a broad range of assessment types, from qualitative profiling to sophisticated loss-estimation analyses; each requires a different level of input and technical capacity. Assessments can be performed for facilities, systems, sectors, or communities. Which approach is chosen depends largely on the purpose and constraints. An RVA may include phases, where the phase 1 effort is broad and helps identify priorities or focus-areas for additional phases of work. Before launching an RVA effort, a planning stage can be used to assess resource and data availability, as well as to determine the goals and intended applications of the RVA and to develop a realistic and feasible approach.

Three basic types of assessments are outlined below.

Probabilistic. This approach generally requires the most significant level of effort, incorporating a systematic and comprehensive quantitative methodology that considers the possible combinations of event occurrences with associated consequences, each with an associated probability[3]. The results of a probabilistic assessment are commonly applied to cost-benefit analyses and other specific financial evaluations. Probability data and associated analyses can be adapted to multiple timeframes (e.g., annual or the lifetime of a proposed improvement project), and so are very flexible in their application. Probabilistic RVA can be challenging since hazard frequency or intensity data may not be comprehensive and often represent relatively small timeframes, introducing significant uncertainty. Additionally, localized exposure databases and damage relationships may not be developed. Methods are available to

[3] Adapted from ASEAN Disaster Terminology document and US Department of Homeland Security Risk Lexicon, 2010 Edition: https://www.dhs.gov/xlibrary/assets/dhs-risk-lexicon-2010.pdf

incorporate uncertainty into the results and provide a potential range of losses. Depending on the application, the level of effort may be warranted.

Scenario Based. This type of RVA typically incorporates a "what-if" scenario. The scenario might be based on a historical event or selected based on probabilistic analysis. Scenario based assessments are most often applied within exercise or planning contexts. Inputs and outputs of scenario based assessments are generally understood by a wide range of stakeholders. When realistic and sound scenarios are selected, the information is widely applicable; there are frequent cases where the "what if" scenario occurs and the estimated impacts become real. Scenario based RVAs also help address data gaps. For example, where a small incomplete set of historic events does not support evaluation of frequency or implementation of a probabilistic analysis, a single event is all that is needed for an actionable scenario based RVA.

Composite Index. Composite indices are created by selecting sets of variables that represent general concepts (e.g., access to information, health status, or strength of governance). The individual variables, or "indicators," are then scaled to a standardized value range (e.g., 0-1 or 1-100) so they can be mathematically combined into a relative measure of the theme of interest. Composite indices can be created at multiple levels (e.g., household, community, province, country) and are generally used for unit comparisons within a specific context. While the approach has limitations and is not used for precise financial decisions such as cost-benefit analyses or insurance schemes, composite indices can help make contextual information more visible within decision making processes and facilitate monitoring, comparison, communication, and the prioritization of investment. When disaggregated, composite indices enable the potential drivers behind similar final "scores" to be examined.

DEVELOPING THE FRAMEWORK

Deciding on the specifics of an approach to RVA can be challenging. Figure 2 illustrates the major considerations in the decision making process. Each choice affects what options are available at the next stage. These Guidelines represent the result of a collaborative process and address each of the considerations depicted below, at least in part. The goals and participants in the process were outlined in Section 1. Scale and resolution, the conceptualization of risk, as well as basic methods and outputs selected are discussed below. Additional information on data, analysis methods, reporting, and interoperability are discussed in more detail in subsequent sections.

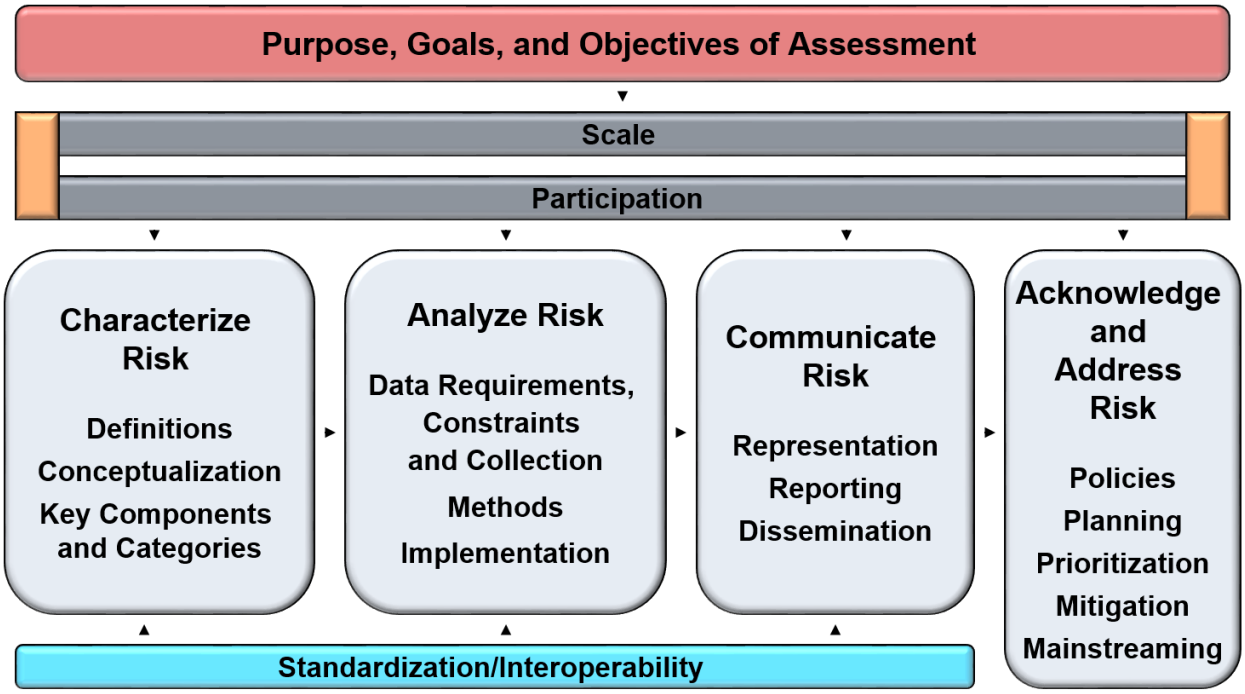


Figure 2: Risk assessment roadmap

SCALE AND RESOLUTION

While it was decided that data would be collected at the finest feasible resolution, data will be aggregated for analysis and reporting at the provincial level (or equivalent Level 1 administrative unit). In the initial stages of implementation, as AMS are developing subnational data and analyses, it is recommended that the AHA Centre leverage the outputs of global assessments, such as those developed for the UN-ISDR Global Assessment Report on Disaster Risk Reduction (GAR), which are generally aggregated at the national level.

DEFINITIONS

Risk, vulnerability, and other terms associated with RVA are often used inconsistently, which can make communication challenging. An overview of key terms is included as Table 1. Definitions are taken from the Disaster Terminology document included as part of "From Risk to Resilience: ASEAN Strategy on Disaster Risk Assessment." Full comments on all terms included here can also be accessed through UN-ISDR at http://www.unisdr.org/we/inform/terminology.

Table 1. Overview of key terms

Key Term	Working Definition
Coping Capacity	The ability of people, organizations and systems, using available skills and resources, to face and manage adverse conditions, emergencies or disasters.
Disaster	A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources.
Disaster Risk	The potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period.
Disaster Risk Management	The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster.
Disaster Risk Reduction	The concept and practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.
Exposure	People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses.
Hazard	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.
Resilience	The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.
Risk Assessment	A methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend.
Vulnerability	The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.

Another important concept that was not initially defined by UN-ISDR or included in the ASEAN Disaster Terminology document is disaster risk governance (DRG). In these Guidelines, we adopt the definition put forth by the UN Development Programme (UNDP) Bureau for Crisis Prevention and Recovery in 2013: “the way in which public authorities, civil servants, media, private sector and civil society coordinate at community, national and regional levels in order to manage and reduce disaster- and climate-related risks. This means ensuring that sufficient levels of capacity and resources are made available to prevent, prepare for, manage and recover from disasters. It also entails mechanisms,

institutions and processes for citizens to articulate their interests, exercise their legal rights and obligations and mediate their differences.[4]"

CONCEPTUALIZATION

AADMER highlights four components requiring identification and analysis: hazards, risk, vulnerabilities, and disaster management capacities. Disaster risk is conceived of as a function of hazard exposure, vulnerability, and coping capacity, which is closely associated with a traditional conceptualization of disaster management that highlights response and recovery activities. However, over the 10 years of implementing the HFA and developing the Sendai Framework, emphasis has increasingly been placed on the policies, programs, and institutional mechanisms that enable coordinated, flexible, multi-dimensional means of enacting interventions that more effectively reduce hazard exposure and vulnerability, improve capacity, and increase overall resilience. DRM and DRR are made possible through good risk governance.

In order to be consistent with current guidance documents inspired by the HFA (such as SFDRR), it is proposed that the Disaster Management Capacity component instead be identified as Disaster Risk Management Capacity. This change perhaps better highlights the relationship of DRR and DRG to risk outcomes. It is these aspects which, in part, enable adaptation and the enhancement of adaptive capacity, critical in an increasingly dynamic and uncertain riskscape.

In these Guidelines and associated documents, risk will be treated in two ways: 1) as physical risk that emphasizes impacts in terms of economic losses and deaths, and 2) societal risk, which highlights the social, economic, environmental, and institutional factors that could increase the likelihood of disruption and secondary impacts. This document focuses on the representation and assessment of relative societal risk. Societal vulnerabilities and capacities will be considered hazard independent.

Because of differences in data constraints, reporting requirements, and relevant communities of practice, the Vulnerability component will focus on information that also supports what are traditionally looked at as "development" activities and associated monitoring. The Disaster Risk Management Capacities Component will emphasize the risk governance, risk management, and risk reduction connection, but will also include information primarily associated with response and short term recovery. This will facilitate reporting associated with DRR related frameworks such as HFA and the Sendai Framework.

The first component enables monitoring of conditions that may reduce or exacerbate impacts. The second enables monitoring of mechanisms that may change these conditions for the better and support successful adaptation. Together, they enable tracking of overall resilience.

Key thematic categories related to societal risk are outlined in Figure 3. Eight hazards were prioritized by regional stakeholders: floods, tropical cyclones, earthquakes, landslides, tsunami, volcanos, land and forest fire, and drought. While population exposure is highlighted in the treatment of societal risk,

[4] http://www.preventionweb.net/files/29974_20121311issuebriefdisasterriskreduc.pdf

discussions of exposure estimation and related estimations of physical impacts and associated risk will include additional elements of interest that were prioritized by AMS.

GENERAL METHODS

Requirements for monitoring and analyzing both vulnerability and disaster risk management capacity will be addressed using a composite index approach. Societal risk will also be described through a composite index approach. With regards to physical risk, the Guidelines will focus on intermediate steps of estimating exposure through geospatial analysis while AMS develop probabilistic hazard information and relevant fragility curves and damage relationships. Suggestions are made regarding global and regional resources that can facilitate estimation of hazard exposure and physical risk. While some data resources may not be appropriate for use at the local level, they can serve to aid prioritization and provide a generalized view.

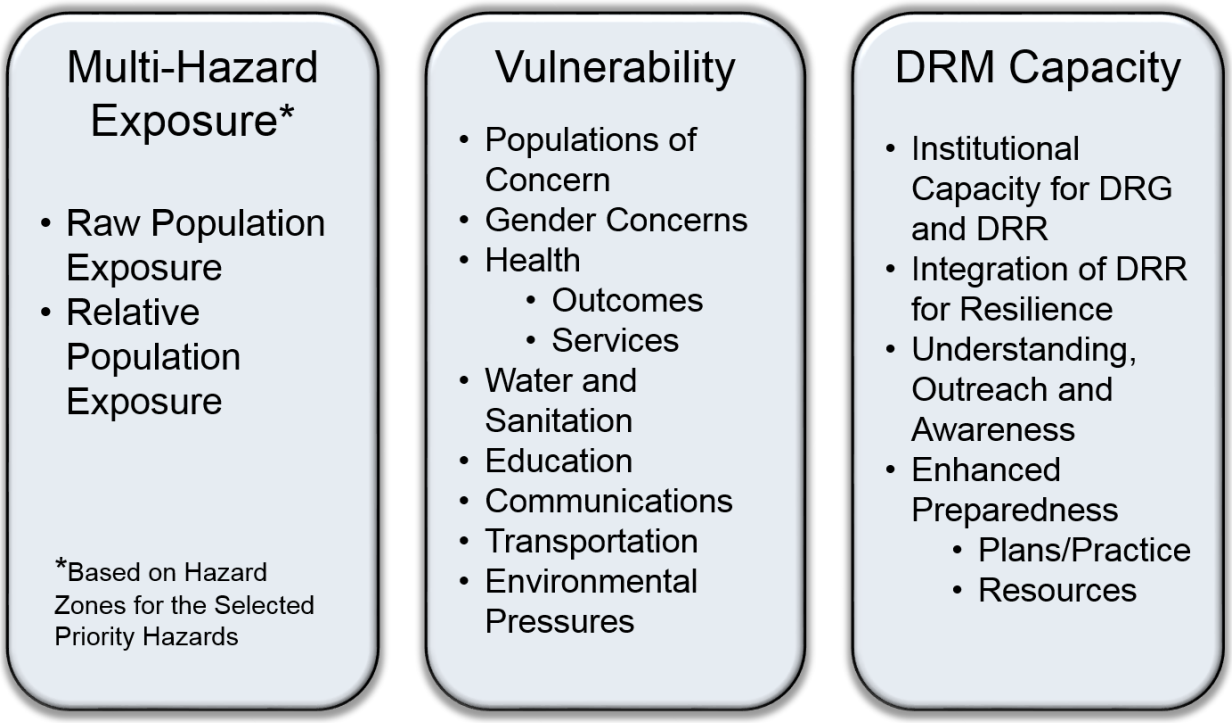


Figure 3: Key thematic categories for examining societal risk

REPRESENTATION AND REPORTING

Geospatial outputs were considered particularly useful by stakeholders. Provinces (or equivalent Level 1 administrative units) were deemed the most appropriate unit of mapping and tabular reporting given data constraints and goals. Tabular data can be further manipulated to produce graphs and charts, if desired. For Vulnerability and Disaster Risk Management Capacity components, outputs include maps and geo-referenced tables of high level component indices. NDMOs and others may also want to make use of thematic indices and raw data as well. For physical risk estimation, where feasible, outputs would include maps and tables of average annual losses (both total and as proportion of GDP) and deaths

(total and as proportion of population). These latter outputs support monitoring related to targets outlined in the Sendai Framework. Regional reporting guidance and supporting materials are included in the Supplemental Implementation Handbook.

3. DATA SUPPORTING DECISION MAKING AND ASSESSMENT

Data provide evidence for decision making. This section highlights some of the key data that support multiple types of disaster-risk-related analyses, including the construction of the Societal Risk Index outlined in these Guidelines. In general, disaster-related assessment and decision making requires three types of information: information on hazards, information on elements or assets of interest that may be exposed to those hazards, and information on how susceptible those elements are to impact and how well they may be able to resist, cope, and recover. Information on historical events and impacts can be useful in understanding and validating relationships between hazards, exposure, vulnerability, and capacities.

The data categories listed here have been prioritized by AMS based on relevance to high-level disaster risk management decision making, flexibility in application, consistency with AADMER requirements and practical frameworks such as the UN Cluster Approach, and consistency with other development data collection and monitoring efforts such as the Millennium Development Goals and Sustainable Development Goals (MDG, SDG). Political and technical constraints were also considered. A discussion of historical disaster data and its application is included in the Supplemental Implementation Handbook.

These recommended data are intended as a base for the region. The needs and capacities of each AMS vary; an AMS may want to add datasets of particular interest. Since conditions change, it is also recommended that the RAA Working Group revisit the Guidelines and the data recommendations at regular intervals. The Guidelines and associated materials are intended to be living documents.

HAZARD DATA

Regionally, eight hazard types were prioritized for data collection and analysis. These include floods, tropical cyclones, earthquakes, landslides, tsunami, volcanos, land and forest fire, and drought. Data on each of the relevant hazards of interest, including the frequency, spatial delineation, and severity of the hazard, are key components of an RVA. However, not all AMS are affected by every hazard. Since developing detailed hazard data can be resource intensive, it is recommended that each AMS prioritize hazards that have the greatest potential impact and work from there. Initial prioritization can be based on a combination of historical records (global and/or local) and global assessments such as the GAR.

Ideally, hazard data are spatially referenced and include information on how likely it is that a particular hazard will affect an area (probability); how severe the hazard will be (magnitude or intensity); the geographic extent of the affected area; and conditions in the region that may increase or reduce the effects of hazards. These elements are closely related, and are often combined in expressions linking probability (or frequency) and magnitude (or extent). Probabilistic hazard data are the “gold standard” since they facilitate more advanced analysis, enable comparison across time periods, and make it easier to compare one area to another.

In many cases, however, not all of this information is available. At minimum, a record of historical occurrences of various hazards should be maintained. These data can support a basic hazard profile and preliminary estimates of probability, if the period of record is relatively long and events are linked to administrative units. Low probability events are likely to be missed, however. Disaster databases such as the Emergency Events Database (EM-DAT) and DesInventar serve this purpose at global and national levels. Related data and applications are discussed in the Supplemental Implementation Handbook. This basic information can be augmented in a number of ways, including through the identification of spatial "hazard zones."

Many AMS do not have consistent, probabilistic, spatialized hazard data for all hazards that affect them. However, some global and regional datasets, such as those developed for the GAR 2013 and 2015 may help augment data limitations. These should be used with caution, as they are generally not appropriate for localized planning and may pose challenges for basic unit comparisons if Level 1 administrative units are small. Regardless of the limitations, though, these data do provide a useful starting point for comparative assessments. For AMS that do not have access to more tailored spatial datasets, those included in Table 2 might be used for initial representations of various hazards. These datasets can then be leveraged to create regionally consistent hazard zones when estimating multi-hazard exposure for inclusion in the Societal Risk Index.

Table 2. Hazard data and initial global sources

Hazard Type	Associated Data	Recommended Initial Global Source(s)
Floods	Modeled extents for riverine flooding with return periods up to 500 years	World Resources Institute (WRI) Aqueduct Global Flood Analyzer 2015, GAR 20015
Tropical Cyclone Winds	Wind speeds for return periods up to 500 years	GAR 2015
Earthquakes	Parameters (spectral acceleration, peak ground acceleration) that can be converted to MMI for return periods from 475 to 2475 years	GAR 2015
Tsunami	Estimated extent of run-up with a return period of 500 years	GAR 2015
Volcanoes	Locations of active Holocene volcanoes with buffers of 10 km, 30 km, 100 km	Smithsonian Global Volcanism Program, GAR 2015
Landslides	Landslide hazard estimated using the Norwegian Geotechnical Institute (NGI) method	GAR 2013, Center for Hazards and Risk Research (CHRR) and Center for International Earth Science and Information Network (CIESIN) at Columbia University 2005
Land and Forest Fire	Historical Fire Density	GAR 2013, European Space Agency (ESA) World Fire Atlas (raw data by year)
Drought	Meteorological drought of below 50% of median precipitation for 3 months	GAR 2013, CIESEN 2005

Links to Sources:
GAR 2015 - http://risk.preventionweb.net/capraviewer/download.jsp?tab=11&mapcenter=0,2965169.792775&mapzoom=3
WRI 2015- http://www.wri.org/resources/maps/aqueduct-global-flood-analyzer
GAR 2013 - http://preview.grid.unep.ch/index.php?preview=data&lang=eng
CHRR and CIESIN 2005 - http://sedac.ciesin.columbia.edu/data/sets/browse
Smithsonian - http://volcano.si.edu/
ESA World Fire Atlas - http://due.esrin.esa.int/page_wfa.php

ELEMENTS OF INTEREST

Information about what might be exposed to the effects of a hazard event is critical to decision making in all phases of disaster risk management. Population is the most important element of interest and is the primary measure of exposure used to construct the Societal Risk Index. However, AMS also prioritized seven other general categories of assets for data collection. These data will help support estimations of physical risk described in more detail in the Supplemental Implementation Handbook.

In order to estimate exposure and apply this information quickly to preparedness, response, and recovery contexts, data must be spatially referenced. Data on the key elements of interest can be either aggregated to a geographic region, common for population data, or assigned a specific location or point on the map, as with essential facilities or lifelines.

In order to better model physical damage in subsequent analyses, building and construction characteristics should also be captured where appropriate and feasible. Construction information is critical to assessing the vulnerability of building stock, and size is used in estimating replacement value or the value at risk. Occupancy information is useful in assessing where populations may be working, going to school, or residing at different times of the day, as well as more accurately defining buildings and content value based on use.

Table 3 outlines recommended data and rationales. It is understood that not all of the data may be able to be easily obtained. Aside from location information, type is the most important attribute for non-population elements. However, if collecting data through site visits or surveys, much of this supporting information may be gathered at the same time.

Table 3: Recommended data and rationale

Asset Category	Rationale	Associated Data
Population	People are the most important element of interest. Reducing suffering, loss, and inequitable distribution of impact is the purpose of DRM.	• Households • Disaggregated by: Gender Age Disability
Agriculture (Key Crops and Livestock)	Agriculture supports livelihoods; exposure may result in cascading economic impacts including hunger and economic instability. Susceptibility can depend of timing of the harvest in relation to relevant hazards. For example, flooding late in the cycle results in far more significant crop value exposure than exposure early in the planting cycle.	• Critical Food Crops • Key Commercial Crops • Livestock • Aquaculture • Land Use/ Land Cover Data • Attributes: Type Value Harvest Cycle
Health Facilities	Critical to the community's ability to provide assistance to the sick and injured and to provide preventive health services.	• Attributes: Health Providers Services Beds Building Characteristics
Schools	Frequently used as shelters, points of distribution for disaster aid, or as meeting places after events. In addition, vulnerable school-age populations are concentrated in these locations.	• Attributes: Number of Students Facilities Building Characteristics

Asset Category	Rationale	Associated Data
Government Facilities	Continuity of governance is a critical aspect of the post-disaster environment.	• Attributes: Function Building characteristics
Transportation	Critical to evacuation and delivery of services before, during, and after an event.	• Roads Type Construction • Railroads • Ports Capacity Depth • Airports Runway Characteristics
Water and Sanitation Infrastructure	Lives and livelihoods depend on access to clean water. Disruption or contamination of water and sanitation systems may have wide-ranging impacts before, during, and after and event.	• Wells and Storage Facilities • Treatment Facilities • Distribution System
Communications Infrastructure	Communications infrastructure facilitates the exchange of information before, during, and after an event. It is also a critical part of monitoring and early warning systems.	• Relay Facilities • Broadcast Facilities

While these categories were prioritized, AMS may also want to include other critical infrastructure such as energy delivery systems, police and fire stations, levee and dam systems, or other facilities with a high potential for loss and/or the failure of which could result in cascading impacts. Additional characteristics of a population (such as ethnicity or marginalization) or facility type may also be of particular importance to decision making in individual AMS.

In discussions, information about general building stock was thought to be important, but few AMS had state-specific information available to them. There are, however, global alternatives that can help fill a need while more refined local data are being developed. The Global Exposure Database, developed for use as part of the Global Earthquake Model and applied for the GAR, is an open building and population inventory that includes generalized structural and occupancy information and some reconstruction costs at a 5km grid (1km in some areas). While developed for probabilistic earthquake modeling, it can be adapted for other hazards and purposes.

DATA FOR MONITORING VULNERABILITY

The data described in the previous two sections is critical to determining potential physical impacts and losses associated with a hazard event. This section outlines data supporting the identification, analysis and monitoring of multi-dimensional vulnerabilities that can increase the likelihood of disruption and make it more difficult for communities to cope and recover. These data are associated with development objectives and monitoring programs and can support multiple communities of practice. Because of differences in data type, availability, and reporting requirements, Disaster Risk Management Capacity is treated separately.

Table 4 outlines general vulnerability categories, rationale, and associated data.

Table 4: Vulnerability subcomponent themes

Vulnerability Categories	Rationale	Associated Data
Populations of Concern	Represents populations who may need more tailored interventions prior to an event or specific arrangements during mass care operations (e.g., sheltering, health care delivery). These groups may be excluded from and/or overlooked in mitigation and preparedness planning and subsequent response and recovery activities. Where marginalized, may be less likely to have their needs met under "normal" conditions, and therefore become more susceptible to harm during times of disaster. Exclusion also limits the pool of ideas from which effective innovations emerge.	• Children and Elderly • Disabled Population • Population in Poverty (National Measure)
Gender Concerns	Represents gender-based differences in access to resources, services, opportunities, and formal economic and political structures. As with other populations, women may be excluded from and/or overlooked in mitigation and preparedness planning and subsequent response and recovery activities. Here, gender inequality focuses on inequalities in male/female representation in government and formal employment. Additionally, early pregnancy can limit opportunities among young women with primary caregiving responsibilities.	• Proportional Representation in Local Government • Ratio of Female to Male Labor Participation • Adolescent Fertility Rate

Vulnerability Categories	Rationale	Associated Data
Health: Outcomes	Reflects the population's general health as an outcome of multiple factors (e.g., health care processes and practices, physical and socio-economic environments). Poor health contributes to increased susceptibility to injury, disease and stress associated with disasters and may complicate activities like evacuation.	• Undernourishment • Under 5 Mortality • Maternal Mortality
Health: Services	If the availability of skilled caregivers and dedicated facilities is limited, timely and effective treatment of sickness and injury is less likely, potentially leading to increased casualties and financial burden, before, during, and after an event.	• Number of Physicians per 10,000 People • Number of Nurses and Midwives per 10,000 People • Hospital Beds per 10,000 People
Water and Sanitation	Represents the general state of water-related infrastructure. Poor distribution and containment systems contribute to poor water quality (and associated potential for spread of disease) and increased labor required to fill basic household needs (limiting resources available for other activities that would reduce susceptibility to impact).	• Access to Improved Sanitation • Access to Improved Water Source
Education	Education contributes to the ability to access and comprehend hazard and disaster related information before, during, and after an event. Limited familiarity with somewhat technical information will also constrain decision making. Access to education may also help increase and diversify skill sets and opportunities for individuals and countries before and after a hazard event. Schools can serve as platforms for outreach and behavior modification and enrollment measures can help establish baselines for response and recovery activities.	• Adult Literacy • Gross Enrollment Ratio • Secondary Completion

Vulnerability Categories	Rationale	Associated Data
Communications	Represents the communications infrastructure available to exchange and access information before, during, and after an event and to support coordinated action among local, national, and international actors.	• Mobile Phone Subscriptions • Internet Users • Fixed Broadband Subscriptions
Transportation	Represents the ability to physically access and distribute goods and services before, during, and after an event. Denser transportation networks provide more options for bringing outside resources into an area (ports and airports) and increase the likelihood of alternate routes for reaching or evacuating impacted populations.	• Distance to Port or Airport • Density of Roads and Railroads
Environmental Pressures	Rapid changes in the size and distribution of a population are more difficult to plan for and can destabilize social, economic, and environmental systems. In addition to altering patterns of exposure, the resulting mismatches in needs, existing institutional structures, and available resources can diminish resource quantity and quality and strain infrastructure and service delivery before, during, and after an event. Environmental stressors such as deforestation can degrade habitat and reduce quantity and quality of resources required to maintain human health and livelihoods. Additionally, these stressors increase the likelihood and magnitude of hazards such as flooding, landslides, and subsidence and can exacerbate impacts.	• Urban Population Change • Change in Forest Area

In most cases, these data will exist in tabular format as part of a National Census, or in the data stores of relevant ministries. Data are available at the national level of aggregation for almost all AMS. For some datasets, additional sampling may be required for provincial-level estimates. The primary challenge may be in NDMOs obtaining existing data from other agencies or organizations. A section in the Supplemental Implementation Handbook addresses some of these challenges.

DATA FOR MONITORING DISASTER RISK MANAGEMENT CAPACITY

AADMER highlights the capture and monitoring of Disaster Management Capacities in Article 5. As previously mentioned, in order to be more consistent with current language and more overtly highlight aspects of DRR and DRG, these Guidelines will reference Disaster Risk Management rather than Disaster Management. At the national level, many AMS have completed and submitted the HFA Monitor. However, understanding disaster risk management capacities at the provincial and district levels is more challenging. In most AMS, these data are not systematically collected. Exceptions include data on trainings and exercises and, in some cases, the completion of high-level plans.

In order to support regional monitoring, as well as the evaluation of progress towards the targets and priorities outlined in the Sendai Framework, data will need to be collected through direct means such as surveys, focus groups, or workshops. While the data are less technically challenging to develop than some other risk related data, collection and management will take institutional resources and time. Table 5 identifies broad thematic categories and associated questions that can be used to gather DRMC data. Specific questions for data collection are adapted from the HFA Local Government Self Assessment Tool (LGSAT) and are organized to be consistent with the priorities outlined in the Sendai Framework.

Table 5: Disaster Risk Management Capacity subcomponent themes and data collection questions (adapted from LGSAT)

Disaster Risk Management Capacity Categories	Questions for Data Collection
Institutional Basis for Disaster Risk Governance and DRR	How well are local organizations (including local government) equipped with capacities (knowledge, experience, official mandate) for disaster risk reduction and climate change adaptation?
	To what extent does the local government provide training in risk reduction for local officials and community leaders?
	To what extent does the local government have access to adequate financial resources to carry out risk reduction activities?
	To what degree does the local government allocate sufficient financial resources to carry out DRR activities, including effective disaster response and recovery?
	To what extent do partnerships exist between communities, private sector and local authorities to reduce risk, in all its dimensions?
	How much does the local government support vulnerable local communities (particularly women, elderly, infirmed, children) to actively participate in risk reduction decision making, policy making, planning and implementation processes?
	To what extent does the local government participate in national DRR planning?
Investment and Integration of DRR for	How far do land use policies and planning regulations for housing and development infrastructure take current and projected disaster risk (including climate related risks) into account?

Disaster Risk Management Capacity Categories	Questions for Data Collection
Resilience	How well are the DRR policies, strategies and implementation plans of local government integrated into existing environmental development and natural resource management plans?
	To what degree do civil society organizations, citizens, and the private sector participate in the implementation of environmental and ecosystems management plans in your local authority?
	How adequate are the measures being taken to protect critical public facilities and infrastructure from damage during disasters, including the assessment process?
	How adequate are the measures taken to ensure all main schools, hospitals and health facilities have the ability to remain operational during emergencies, including the assessment process?
	How effective (strength and enforcement) are existing regulations (e.g., land use plans, building codes, etc.) to support disaster risk reduction in your local authority?
	What is the scope of financial services (e.g. saving and credit schemes, macro and micro-insurance) available to vulnerable and marginalized households for pre-disaster times?
	How well established are economic incentives for investing in disaster risk reduction for households and businesses (e.g. reduced insurance premiums for households, tax holidays for businesses)?
Understanding, Outreach and Awareness	To what degree does the local government conduct and update thorough disaster risk assessments for key vulnerable development sectors in your local authority?
	How well are local government risk assessments linked to, and supportive of, risk assessments from neighboring local authorities and state or provincial government risk management plans?
	How regularly does the local government communicate information on local hazard trends and risk reduction measures (e.g. using a Risk Communications Plan), including early warnings of likely hazard impact?
	To what degree does the community participate in the development and operation of early warning systems?
	How regularly does the local government conduct awareness-building or education programs on DRR and disaster preparedness for local communities?
	To what degree do local schools and colleges include courses, education or training in disaster risk reduction (including climate-related risks) as part of the educational curriculum?
Enhanced Preparedness for Response and Recovery: Plans	To what extent are contingency plans developed for all major hazards, including the identification of evacuation routes?
	To what extent are procedures in place to exchange relevant information during hazard events and disasters, and to undertake post-event reviews?

Disaster Risk Management Capacity Categories	Questions for Data Collection
and Practice	To what degree does the contingency plan (or similar plan) include an outline strategy for post-disaster recovery and reconstruction, including needs assessments and livelihoods rehabilitation?
	How well are disaster risk reduction measures integrated into post-disaster recovery and rehabilitation activities (i.e. build back better, livelihoods rehabilitation)?
	To what extent are citizens aware of evacuation plans or participate in evacuation drills?
	How regularly are training drills and rehearsals carried out with the participation of relevant government, non-governmental, local leaders and volunteers?
	How regularly are disaster preparedness drills undertaken in schools, hospitals and health facilities?
Enhanced Preparedness for Response and Recovery: Implementation Resources	To what extent are early warning centers established, adequately staffed (or on-call personnel) and well resourced (power backups, equipment redundancy, etc.) at all times?
	To what extent does the local government have an adequately staffed and resourced emergency operations center (EOC) and emergency communication system?
	To what extent are key resources for effective response, such as emergency supplies and emergency shelters available at all times?
	To what degree do local institutions have access to financial reserves to support effective disaster response and early recovery?
	To what extent are microfinancing, cash aid, soft loans, loan guarantees, etc. available to affected households after disasters to restart livelihoods?
	How much access does the local government have to resources and expertise to assist victims of psycho-social (psychological, emotional) impacts of disasters?
	To what extent do local business associations, such as chambers of commerce and similar, support efforts of small enterprises for business continuity during and after disasters?

During data collection, each of the questions should be scored according to levels of progress outlined in the LGSAT and described in Table 6 below. This will facilitate more consistent comparison and enable combination of the data in subsequent analyses. The full LGSAT template is included as Appendix A and is available at http://www.preventionweb.net/english/hyogo/hfa-monitoring/local/?pid:73&pil:1. The Guidance Note developed by UN-ISDR to support implementation of the LGSAT can be found at http://www.preventionweb.net/applications/hfa/assets/lgsat/documents/GuidanceNote.pdf.

Table 6. LGSAT descriptions of progress

Level	General Description of Level of Progress for Overall Ranking
5	**Comprehensive** achievement has been attained, with the commitment and capacities to sustain efforts at al levels.
4	**Substantial** achievement has been attained, but with some recognized deficiencies in commitment, financial resources or operational capacities.
3	There is **some institutional commitment and capacities** for achieving DRR, but progress I not comprehensive or substantial.
2	**Achievements** have been **made**, **but** are **incomplete**, and while improvements are planned, the commitment and capacities are limited.
1	Achievements are minor and there are few signs of planning or forward action to improve the situation.

The LGSAT has been used by AMS for monitoring at the provincial and city level and was initially cited by stakeholders as a recommended tool. However, the LGSAT will soon be replaced by tools more closely aligned with the Sendai Framework for Disaster Risk Reduction and the new "10 Essentials" currently in development. It is recommended that the DRMC indicators be revisited after initial implementation of the Guidelines. Indonesia is in the process of developing a set of relevant indicators as well as guidance documents and technical tools for improved data collection.

4. CONSTRUCTING THE SOCIETAL RISK INDEX

As discussed in Section 2, a comparative assessment of Societal Risk will leverage a composite index approach. Composite indices are created by selecting sets of variables that represent general concepts (e.g., access to information, health status, or inequality). The individual variables, or "indicators," are then scaled to a standardized value range (e.g., 0-1 or 1-100) so they can be mathematically combined into a relative measure of the theme of interest. These measures can then be combined to represent more complex multi-dimensional concepts. This section describes the general steps required to construct composite indices and provides specific guidance on the construction of the Societal Risk Index and each of its components.

GENERAL STEPS FOR CONSTRUCTING COMPOSITE INDICES

The following six steps can be used to guide index development:

1. Establishing a conceptual framework
2. Collecting data
3. Dealing with missing data
4. Deriving indicators
5. Scaling indicators
6. Aggregating indicators and indices

STEP 1: CONCEPTUAL FRAMEWORK

In order for indices to be useful, the concepts and themes being represented must be defined and the rationale for inclusion clear. Additionally, the conceptual framework should identify how themes are linked and how they relate to larger multi-dimensional concepts. A high level framework was presented in Figure 3 and further specified in Section 3. Specific structures of the component indices will be described in more detail later in this section.

STEP 2: DATA COLLECTION

Section 3 outlined many of the types of data needed to support DRM related decision making and construct the Societal Risk Index. Input data used to prepare indicators should represent the latest data available, preferably collected or estimated within the last 5 years. The quality of data collected has a substantial effect on the utility of an index. Data should be relevant and reliable and have good temporal and spatial coverage. Data should also be formally documented by both the source and the user. Table 7 outlines some key considerations and questions that can help evaluate data.

Table 7. Considerations when collecting data

Consideration	Related Questions
Relevance	Do the data truly represent the intended concepts or themes?
Source	Is the source reputable and reliable? Is it the official source for the dataset of interest?
Timeliness	Are the data current? How often are they published?
Spatial Coverage	Are the data available for all administrative areas or other units of analysis?
Caveats/constraints	Are there known limitations to the quality of the data or constraints on how it can be used? Can it be used to make meaningful comparisons?
Documentation	Does the data have accompanying metadata? Is there enough information about the data to make an evaluation?

STEP 3: MISSING DATA

Missing data is a common problem. Data may go unreported for technical, political, or organizational reasons. There are a number of ways to "fill in the blanks," ranging from substitution to statistical analysis. For the construction of the Societal Risk Index, it is recommended that if data are missing for select administrative units, earlier versions of the same datasets are consulted. It is recommended that data older than 10 years old should not be used, however. Alternative sources that are reliable and collect and/or maintain similar datasets as the primary source might also be consulted. If these two approaches are ineffective, leave the record blank. Missing data will also need to be considered during the aggregation process; if several indicators are missing, the province may need to be excluded from the index. Missing data should be documented for transparency.

STEP 4: DERIVATION

Depending on the data collected, it may be necessary to derive variables from multiple input datasets or to perform an intermediate calculation on a single dataset to create the specific indicator used to construct the indices. For example, in order to facilitate meaningful comparison across administrative units of varying size and population, indicators should be reported as a rate, percentage, or density measure (e.g., GDP per capita or physicians per 10,000 persons). Or forest cover might be reported in hectares or square kilometers at specific points in time rather than as a measure of change, which is really what we're interested in. Units will also need to be consistent. Additional calculations may be needed to convert measurements to metric units or to change data that may be reported as "per 1000" persons to "per 10,000" persons. All derivations should be documented.

STEP 5: SCALING

The indicators used to create sub-indices and sub-component indices measure unlike things and have inconsistent units, ranges, and scales. In order to combine them and perform the mathematical operations required to create a single composite index score, indicator values must be standardized or

normalized. Prior to aggregation, the indicators must also have the same value range and directionality. This requires three steps.

Step 1: Normalization

In order to normalize values, it is recommended that AMS leverage a commonly used process to create scaled scores ranging from 0 to 1:

(Observed indicator value – Indicator minimum value) / (Indicator maximum value – Indicator minimum value).

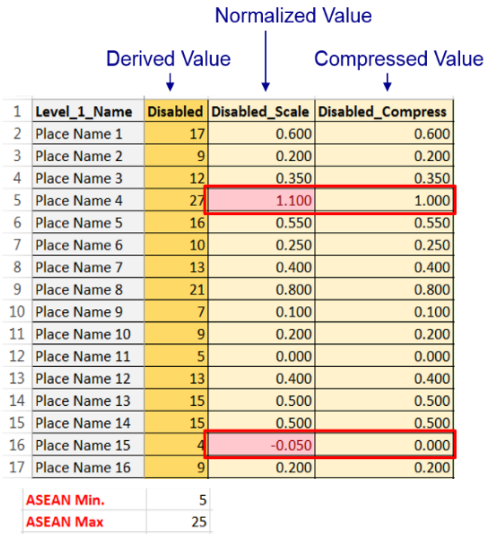
Here, minimums and maximums represent reasonable bounds that will facilitate comparison both within AMS and between AMS and provide relevant points of reference for improvement. They are not intended to capture the full range of conditions within the region; data for some provinces at the very high end or very low end of the Vulnerability or Multi-hazard Exposure spectrum will fall outside the given range. As noted in Section 3, all Disaster Risk Management Capacity data have a consistent set range of 1-5. For Vulnerability indicators, minimums and maximums were selected based on the range and distribution of data available at the national level within ASEAN (mean +/- two standard deviations). The intent was to simplify the scaling process and provide meaningful anchor points that limit the influence of extreme values. It is important to remember that "0" does not represent "no vulnerability" or "no exposure," but instead the minimum reasonable case relative to others. Minimums and maximums should be reviewed after a testing period.

Step 2: Compression

As noted above, some values may fall outside of the 0 to 1 range after normalization. These cases should be assigned a value of either "0" or "1," as appropriate. Figure 4 illustrates normalization and compression steps included as part of the Excel-based ASEAN RVA Template.

Step 3: Ensure Consistent Conceptual Direction

In the Societal Risk Index, the aim is to emphasize areas with high risk. In order to do this, a value of "0" needs to consistently represent relatively better conditions and a value of "1" needs to consistently represent relatively worse conditions when discussing exposure, vulnerability, or risk.



	Level_1_Name	Disabled	Disabled_Scale	Disabled_Compress
2	Place Name 1	17	0.600	0.600
3	Place Name 2	9	0.200	0.200
4	Place Name 3	12	0.350	0.350
5	Place Name 4	27	1.100	1.000
6	Place Name 5	16	0.550	0.550
7	Place Name 6	10	0.250	0.250
8	Place Name 7	13	0.400	0.400
9	Place Name 8	21	0.800	0.800
10	Place Name 9	7	0.100	0.100
11	Place Name 10	9	0.200	0.200
12	Place Name 11	5	0.000	0.000
13	Place Name 12	13	0.400	0.400
14	Place Name 13	15	0.500	0.500
15	Place Name 14	15	0.500	0.500
16	Place Name 15	4	-0.050	0.000
17	Place Name 16	9	0.200	0.200

ASEAN Min.	5
ASEAN Max	25

Figure 4. Illustration of some scaling steps from the Excel-based ASEAN RVA Template

It is possible to look at this directional match in two places: first, when constructing the indicator, and second, after normalization and compression. For example, let's consider literacy. Higher values represent better conditions. In order to instead highlight areas where understanding of and access to information might be a challenge, it is necessary to reverse the direction so that higher numbers instead represent worse conditions. If the data reported represented "illiteracy," then there would be no need to change direction of the values. However, if illiteracy is reported, then the minimums and maximums given below would need to be reflected (subtracted from 100). The same is true if data for sanitation and water is reported as the percent *without* access.

Level_1_Name	Internet	Internet_Scale	Internet_Compress	Internet_Score
Place Name 1	38	0.404	0.404	0.596
Place Name 2	67	0.713	0.713	0.287
Place Name 3	56	0.596	0.596	0.404
Place Name 4	26	0.277	0.277	0.723
Place Name 5	38	0.404	0.404	0.596
Place Name 6	74	0.787	0.787	0.213
Place Name 7	75	0.798	0.798	0.202
Place Name 8	96	1.021	1.000	0.000
Place Name 9	56	0.596	0.596	0.404
Place Name 10	69	0.734	0.734	0.266
Place Name 11	81	0.862	0.862	0.138
Place Name 12	54	0.574	0.574	0.426
Place Name 13	89	0.947	0.947	0.053

Figure 5. Illustration of consistent conceptual direction from the ASEAN RVA Template

Because the standardization process outlined is relatively straightforward and does not require any transformations or other data manipulation, it is in most cases easiest to correct directionality after normalization. In order to reverse value direction, simply subtract the normalized value from 1. This is illustrated in Figure 5.

STEP 6: AGGREGATION

Aggregation is the act of mathematically combining the scaled indicators into a single score. As illustrated in Figure 6, there are three levels of indices: component, sub-component, and sub-index. Each sub-index and sub-component index is made up of a varying number of indicators. For simplicity, indices will be calculated by taking the arithmetic mean of the directionally consistent, scaled scores of the contributing indicators. This results in the equal weighting of each variable within a given sub-index or sub-component index and helps to keep the method transparent and the results easily understood and interpreted. Component indices will be calculated using the arithmetic mean of the various sub-component indices. The aggregation process is essentially automated in the Excel-based ASEAN RVA Template.

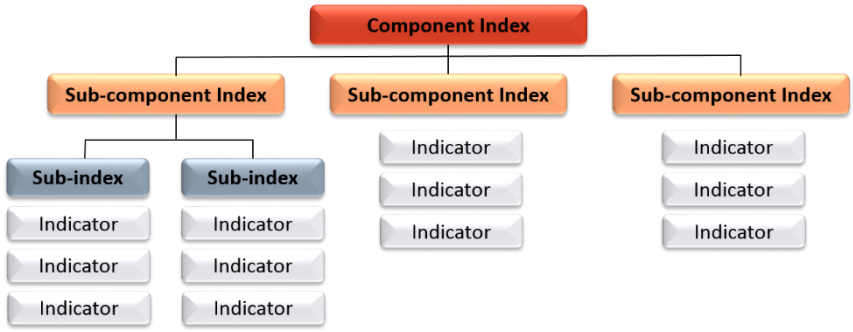


Figure 6. Index hierarchy

THE ASEAN RVA TEMPLATE AND INTEROPERABILITY

The ASEAN RVA Template is an Excel Workbook that provides comprehensive guidance for the construction of the Societal Risk Index. It includes field names, descriptions, examples, and worksheets

with active formulas to partially automate each step of the scaling and aggregation process. All components are represented, and the template also contains active formulas for the calculation of the Societal Risk Index and a hazard independent Lack of Resilience Index. The intent is to simplify the RVA process while facilitating good data management practices and interoperability through consistent naming conventions, formatting, rounding, as well as clear instructions and preliminary documentation. Interoperability will be particularly important when merging individual AMS outputs into a regional index. Care should be taken not to change or delete the formulas and to maintain field names and formatting.

All data should be referenced to the consistently formatted name (be sure to avoid special characters) and/or code of the associated Level 1 administrative unit (e.g., province). Regardless of how you choose to organize your data or which program you use to derive indicators, it is always critical that the administrative units are sorted in the same manner before adding new data to a worksheet or database. That is one reason why all input datasets should include the full set of standardized province names and codes prior to subsequent processing. This step enables a consistent sorting and a "key" through which to join tables.

Technical officers with GIS experience from each AMS should work with the AHA Centre to establish an acceptable working dataset with consistent names and codes that will support interoperability. The Global Administrative Unit Layers (GAUL) dataset developed by the Food and Agriculture Organization of the United Nations (FAO) could provide a good potential starting point for the development of a regional dataset that would support the implementation, compilation, and visualization of the ASEAN Regional RVA. The latest files are available for review and request at http://www.fao.org/geonetwork/srv/en/metadata.show?id=12691.

The GAUL dataset (or any other dataset used as a base) may need to be updated or adapted before use by AMS and the AHA Centre to ensure that recent administrative boundary changes are reflected. Key considerations raised during the review and collaboration process are the inclusion of the relatively new provinces of Xaysomboun (Lao PDR), Tbong Khmum (Cambodia), and Bueng Kan (Thailand); the merging of Ha Tay with Ha Noi City in Viet Nam; and the proper coding of Langkawi Island as part of the State of Kedah in Malaysia. It is recommended that AMS work directly with those that maintain the data to update any dataset used as a base for the RVA. The distributor of the GAUL dataset can be reached at GeoNetwork@fao.org.

In order to improve compatibility with mapping software, it is recommended that outputs be saved with an ".xls" extension rather than as ".xlsx" and that underscores are used rather than spaces in all file and field names. It is also helpful to create a copy of the final scale that is not tied to the formulas used to create it and represents the values only. Additional information on the ASEAN RVA Template and its use can be found in the Exercise Handbook.

THE MULTI-HAZARD EXPOSURE INDEX

At the most basic level, exposure is simply the geographic intersection of a hazard and key elements of interest (see Figure 7). For the Societal Risk Index, population is the primary element of concern. Applications and tools supporting the estimation of physical risk measures that leverage additional types of data are described in the supplemental implementation handbook.

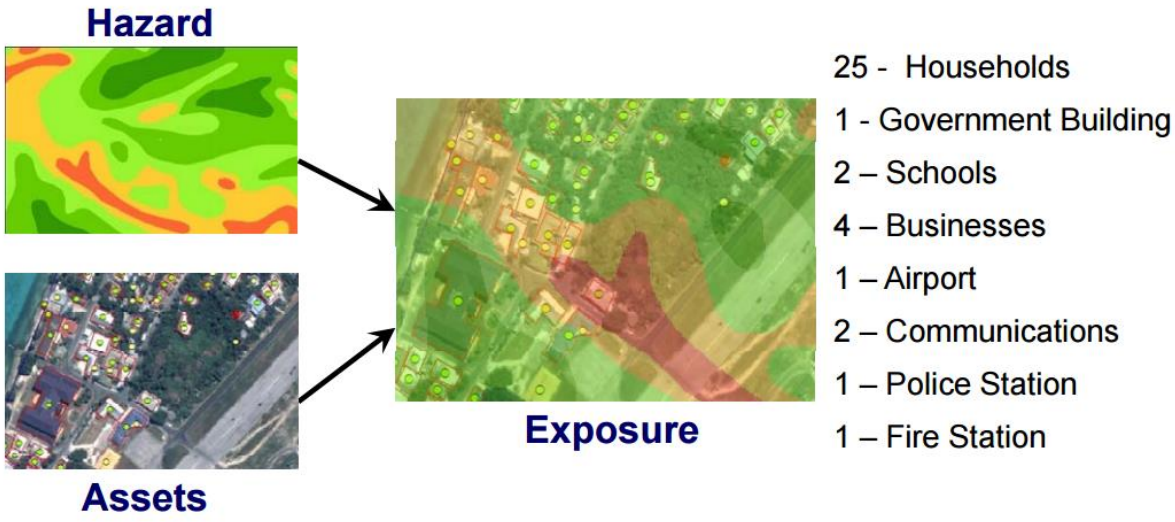


Figure 7: Exposure is the intersection of hazards and elements of interest.

In order to be truly comparable between hazards and across AMS, exposure information would need to represent the same basic unit of analysis. Ideally, this would include a measure of probability or frequency as well as a relatively comparable level of intensity (e.g., descriptions for earthquake MMI VII and Saffir-Simpson intensity measures are qualitatively similar) or meet a consistent policy standard (e.g., magnitude used for design standards). This depends on consistent hazard information, which is currently not available across AMS for all relevant hazards at resolutions that would support comparison. The long term goal is average annual number of people (or "person units") exposed to a potentially damaging hazard by province.

In practice, AMS will likely need to make phased progression towards consistent hazard and exposure estimates at a level of detail that can be used locally. In the meantime, the global hazard datasets outlined in Section 3 can temporarily fill AMS data gaps and provide moderate consistency across hazards and AMS in the first implementation of the Societal Risk Index. Disaggregated population data is readily available (e.g., Landscan or the Gridded Population of the World, available at http://sedac.ciesin.columbia.edu/data/collection/gpw-v4) and can be improved and localized with additional effort. Specific methods for augmenting population data are included in the Supplemental Implementation Handbook.

The Multi-hazard Exposure component of the Societal Risk Index is comprised of the two indicators described in Table 8. The conceptual direction of the indicators is consistent and no reflection will be

necessary once scaled. Hazards considered include the eight prioritized hazards outlined in Section 3. Minimums and maximums will need to be established once high hazard zones have been delineated for all hazards and exposure has been calculated for all ASEAN Level 1 administrative units using GIS. Guidance for establishing exposure for "high hazard" zones is included as Table 9. These can be derived using the recommended global datasets. Preliminary boundaries for high hazard zones for earthquakes, floods, and tropical cyclone winds were calculated by PDC and are included as part of the exercise data that accompanies the Exercise Manual.

Table 8. Multi-hazard Exposure indicators

Indicator	Derivation
Total Raw Multi-hazard Population Exposure	Sum, for all hazards, of population in high hazard zones
Total Relative Multi-hazard Population Exposure	Sum, for all hazards, of population in high hazard zones per 10,000 population

Looking at exposure as raw counts provides an indication of *how many* or *how much*, which can assist in planning and give an idea of the raw scale of potential activities. Representing exposure as a proportion of the total population of elements or value provides an indication of *how important* and can assist with prioritization. Including relative exposure helps highlight the relevance of hazards to provinces with small populations or economies.

Table 9. Guidance for delineation of "high hazard" zones

Hazard	Estimating Exposure for "High Hazard" Zones
Floods	Population in areas where the return period is 500 years for flood depths of 1 cm or more
Tropical Cyclone Winds	Population in areas where the return period is 500 years for winds of 119 km/hr or more
Earthquakes	Population in areas where the return period is 2475 years for an earthquake of MMI VII and above
Tsunami	Population in areas where the return period is 500 years for run-up
Volcanoes	Population within a 10 km radius circle of a volcano
Landslides	Population within the area included in the top three categories
Land and Forest Fire	Population within the area included in the top three categories
Drought	Population within the area included in the top three categories

THE VULNERABILITY INDEX

The Vulnerability Index consists of eight sub-component indices. The Health sub-component is made up of two sub-indices related to general health status and healthcare infrastructure. The overall structure of the index is illustrated in Figure 8. Table 10 outlines the likely derivations needed to create each Vulnerability indicator, the relevant minimums and maximums to be used for scaling, and any value reflection likely to be required prior to combination.

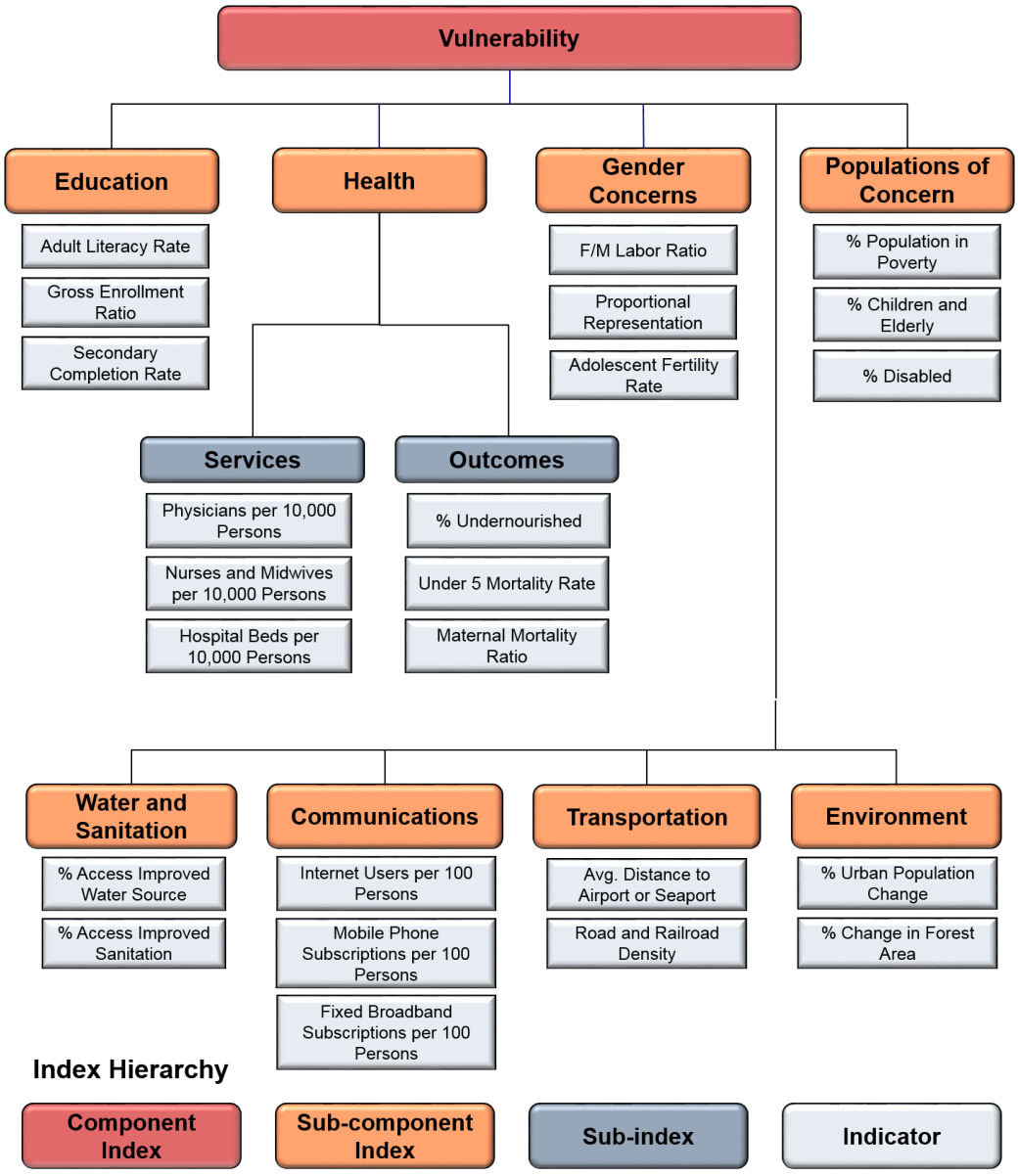


Figure 8: Structure of the Vulnerability Index

The sub-component indices will be aggregated using the arithmetic mean. Again, this simplifies calculation and interpretation, and makes it easier to examine individual drivers. Mathematically, each sub-component index will make up 12.5% of the final component index score. Thematically, this means that vulnerable populations and potential inequalities contribute 25%, differences in services and outcomes often associated with poverty contribute 37.5%, infrastructure related to logistics is 25%, and environmental pressures makes up 12.5%.

Table 10. Indicator derivation and scaling for Vulnerability indicators

Indicator Measure	Derivation	Minimum	Maximum	Change in Value Direction
Populations of Concern				
% Children and Elderly	No change from collected data.	24	40	N/A
% Disabled		5	25	
% Population in Poverty (National Measure)		0	32	
Gender Concerns				
F/M Labor Ratio	ABS (1-F/M ratio)	0	.50	N/A
Female Proportional Local Representation	ABS ((1-(% in gov / % of pop)	0	.49	
Adolescent fertility rate (births per 1,000 women 15-19)	May need calculations to match denominator.	0	79	
Health				
Outcomes				
% Undernourished	No change from collected data.	0	24	N/A
Under 5 Mortality (per 1,000)	May need calculations to match denominator.	0	66	
Maternal Mortality (per 100,000 live births)		10	417	
Services				
Hospital Beds per 10,000	May need calculations to match denominator.	2	30	Subtract scaled value from 1.
Physicians per 10,000		0	20	Subtract scaled value from 1.
Nurses and Midwives per 10,000		0	82	Subtract scaled value from 1.
Water and Sanitation				
% with Improved Water Source	No change from collected data.	69	100	Subtract scaled value from 1.*
% with Improved Sanitation		41	100	Subtract scaled value from 1.*

Indicator Measure	Derivation	Minimum	Maximum	Change in Value Direction
Education				
Adult Literacy	No change from collected data.	72	100	Subtract scaled value from 1.*
Gross Enrollment Ratio		50	90	Subtract scaled value from 1.
Secondary Completion		33	106	Subtract scaled value from 1.
Communications				
Mobile Phone Subscriptions per 100	May need calculations to match denominator.	46	198	Subtract scaled value from 1.
Internet Users per 100		0	94	Subtract scaled value from 1.
Fixed Broadband Subscriptions per 100		0	28	Subtract scaled value from 1.
Transportation				
Average Distance to Airport and Seaport	Zonal average of cell distances to airport or seaport	0	TBD	Subtract scaled value from 1.
Road and Railroad Density	(Sum of road and railroad length by province / calculated area) * 100	1	120	Subtract scaled value from 1.
Environmental Pressures				
% 5 Year Urban Population Change	ABS (((Urban Pop at Year X) – (Urban Pop at Year X – 5)) / (Urban Pop at Year X – 5))	2	22	N/A
% 5 Year Change in Forest Cover	((Forest cover at Year X) – (Forest cover at Year X - 5)) / (Forest cover at Year X – 5)	-8	6	Subtract scaled value from 1.

*If higher numbers represent better conditions in the normalized values.

If data availability is an issue, it is recommended that AMS start index development by compiling and processing information on the populations of concern, which are sometimes associated with differences in access to resources and services. Combining this information with general population exposure will provide a quick high-level comparison of areas likely to need the most help. This will help provide a useful overview as additional data are being developed.

THE DISASTER RISK MANAGEMENT CAPACITY INDEX

The steps outlined in the preceding sections are also relevant in constructing the Disaster Risk Management Capacity Index. Because of the way the data are collected, however, there will be no need for compression. All indicators created from the questions on Disaster Risk Management Capacity will

have a minimum of 1 and a maximum of 5. When these indicators are scaled, all 1's will equal 0, 2's will equal 0.25, 3's will equal 0.50, 4's will equal 0.75, and 5's will equal 1. Additionally, the 1-5 scale represents a consistent value direction, so there will be no need to reflect values. Figure 9 illustrates the index structure for the Disaster Risk Management Capacity component.

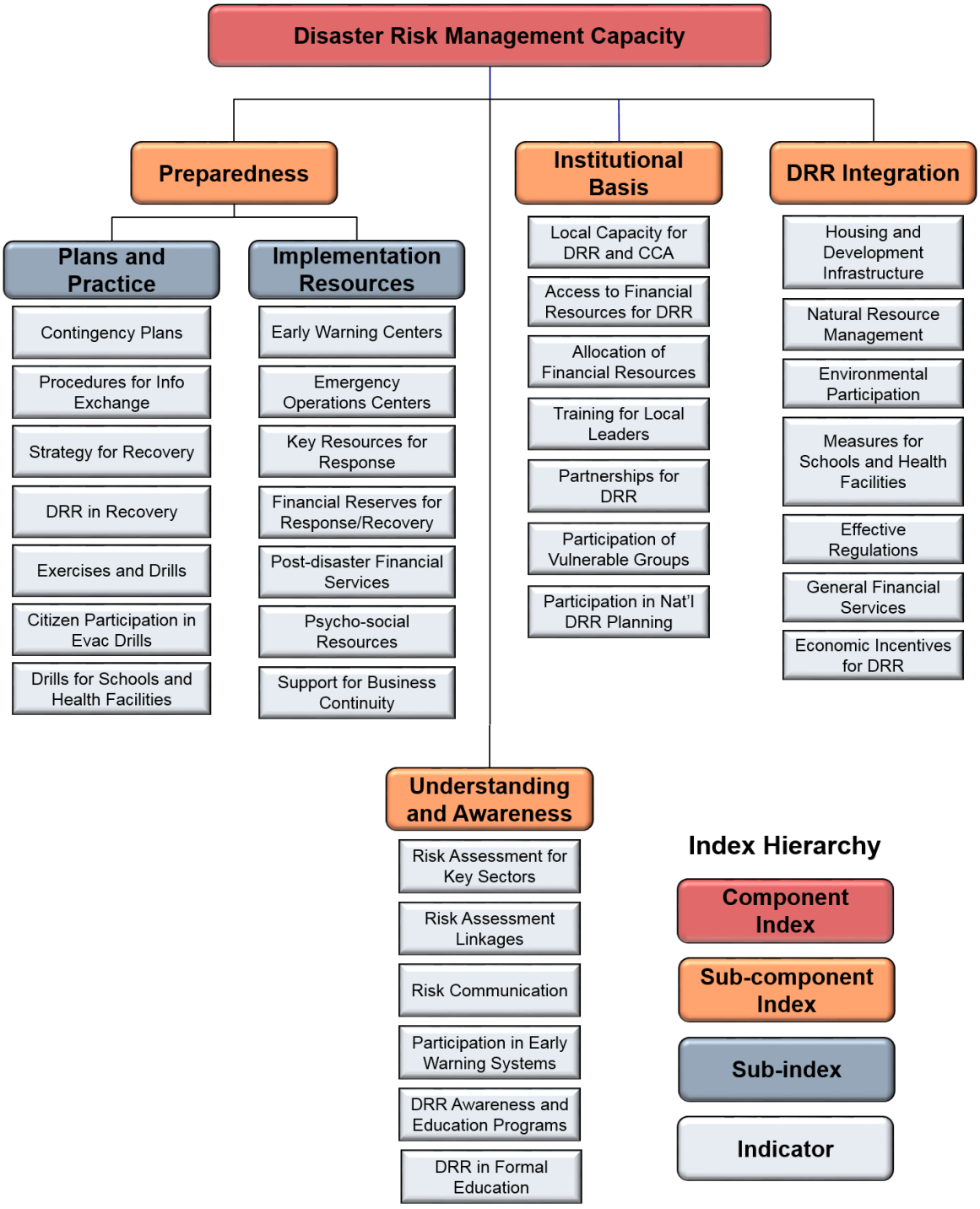


Figure 9: Structure of the Disaster Risk Management Capacity Index

As with the Vulnerability Index, all sub-component indices will be weighted equally when averaged. The Preparedness Plans and Practice and Preparedness Implementation Resources sub-indices will be averaged to create the Preparedness sub-component index. In the Disaster Risk Management Capacity Index, all sub-components contribute 25% to the final score.

ASSESSING SOCIETAL RISK

In order to maintain consistency, transparency, and ease of interpretation, the index representing relative societal risk will be created using an arithmetic mean. However, because the Disaster Risk Management Capacity Index is conceptually reversed, it is necessary to subtract the index score from 1 before averaging. The calculation can be represented as **R = [MHE + V + (1-DRMC)] / 3**. Once preliminary Multi-Hazard Exposure indicator minimums and maximums are established, the final index and all contributing indices index will be directly comparable at a regional level. It is recommended that the RAA Working Group revisit all components after 1-2 years and consistently evaluate changes in data availability and quality as well as any changes in priorities or constraints.

A hazard independent Lack of Resilience Index would also be comparable across AMS and might be beneficial for dynamic estimation of Risk based on impending hazard events in addition to guiding general investment focus and prioritization. Lack of Resilience can be calculated as **LR = [V + (1-DRMC)] / 2**. In later phases of implementation, this index can be used to modify and contextualize measures of physical risk, aspects of which are addressed in the supplemental implementation handbook.

VISUALIZATION

Visualization is the last step of index development, helping to communicate results to those who will use the inputs and outputs for decision making. Tables and maps are both useful decision support tools; integration into DMRS will further increase the utility of the assessment and supporting data. Figure 10 illustrates outputs in two different forms. Figure 11 depicts the login page of DMRS, which is maintained by the AHA Centre and available to support all AMS.

High-level outputs sent to the AHA Center will be compiled and ranked, and likely visualized using equal intervals. For visualization at the national level, it is recommended that indices be ranked and then visualized using quantiles instead. The ASEAN RVA Template supports national level ranking.

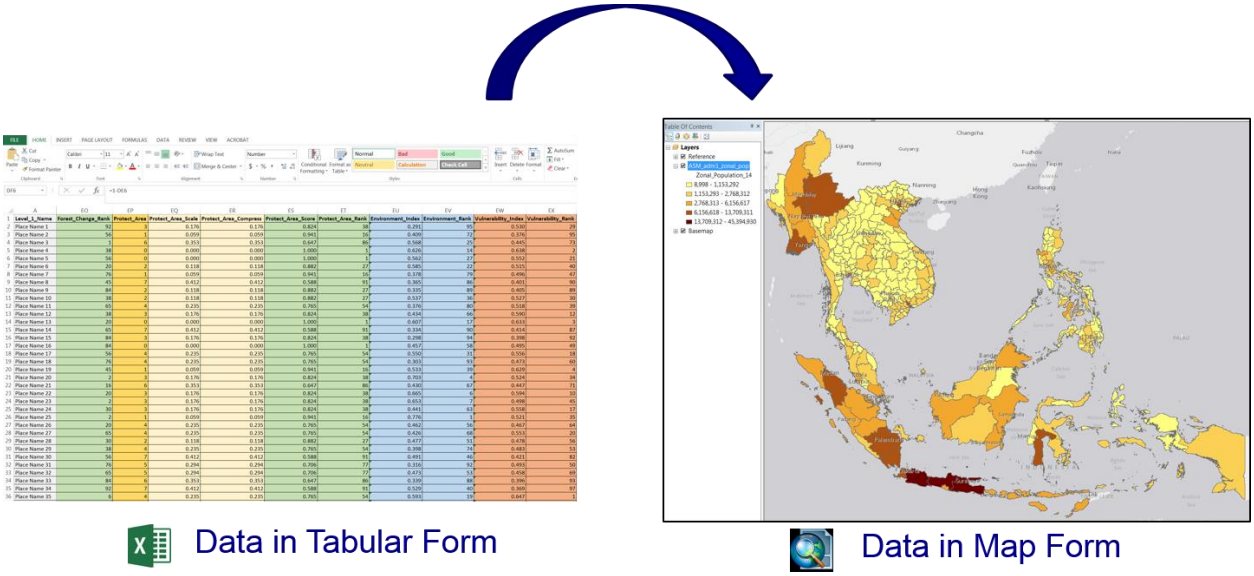


Figure 10. Visualizing data for decision makers (sample)

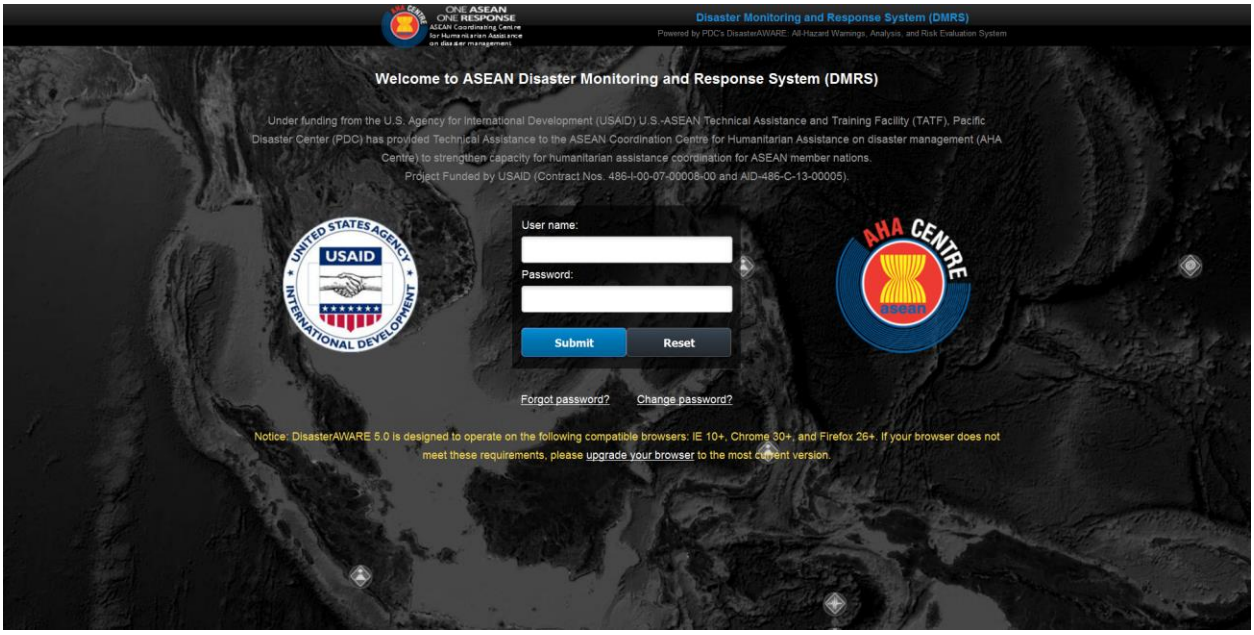


Figure 11. Login page of the Disaster Monitoring and Response System (DMRS)

APPENDIX A: LOCAL GOVERNMENT ASSESSMENT TOOL (LGSAT)

Local HFA: Local Government Self Assessment Tool (LGSAT)

City / Local Government	
Local government name	
Province/ Country	
Focal Point contact details	
Name	
Function	
Department	
Address	
Email	
Telephone	
Fax	

For more information, please contact your regional UNISDR office:

Africa	*Rhea Katsanakis*	*rhea.katsanakis@unep.org*
Americas	*Sandra Amlang*	*samlang@eird.org*
Arab States	*Ragy Saro*	*saro@un.org*
Asia-Pacific	*Hang Thi Thanh Pham*	*phamh@un.org*
Central Asia	*Abdurahim Muhidov*	*muhidov@un.org*
Europe	*Mariana Osihn*	*osihn@un.org*

UNISDR developed the Local HFA: Local Government Self Assessment Tool (LGSAT), a self-assessment tool and feedback mechanism offered to local and city governments that can facilitate the understanding of gaps and challenges in disaster risk reduction.

The LGSAT is supported by an offline version (see pages 2-16) and an online system to capture the information on progress in disaster risk reduction at the local level, generated through the multi stakeholder review process.

The on-line system is accessible for local governments participating in the Making Cities Resilient campaign through the campaign website www.unisdr.org/campaign. The tool can be also accessed through the www.preventionweb.net website. Detailed guidelines for the LGSAT are available at these sites and from your UNISDR regional office.

41 Key questions are provided which are in this version aligned to the 10 essentials. These questions shall be discussed in multi stakeholder consultations in which the level of achievement per indicator shall be identified.

Local governments and supporting agencies are encouraged to transfer the results from the offline templates onto the web-based wherever possible.

Furthermore, local governments are also encouraged to make their findings available to national governments as inputs to the national HFA review process (see LGSAT guidelines provided on the indicated websites). This is, however, a voluntary exercise and any decisions on use of the results are to be decided by the local government.

1

Essential 1: Put in place organization & coordination to clarify everyone's roles & responsibilities [HFA 1]

How well are local organizations (including local government) equipped with capacities (knowledge, experience, official mandate) for disaster risk reduction and climate change adaptation? [1.1.1]

Local government departments and organisations with the responsibility for reducing disaster risk and supporting community adaptation to climate change require adequate levels of human resources, knowledge and experience, and relevant skills and tools to be effective. Further, the different tasks and programmes involved in delivering disaster risk reduction and climate change adaptation must correspond to officially and socially recognised roles and responsibilities among the different actors involved.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

+ Additional related links *(links can be added online)* -

To what extent do partnerships exist between communities, private sector and local authorities to reduce risk? [1.1.2]

Experience from local governments across the globe highlights the need for effective partnerships in order to implement successful community development. Where representatives from affected communities, local organisations, the private sector and responsible local authorities work together, results are usually significant.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

+ Additional related links *(links can be added online)* -

How much does the local government support vulnerable local communities (particularly women, elderly, infirmed, children) to actively participate in risk reduction decision-making, policy making, planning and implementation processes? [1.3.1]

Affected local communities need to be involved in the whole process of review, planning and implementation of any community-level activity. Furthermore, where particularly vulnerable groups are successfully included in dialogue and decision-making from the beginning, local investments usually yield high levels of return and have the potential to be sustainable.

Level of achievements:

5-Comprehensive achievement has been attained, with the commitment and capacities to sustain efforts at all levels.

4-Substantial achievement has been attained, but with some recognised deficiencies in commitment, financial resources or operational capacities.

3-There is some institutional **commitment and capacities to achieving DRR** but progress is not comprehensive or substantial.

2-Achievements have been made but are **incomplete**, and while improvements are planned, the commitment and capacities are limited.

1-Achievements are **minor** and there are few signs of planning or forward action to improve the situation.

*Provide details on **progress, challenges and plans** for each indicator question.*

(e.g. [1.1.1] indicates the linkages to the 5 HFA priorities. For more details refer to the following guidelines: add link.)

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

+ Additional related links *(links can be added online)* -

To what extent does the local government participate in the national DRR planning? [1.4.1]

Ensuring a link between national policy and planning processes on the one hand and local government programmes on the other hand is crucial for success. Yet, enabling local governments to contribute local experience to national planning processes can result in the selection and implementation of more effective and efficient disaster risk reduction strategies.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

+ Additional related links *(links can be added online)* -

Essential 2: Assign a budget & provide incentives for homeowners, low-income families, private sector to invest in risk reduction [HFA 1 and 4]

How far does the local government have access to adequate financial resources to carry out risk reduction activities? [1.2.1]

Adequate levels of financing for disaster risk reduction remains a challenge at all levels. At local level, governments can mobilise resources from nationally allocated budgets, local revenue streams and the private sector. Ensuring that adequate resources can be invested into reducing disaster risk rather than just responding to extreme events will be one of the key determinants of the success of local disaster risk management.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

+ Additional related links *(links can be added online)* -

Level of achievements:

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1-Achievements are **minor** and there are few signs of planning or forward action to improve the situation.

*Provide details on **progress, challenges and plans** for each indicator question.*

(e.g. [1.1.1] indicates the linkages to the 5 HFA priorities. For more details refer to the following guidelines: add link.)

To what degree does the local government allocate sufficient financial resources to carry out DRR activities, including effective disaster response and recovery? [1.2.2.]

Financial allocations to disaster risk management must consider the whole disaster management cycle and hard wire risk considerations into local development budgets. Allocations for risk (hazard, vulnerability and exposure) assessments, early warning and communication, education and monitoring, preparedness, response and recovery need to be made in a coherent manner that are integrated into the local economic and social development plans.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

+ Additional related links *(links can be added online)* -

What is the scope of financial services (e.g. saving and credit schemes, macro and micro-insurance) available to vulnerable and marginalised households for pre- disaster times? [4.2.1]

Access to formal financial services for vulnerable communities can significantly reduce the mid- to long-term economic effects of local disasters. Local governments can actively encourage the provision of microfinance and micro insurance services to small businesses, farmers and households with low asset-levels by private service providers and non-profit organisations. Local governments can also advocate for improved outreach of national programmes in their local authority.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

+ Additional related links *(links can be added online)* -

To what extent are micro finance, cash aid, soft loans, lone guarantees etc available to affected households after disasters to restart livelihoods? [4.2.2]

Post-disaster loans and grant schemes can alleviate suffering of affected households in the immediate aftermath of a disaster. They can also avoid significant asset loss that could in turn lead to a loss of livelihoods, for example in the case of small farmers and livestock owners who have to otherwise sell farm equipment or livestock to meet immediate consumption needs.

Level of achievements:

5-Comprehensive achievement has been attained, with the commitment and capacities to sustain efforts at all levels.

4-Substantial achievement has been attained, but with some recognised deficiencies in commitment, financial resources or operational capacities.

3-There is some institutional **commitment and capacities to achieving DRR** but progress is not comprehensive or substantial.

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*Provide details on **progress, challenges and plans** for each indicator question.*

(e.g. [1.1.1] indicates the linkages to the 5 HFA priorities. For more details refer to the following guidelines: add link.)

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

+ Additional related links *(links can be added online)* -

How well established are economic incentives for investing in disaster risk reduction for households and businesses (e.g. reduced insurance premiums for households, tax holidays for businesses)? [4.3.1]

Local businesses and households may not invest in disaster risk reduction unless they see clear incentives for doing so. There are a number of policies and regulations, which local (and national) governments can provide and that can create such incentives, for example through the pricing of insurance, tax breaks for resilient investments etc.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

+ Additional related links *(links can be added online)* -

To what extent do local business associations, such as chambers of commerce and similar, support efforts of small enterprises for business continuity during and after disasters? [4.3.2]

The role of the private sector in ensuring the continued delivery of goods and services in the aftermath of a disaster is pivotal. Local governments can help in facilitating active support to small and medium sized enterprises in affected areas, through partnering with local business networks and professional associations and creating incentives for their engagement in disaster response and recovery.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

+ Additional related links *(links can be added online)* -

Level of achievements:

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*Provide details on **progress, challenges and plans** for each indicator question.*

(e.g. [1.1.1] indicates the linkages to the 5 HFA priorities. For more details refer to the following guidelines: add link.)

Essential 3: Update data on hazards & vulnerabilities, prepare & share risk assessments
[HFA 2, 3 and 4]

To what degree does the local government conducted thorough disaster risk assessments for key vulnerable development sectors in your local authority? [2.1.1]

Local risk assessments that include a comprehensive analysis of hazards, exposure and vulnerability levels are the first step toward successful risk reduction. Without understanding the risks faced by local communities and economies, no adequate disaster risk management strategy can be developed and investments are likely to be less effective.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

+ Additional related links *(links can be added online)* -

To what extent are these risk assessments regularly updated, e.g. annually or on a bi-annual basis? [2.1.2]

Risk assessments at any level should not be a one-off exercise but need to be conducted regularly. This includes the systematic recording of realised losses, regular updates on hazard risks and exposure levels, and continuous monitoring of the vulnerability of households, businesses, infrastructure and services to natural hazards and extreme events..

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

+ Additional related links *(links can be added online)* -

How regularly does the local government communicate to the community, information on local hazard trends and risk reduction measures (e.g. using a Risk Communications Plan) including early warnings of likely hazard impact? [3.1.1]

Local communities have to understand what risks they are facing, what can be done to reduce them and what is already in place to manage them, in order to avoid major losses in the event of a disaster. Clear and regular communication of local risk assessment findings and of early warning messages is one of the most important factors in saving lives. Further, information on services available and expected actions before, during and after a disaster event – such as contingency and evacuation plans, shelter location, financial support, health services etc. – that are made available on a regular basis and in an appropriate format and language for the respective communities can substantially reduce loss of lives and assets.

Level of achievements:

5-Comprehensive achievement has been attained, with the commitment and capacities to sustain efforts at all levels.

4-Substantial achievement has been attained, but with some recognised deficiencies in commitment, financial resources or operational capacities.

3-There is some institutional **commitment and capacities to achieving DRR** but progress is not comprehensive or substantial.

2-Achievements have been made but are **incomplete**, and while improvements are planned, the commitment and capacities are limited.

1-Achievements are **minor** and there are few signs of planning or forward action to improve the situation.

*Provide details on **progress, challenges and plans** for each indicator question.*

(e.g. [1.1.1] indicates the linkages to the 5 HFA priorities. For more details refer to the following guidelines: add link.)

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

+ Additional related links *(links can be added online)* -

How well are local government risk assessments linked to, and supportive of, risk assessments from neighbouring local authorities and state or provincial government risk management plans? [2.4.1]

Even localised disasters are rarely confined to administrative boundaries. Therefore, local risk assessments that do not take into account risk levels in surrounding locations and at the national level may be in danger of producing limited information that cannot be acted upon in the case of an emergency and that provides a wrong basis for risk reduction measures.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

+ Additional related links *(links can be added online)* -

How well are disaster risk assessments incorporated into all relevant local development planning on a consistent basis? [2.1.3]

Making the findings of local disaster risk assessments available to all planning processes has the potential to ensure that important progress in local development is protected. When risk considerations are not taken into account in sectoral policies and programmes or in local economic development plans, significant amounts of investments may be lost due to small and frequent hazard events and large scale disasters.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

+ Additional related links *(links can be added online)* -

Level of achievements:

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*Provide details on **progress, challenges and plans** for each indicator question.*

(e.g. [1.1.1] indicates the linkages to the 5 HFA priorities. For more details refer to the following guidelines: add link.)

Essential 4: Invest in and maintain risk reducing infrastructure, such as storm drainage [HFA 4]

How far do land use policies and planning regulations for housing and development infrastructure take current and projected disaster risk (including climate related risks) into account? [4.1.2]

☐ **housing**

☐ **communication**

☐ **transportation**

☐ **energy**

Land use planning and building regulations are two of the most important areas for local rural and urban disaster risk reduction. Existing policies and regulations that take disaster risk into account and provide for clear negative and positive sanctions, provide the essential basis for effective risk management. These regulations need to be articulated and enforced for all critical infrastructure and housing

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

+ Additional related links *(links can be added online)* -

How adequately are critical public facilities and infrastructure located in high risk areas assessed for all hazard risks and safety? [4.4.1]

In-depth risk assessments for all critical infrastructure, such as hospitals, schools, roads, energy and water supply systems, local market places, administrative buildings, telecommunications infrastructure etc. are a basic requirement for local disaster risk management in hazard-prone areas. These risk assessments have to be done for all relevant hazards and updated on a regular basis.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

+ Additional related links *(links can be added online)* -

Level of achievements:

5-Comprehensive achievement has been attained, with the commitment and capacities to sustain efforts at all levels.

4-Substantial achievement has been attained, but with some recognised deficiencies in commitment, financial resources or operational capacities.

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*Provide details on **progress, challenges and plans** for each indicator question.*

(e.g. [1.1.1] indicates the linkages to the 5 HFA priorities. For more details refer to the following guidelines: add link.)

How adequate are the measures that are being undertaken to protect critical public facilities and infrastructure from damage during disasters? [4.4.2]

Risk assessments of critical local infrastructure provide the basis, but the findings have to be acted upon in a timely and adequate manner. Investments in the protection of important public facilities will pay off by significantly lowering the cost of disaster response, relief and rehabilitation in the case of an extreme event.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

+ Additional related links *(links can be added online)* -

Essential 5: Assess the safety of all schools and health facilities & upgrade these as necessary
[HFA 2, 4 and 5]

To what extent have local schools, hospitals and health facilities received special attention for "all hazard" risk assessments in your local authority? [2.1.1]

☐ **Schools** and/or ☐ **Hospitals/ health facilities**

While all public infrastructure should undergo regular risk assessments, local schools, health facilities and hospitals are the most important as their buildings and services can significantly reduce vulnerability of affected communities before, during and after disasters.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

+ Additional related links *(links can be added online)* -

How safe are all main schools, hospitals and health facilities from disasters so that they have the ability to remain operational during emergencies? [2.1.2]

☐ **Schools** and/or ☐ **Hospitals/ health facilities**

Level of achievements:

5-Comprehensive achievement has been attained, with the commitment and capacities to sustain efforts at all levels.

4-Substantial achievement has been attained, but with some recognised deficiencies in commitment, financial resources or operational capacities.

3-There is some institutional **commitment and capacities to achieving DRR** but progress is not comprehensive or substantial.

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1-Achievements are **minor** and there are few signs of planning or forward action to improve the situation.

*Provide details on **progress, challenges and plans** for each indicator question.*

(e.g. [1.1.1] indicates the linkages to the 5 HFA priorities. For more details refer to the following guidelines: add link.)

Schools and health facilities often provide essential space and services during emergencies. While in extreme events, they may function as shelters and administrative centres for the management of response and relief, successful management of these assets means that they can continue to function as educational and health centres throughout disaster events – which is essential for the protection of lives, livelihoods and human capital.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

+ Additional related links *(links can be added online)* -

To what degree do local governments or other levels of government have special programs in place to regularly assess schools, hospitals and health facilities for maintenance, compliance with building codes, general safety, weather-related risks etc.? [3.1.1]

☐ **Schools** and/or ☐ **Hospitals/ health facilities**

Risk assessments of local infrastructure must be coupled with regular checks of maintenance levels and health and safety standards to ensure compliance with codes and regulations. This is particularly important for schools and health facilities.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

+ Additional related documents *(documents can be attached online)* -

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How far are regular disaster preparedness drills undertaken in schools, hospitals and health facilities? [2.4.1]

☐ **Schools** and/or ☐ **Hospitals/ health facilities**

Experience from many countries has shown that undertaking regular preparedness exercises and drills in schools and hospitals can save lives. These exercises can be done at relatively low cost and create a risk awareness amongst students, staff and patients that enables them to react appropriately during an emergency and save themselves and others.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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Essential 6: Apply and enforce realistic, risk compliant building regulations and land use planning principles. Identify safe land for low-income citizens and develop upgrading of informal settlements, wherever feasible. [HFA 2, 4 and 5]

How well are risk-sensitive land use regulations and building codes, health and safety codes enforced across all development zones and building types? [4.1.3]

The enforcement of land use planning and building regulations is a critical challenge for all local governments. While some urban areas and building types are relatively well regulated, informal settlements and large parts of rural infrastructure remain outside of common regulations and enforcement systems. They are often vulnerable to natural hazards and therefore require context-specific and appropriate support that ensures compliance with minimum standards of safety without further marginalising vulnerable households and businesses.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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How strong are existing regulations (e.g. land use plans, building codes etc) to support disaster risk reduction in your local authority? [4.1.4]

Land use plans and building codes can be developed in ways that either foster a culture of disaster risk reduction or create barriers to resilient building and land use. Regulations that are oriented at very high standards, may push poor communities and small businesses to move to informal settlements and invest in non-compliant infrastructure, further increasing overall disaster risk. Appropriate regulative policies can be developed in dialogue with these groups in order to ensure compliance and risk reduction.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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Essential 7: Ensure education programmes & training on disaster risk reduction are in place in schools and communities [HFA 1, 3 and 5]

How regularly does the local government conduct awareness-building or education programs on DRR and disaster preparedness for local communities? [1.3.3.]

☐ **programs include cultural diversity issues**

☐ **programs are sensitive to gender perspectives**

Regular communication and education on hazards, risk and risk reduction strategies can create a culture of risk awareness and prevention among affected communities. When these activities take the form of inclusive and culturally-sensitive programmes that regularly reach out to all groups within local communities, they can become effective agents for successful risk reduction and preparedness.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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To what extent does the local government provide training in risk reduction for local officials and community leaders? [3.2.1]

Knowledge of basic concepts of disaster risk reduction and of common risk management strategies is not necessarily readily available within local government and communities. Regular training of local government staff (across departments) and community representatives contributes to generating an awareness of risk and – most importantly – of the options available to local governments and communities in reducing and preparing for disaster risk.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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To what degree do local schools and colleges include courses, education or training in disaster risk reduction (including climate related risks) as part of the education curriculum? [5.2.4]

Apart from conducting preparedness drills to alert students to how to behave in emergencies, regular sessions on disaster and climate risks that are integrated into school and college curricula will increase their understanding of how they can actively reduce the risk of future disasters. Curricula for all education levels can be adapted at relatively low cost to include disaster and climate risks knowledge into, for example, geography, history and physics classes.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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How aware are citizens of evacuation plans or drills for evacuations when necessary? [4.2.2]

While local governments may have developed full evacuation plans for hazard-prone communities, this does not mean that citizens are aware of them or know how to act in emergencies. When developing evacuation plans and drills for evacuations, an effective communication strategy that ensures communities get to know their content will be a central factor for success.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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Essential 8: Protect ecosystems & natural buffers to mitigate hazards, adapt to climate change
[HFA 4]

How well integrated are local government DRR policies, strategies and implementation plans with existing environmental development and natural resource management plans? [4.1.1]

Sustainable environmental management in rural and urban areas is a prerequisite for successful disaster risk reduction. Where disaster and climate risks are taken into consideration for natural resource management, there is a lower risk of increased exposure and vulnerability of local communities to natural hazards.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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To what degree does the local government support the restoration, protection and sustainable management of ecosystems services? [4.1.5]

☐ **forests**

☐ **coastal zones**

☐ **wetlands**

☐ **water resources**

☐ **river basins**

☐ **fisheries**

Local ecosystems provide essential services to communities and local economies. These include that they can act as buffers against natural hazards and significantly mitigate the impact particularly of weather-related disasters.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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How much do civil society organizations and citizens participate in the restoration, protection and sustainable management of ecosystems services? [4.1.6]

Local communities are often the primary users and managers of ecosystem services. Their involvement in the planning and implementation of natural resource and environmental management programmes is critical for the role that these services can play in reducing disaster risk. Involving such communities in decision-making can also make visible any potential conflict of interest and provide the space for negotiating a sustainable use of natural resources across the local authority.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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How much does the private sector participate in the implementation of environmental and ecosystems management plans in your local authority? [4.1.7]

Private businesses, particularly small and medium enterprises, are often largely dependent on local ecosystems and have a strong interest in the sustainable management of their resources. Involving them, as well as potentially interested large corporations, into environmental management plans and programmes will be important to ensure compliance within the local authority.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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Essential 9: Install early warning systems & emergency management capacities [HFA 2 and 5]

To what degree do local institutions have access to financial reserves to support effective disaster response and early recovery? [5.3.1.]

In the event of disasters, providing immediate relief to affected individuals and households takes precedent over all other activities and requires adequate levels of liquidity in the local budget. Access to local and national contingency and recovery funds is critical to the success of response and rehabilitation in emergencies.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Description of Progress and Achievements *(300 words max)* -

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To what extent are early warning centres established, adequately staffed (or on-call personnel) and well resourced (power back ups, equipment redundancy etc) at all times? [2.3.1]

Saving lives depends on functioning early warning systems and therefore on local early warning centres that have the capacity to respond immediately to nationally broadcast early warnings or pick up on local warning messages. This requires dedicated financial and human resources to ensure continuous functioning of the centre.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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How much do warning systems allow for adequate community participation? [2.3.2]

The 'last mile' of communicating early warning messages to affected households and individuals has been identified as the main challenge in national early warning systems. At the local level, governments can determine how short that mile is by actively encouraging the involvement of communities in the development and operation of local early warning systems, e.g. through operating local radios, putting in place mobile community messenger systems etc.

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To what extent does the local government have an emergency operations centre (EOC) and/or an emergency communication system? [5.2.3]

In the event of a disaster, coordination of response and relief efforts is critical to ensure that all affected individuals are reached and the waste of resources is kept to a minimum. Being able to rely on a functioning emergency operations centre and emergency communications system is the basis for this effective coordination. Such a centre and system can be hosted by a government department, a local organisation or set up in a public building as long as all actors involved can access it and fully understand how it operates.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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How regularly are training drills and rehearsal carried out with the participation of relevant government, non-governmental, local leaders and volunteers? [5.2.1]

Effective response cannot be planned for on paper. Regular training drills, reminder exercises and rehearsals are the only way to ensure that everybody involved knows what to do in an emergency. Where these drills are carried out a minimum of once a year, the chance for success in relief efforts increases significantly.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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How available are key resources for effective response, such as emergency supplies, emergency shelters, identified evacuation routes and contingency plans at all times? [5.2.2]

☐ **Stockpiles of relief supplies**

☐ **Emergency shelters**

☐ **Safe evacuation routes identified**

☐ **Contingency plan or community disaster preparedness plan for all major hazards**

While the whole range of response activities should be adequately funded, there are a few critical items that must be identified beforehand and funding for these ensured. They include the stockpiling of relief supplies in appropriate locations, ensuring the functioning of emergency shelters and clearly articulated contingency plans for all major hazards.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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Essential 10: Ensure that the needs and participation of the affected population are at the centre of reconstruction [HFA 4 and 5]

How much access does the local government have to resources and expertise to assist victims of psycho-social (psychological, emotional) impacts of disasters? [5.3.2]

Disasters are highly traumatic events and can leave whole communities devasted not only physically and financially, but also mentally and psychologically. Supporting victims and their families in dealing with the emotional and social impacts of disasters, requires additional resources and specialised skills that are not always readily available within local governments. Partnering with relevant non-governmental organisations and the private sector can make some of these resources available.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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How well are disaster risk reduction measures integrated into post-disaster recovery and rehabilitation activities (i.e. build back better, livelihoods rehabilitation)? [4.5.1]

The importance of finding a way to move as early as possible from response to recovery and long-term development has been well recognised. More importantly, understanding the concepts and basic strategies of disaster risk reduction need to be built into the full cycle of disaster management if a shift is to be achieved at the local level.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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To what degree does the Contingency Plan (or similar plan) include an outline strategy for post disaster recovery and reconstruction, including needs assessments and livelihoods rehabilitation? [5.2.5]

While contingency plans have to mainly meet the immediate needs in the event of a disaster, integrating plans for post-disaster recovery and reconstruction, particularly of the livelihoods of affected communities, into the plans can greatly improve the overall risk management cycle and shorten the period for which immediate relief is required. Well-conducted needs assessments and assessments of what is required to rehabilitate livelihoods can accelerate how quickly affected households bounce back.

Level of achievements: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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APPENDIX B: LIST OF REFERENCES

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