STRENGTHENING ASEAN MULTI-HAZARD END TO END EARLY WARNING SYSTEM FOR NATURAL DISASTERS

An Assessment of Current Capacity

February 2024

The Association of Southeast Asian Nations (ASEAN) was established on 8 August 1967. The Member States are Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam. The ASEAN Secretariat is based in Jakarta, Indonesia.

For inquiries, contact:
The ASEAN Secretariat
Community Relations Division (CRD)
70A Jalan Sisingamangaraja
Jakarta 12110, Indonesia
Phone: (62 21) 724-3372, 726-2991
Fax: (62 21) 739-8234, 724-3504
E-mail: public@asean.org

Catalogue-in-Publication Data

STRENGTHENING ASEAN MULTI-HAZARD END TO END EARLY WARNING SYSTEM FOR NATURAL DISASTERS
An Assessment of Current Capacity

Jakarta, ASEAN Secretariat, February 2024

ASEAN – Disaster Management – Natural Disasters
Early Warning System – Prevention and Mitigation

ISBN 978-623-5429-40-3 (PDF)

ASEAN: A Community of Opportunities for All

The text of this publication may be freely quoted or reprinted, provided proper acknowledgement is given and a copy containing the reprinted material is sent to the Community Relations Division (CRD) of the ASEAN Secretariat, Jakarta.

General information on ASEAN appears online at the ASEAN Website: www.asean.org.

Copyright Association of Southeast Asian Nations (ASEAN) 2024.
All rights reserved.

STRENGTHENING ASEAN MULTI-HAZARD END TO END EARLY WARNING SYSTEM FOR NATURAL DISASTERS

An Assessment of Current Capacity

ASEAN Secretariat
Jakarta

TABLE OF CONTENTS

ACKNOWLEDGEMENTS 6

LIST OF ABBREVIATIONS 7

FOREWORDS 10

EXECUTIVE SUMMARY 12

INTRODUCTION 16

BACKGROUND AND METHODOLOGY 18

ASSESSMENT FINDINGS 24

DISASTER RISK KNOWLEDGE 25

HAZARD DETECTION, MONITORING, ANALYSIS, AND FORECASTING CAPACITY 28

WARNING DISSEMINATION AND COMMUNICATION 31

PREPAREDNESS AND RESPONSE CAPABILITIES 34

CROSS-CUTTING CONSIDERATIONS 37

ASSESSMENT LIMITATIONS 38

GLOBAL AND REGIONAL CONTEXT 39

RECOMMENDATION AND PROPOSED INITIATIVES 40

RECOMMENDATION 41

PROPOSED INITIATIVES 42

INITIATIVES SUPPORT 52

TABLE OF CONTENTS

APPENDICES **54**

APPENDIX A: FINDINGS FROM ASEAN MEMBER STATES 56

APPENDIX B: STAKEHOLDER ENGAGEMENT LIST 118

APPENDIX C: RAW DATA SCORE SHEETS 123

APPENDIX D: GLOBAL AND REGIONAL INITIATIVES, SYSTEMS, AND FRAMEWORKS 178

APPENDIX E: DESK STUDY BIBLIOGRAPHIES 183

ENDNOTES 213

ACKNOWLEDGEMENTS

The report on Strengthening ASEAN Multi-hazard End to End Early Warning System (EWS) for natural disasters - An Assessment of Current Capacity was prepared under the guidance of the ASEAN Committee on Disaster Management Working Group on Prevention and Mitigation (ACDM WG P&M) and the United States Government through the ASEAN-USAID Partnership for Regional Optimization within the Political-Security and Socio-Cultural Communities (PROSPECT). We would like to acknowledge the contributions of experts, practitioners, and researchers from across ASEAN Member States who provided their expertise and shared their experiences. Their valuable inputs during focus group discussions, meetings, and consultations have enriched our understanding of the current state of EWS in the region.

We are grateful to the regional and international organizations, including the United Nations agencies, and non-governmental organizations for their valuable contributions. Their support, technical expertise, and collaboration have been invaluable in enriching the report and providing a broader perspective on EWS in the ASEAN region. We wish to emphasize that their collective efforts have been indispensable in its production.

Valuable inputs and reviews were also received from Dr. Riyanti Djalante and Ms. Nguyen Anh Son of the ASEAN Secretariat. We sincerely thank everyone involved for their dedication, collaboration, and commitment to building a more resilient ASEAN community, including members of the Pacific Disaster Center (PDC) project team.

CONTRIBUTORS

Victoria Leat (BSc), Lead Author
Asia Program Advisor, Pacific Disaster Center

Chris Chiesa (MS, MBA), Lead Author
Deputy Executive Director, Pacific Disaster Center

Ray Shirkhodai
Executive Director, Pacific Disaster Center

Erin Hughey (PhD)
Director of Global Operations, Pacific Disaster Center

Cassie Stelow (MS)
Director of Information Technology, Pacific Disaster Center

Alison Somilleda (MBA, MS)
Technical Editor, Pacific Disaster Center

Anom Parikesit (BSc)
Indonesia National Representative, Pacific Disaster Center

Abby Guiang (BA)
Philippines National Representative, Pacific Disaster Center

Chani Goering (BFA)
Communication and Outreach Manager, Pacific Disaster Center

Pongsri Virapat (BSc)
Thailand National Representative, Pacific Disaster Center

Mohammad Fadli (BSc)
AHA Liaison Officer, Pacific Disaster Center

Thawatchai Palakhamarn (PhD)
Independent Consultant

LIST OF ABBREVIATIONS

AADMER
ASEAN Agreement on Disaster Management and Emergency Response

ACDM
ASEAN Committee on Disaster Management

ACFCSS
ASEAN Common Framework for Comprehensive School Safety

ADINet
ASEAN Disaster Information Network

ADRP
ASEAN Disaster Resilience Forum

AEIC
ASEAN Earthquake Information Centre

AHA Centre
ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management

ASEAN
Association of Southeast Asian Nations

ASCMG
ASEAN Sub-Committee on Meteorology and Geophysics

ASMC
ASEAN Specialized Meteorological Center

BDMD
Brunei Darussalam Meteorological Department

BIG
Badan Informasi Geospasial

BMKG
Badan Meteorologi, Klimatologi, Dan Geofisika

BNPB
Badan Nasional Penanggulangan Bencana

CAP
Common Alerting Protocol

CBDRM
Community-based disaster risk management

CBEWS
Community Based Early Warning Systems

CDMC
Central Disaster Management Committee

COSTI
ASEAN Committee on Science, Technology, and Innovation

CREWS
Climate Risk and Early Warning Systems Initiative

CVGHM
Center for Volcanology and Geological Hazard Mitigation

DAN
Disaster Alert Notification

DCC
Disaster Command Centre

DDM
Department of Disaster Management

DDPM
Department of Disaster Prevention and Mitigation

DENR
Department of Environment and Natural Resources

DID
Department of Irrigation and Drainage

DJPPI
Direktorat Jenderal Pengendalian Perubahan Iklim

DMH
Department of Meteorology and Hydrology

DMHA
Disaster Management and Humanitarian Assistance

DMPTC
Disaster Management Policy and Technology Center

DMRS
Disaster Monitoring and Response System

DMSPF
Disaster Management Strategic Policy Framework

DOST
Department of Science and Technology

DRR
Disaster Risk Reduction

DRR WG
Disaster Risk Reduction Working Group

E2E-EWS
End-to-End Early Warning System

EITWC
Earthquake Information and Tsunami Warning Center

ESCAP
Economic and Social Commission for Asia and the Pacific

ESDM
Energi Sumber Daya Mineral

EW4ALL
Early Warning for All

(Abbreviations Continued...)

EWS
Early Warning Systems

FGD
Focus Group Discussion

FDM-EWS
Flood and Drought Management and Early Warning System

GDACS
Global Disaster Alert and Communication System

GRI
Global Risk Index

InaTEWS
Indonesia Earthquake and Tsunami Warning System

INFORM
Index for Risk Management

IOC
Intergovernmental Oceanographic Commission

IOTWMS
Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System

JMG
Malaysia Minerals and Geoscience Department

KOMINFO
Kementerian Komunikasi & Informatika

LAPAN
Lembaga Penerbangan dan Antariksa Nasional

LNDPC
Law on Disaster Prevention and Control

MAPDRR
Myanmar Action Plan on Disaster Risk Reduction

MARD
Ministry of Agriculture and Rural Development

MGB
Mines and Geoscience Bureau

MHA
Ministry of Home Affairs

MIMU
Myanmar Information Management Unit

MLSW
Ministry of Labour and Social Welfare

MNTEWS
Malaysian National Tsunami Early Warning System

MoNRE
Ministry of Natural Resources and Environment

MOWRAM
Ministry of Water Resources and Meteorology

MRC
Mekong River Commission

MSE
Ministry of Sustainability and the Environment

MSS
Meteorological Services Singapore

NADMA
National Disaster Management Agency

NaFFWS
National Flood Forecasting and Warning System

NAP-DRR
National Action Plan for Disaster Risk Reduction

NaSOP
National Standard Operating Procedures

NCDM
National Committee on Disaster Management

NCHMF
National Center for Hydro-meteorological Forecasting

NDC
National Disaster Council

NDCC
National Disaster Command Centre

NDMC
National Disaster Management Centre/ Committee

NDMO
National Disaster Management Organization

NDPMC
National Disaster Prevention and Mitigation Committee

NDPP
National Disaster Preparedness Plan

NDRRMC
National Disaster Risk Reduction and Management Council

NDRRMP
National Disaster Risk Reduction and Management Plan

NDWC
National Disaster Warning Center

NEA
National Environment Agency

(Abbreviations Continued...)

NEWC
National Early Warning Centre

NMS
National Meteorological Services

NSCNDPC
National Steering Committee for National Disaster Prevention and Control

OCD
Office of Civil Defense

PAGASA
Philippine Atmospheric, Geophysical, and Astronomical Services Administration

PDC
Pacific Disaster Center

PHIVOLCS
Philippine Institute of Volcanology and Seismology

PIN
People in Need

PRISM
Platform for Real-time Impact and Situational Monitoring

PROSPECT
Partnership for Regional Optimization within the Political-Security and Socio-Cultural Communities

PTWS
Pacific Tsunami Warning and Mitigation System

PUB
Public Utility Board

PVMBG
Pusat Vulkanologi & Mitigasi Bencana Geologi

RAN PRB
National Action Plan for Disaster Risk Reduction

RBPF
Royal Brunei Police Force

RID
Royal Irrigation Department

RIMES
Regional Integrated Multi-Hazard Early Warning System for Africa and Asia

RVA
Risk and Vulnerability Assessment

SAOFFG
Southeastern Asia-Oceania Flash Flood Guidance

SCDF
Singapore Civil Defense Force

SCSTAC
South China Sea Tsunami Advisory Center

SEADRIF
Southeast Asia Disaster Risk Insurance Facility

SFDRR
Sendai Framework for Disaster Risk Reduction

SNAP
Strategic National Action Plan

STEP
Science and Technology Expert Panel

TMD
Thailand Meteorological Department

TTF
Trust Fund for Tsunami, Disaster and Climate Preparedness

TWG
Technical Working Group

UNDP
United Nations Development Programme

UNESCO
United Nations Educational, Scientific and Cultural Organization

UNOPS
United Nations Office for Project Services

VDDMA
Viet Nam Disaster and Dyke Management Authority

WFP
World Food Programme

WG P&M
Working Group on Prevention and Mitigation

WMO
World Meteorological Organization

WOG-IRM
Whole-of-Government Integrated Risk Management

FOREWORDS

As the Chair of the ASEAN Committee on Disaster Management (ACDM), it is my honor to introduce the report on Strengthening ASEAN multi-hazard end to end early warning system (EWS) for natural disasters - An Assessment of Current Capacity which examines the progress and challenges of EWS in mitigating the risks and impacts of disasters across our region.

Disasters have always posed significant threats to the well-being and development of our communities. Recognizing the need to enhance our collective resilience, ASEAN Member States adopted the ASEAN Agreement on Disaster Management and Emergency Response (AADMER) in 2009. Since then, we have witnessed concerted efforts across the region to strengthen our early warning capabilities and establish a more coordinated approach to disaster risk reduction and management.

This report serves as a significant milestone in our ongoing pursuit of a safer ASEAN. It provides an in-depth assessment of the current state of early warning systems throughout the region—evaluating their effectiveness, coverage, and integration within national and regional frameworks.

The report highlights the substantial progress made through the implementation of AADMER and other regional early warning initiatives. It underscores the importance of these frameworks in promoting regional cooperation, information sharing, and capacity-building to strengthen our collective resilience. By fostering collaboration among Member States, we have been able to develop a more comprehensive and integrated approach to early warning.

While commending the achievements, the report also acknowledges the challenges that lie ahead. Climate change, rapid urbanization, and the increasing frequency of extreme weather events pose new complexities for early warning systems. The assessment outlines recommendations to further enhance these systems across the region in the coming years.

In conclusion, I extend my sincere appreciation to all those who have contributed to this assessment. Their dedication, expertise, and unwavering commitment to a resilient ASEAN region have been instrumental in shaping its content. Let us work hand in hand to further strengthen our early warning system capacity, and the safety and well-being of our people.

Together, we can build a more resilient ASEAN community and better prepare to face the challenges of the future.

Thank you.

COLONEL (R) MUHD HARRITH RASHIDI BIN HAJI MUHD JAMIN
Director National Disaster Management Centre
Ministry of Home Affairs Brunei Darussalam
Chair of ASEAN Committee on Disaster Management

(Credit: Shutterstock)

AHA Centre EOC (Credit: Pacific Disaster Center)

STRENGTHENING ASEAN MULTI-HAZARD END TO END EARLY WARNING SYSTEM FOR NATURAL DISASTERS

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

This Strengthening ASEAN Multi-Hazard End to End Early Warning System (E2E EWS) for Natural Disasters Assessment plays a critical role in understanding the state of early warning systems (EWS) in the region, identifying capacities and gaps, and providing recommendations to enhance resilience, including opportunities to better leverage existing activities and successes across the entire region. It serves as a foundation for targeted capacity building and interventions to strengthen EWS and promote disaster resilience across ASEAN.

The assessment provides valuable insights into the existing capacities—as well as remaining gaps—in the region's early warning fabric by systematically analyzing these components across all ASEAN Member States. This granular analysis facilitates targeted interventions to enhance regional resilience and promote a safer ASEAN. The assessment leverages the World Meteorological Organization (WMO) Multi-hazard Early Warning Systems Checklist and assesses capacities in: 1) disaster risk knowledge; 2) detection and monitoring; 3) warning dissemination and communication; and 4) preparedness and response capabilities.

1) Disaster Risk Knowledge. The assessment reveals that while all ASEAN Member States display some capacity achievement, there are disparities in scientific and technical review of risk data, limited consideration of compound and secondary risks, and challenges in consolidating risk information across multiple repositories, as well as comprehensively factoring in available risk data into EWS strategies.

2) Detection, monitoring, analysis, and forecasting capacity. There is significant variation in capacities across ASEAN Member States, particularly in forecasting and warning services. Challenges include inadequate maintenance of monitoring systems, limited system and service upgrades, and a lack of cross-border exchange of warnings and observation data.

ARDEX Exercise, 2023 (Credit: ASEAN Secretariat)

ARDEX Exercise, 2023 (Credit: ASEAN Secretariat)

3) Warning dissemination and communication. This area exhibits significant limitations in many ASEAN Member States, with gaps in tailoring communication to different groups, the absence of clear actionable guidance in warning messages, and weaknesses in communication channels—especially to reach isolated, rural communities—and feedback mechanisms. Additionally, the assessment noted a gap in capacity in the sharing of warning messages between ASEAN Member States and with regional EWS partners.

The assessment highlights the limited interconnectedness of the four early warning elements among ASEAN Member States...

4) Preparedness and response capabilities. There are relative comparable levels of capacity demonstrated across the region, with well-developed legislative frameworks. However, limitations were observed in community communication, testing, and exercising of plans, utilization of risk assessments, and addressing the needs of vulnerable groups.

The assessment highlights the limited interconnectedness of the four early warning elements among the ASEAN Member States, leading to missed capacity-building opportunities, misinformed planning activities, and duplication of efforts.

While the assessment provides valuable insights, some limitations were noted due to the limited availability of information and stakeholder engagement in some cases. Further assessment and research is recommended for ASEAN Member States that were not able to participate fully.

CHALLENGES:

Underutilization of risk assessments

Siloed data

Gaps in last-mile alerting

Limited harmonization among early warning system components

RECOMMENDATION AND SUGGESTED INITIATIVES

The regional findings led to a recommendation to **strengthen and harmonize regional early warning system components to build an effective and resilient ASEAN end-to-end early warning system**. This recommendation is developed in recognition of, and appreciation for, the substantial EWS efforts already undertaken across the region.

Four programmatic areas support a range of suggested initiatives:

1 **Policy Enhancement:** Building on existing national and regional efforts, enhance policies for the application of risk and vulnerability assessments, engagement of hazard experts, institutionalization of EWS interoperability, formulization of localized and actionable warning messages, and tailoring of public education programs to enhance national and regional EWS.

2 **Institutional Strengthening:** Enhance EWS institutional systems and structures through strengthening of processes and agreements for the sharing of RVA data, establishment of knowledge exchange forums, leveraging of the ASEAN Disaster Monitoring and Response System (DMRS), and implementation of mobile technologies to enhance EWS last mile processes.

3 **Capacity Development:** Expand capacity across all four EWS thematic areas within ASEAN Member States and regionally, especially in the application of Risk and Vulnerability Assesment (RVA) to EWS processes, use of cloud technologies for high availability and sustainable alerting, adoption of international Common Alerting Protocol (CAP) standard for message delivery, and the establishment of knowledge exchange forums and technical working groups.

4 **Technical Assistance:** Provide targeted assistance to national and regional bodies for the delivery of planned initiatives, including engagement of national and regional experts, support for cloud hosting of EWS systems, deployment of mobile technologies, and the implementation of CAP.

INTRODUCTION

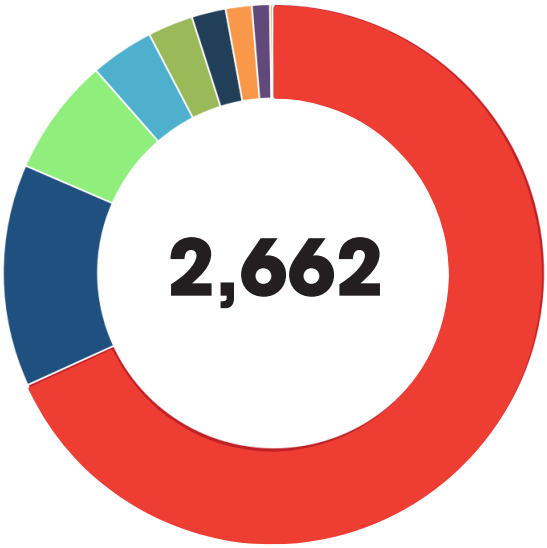
The ASEAN region is facing an increasing likelihood of high-impact hazard events. The overall number of disasters—particularly hydrometeorological hazards—are on the rise and being further exacerbated by climate change. These changes are making hazard events less predictable and increasingly more challenging for existing monitoring systems and responders. While effective systems are in place in select communities throughout ASEAN, a more efficient E2E-EWS is essential if ASEAN Member States are to be able to identify, and prepare for, potential risks in the future.

The ASEAN Multi-Hazard E2E-EWS Assessment provides a comprehensive assessment of the current state of multi-hazard E2E-EWS capacity across all ASEAN Member States, as well as the region as a whole. The results of the assessment, conducted by the Pacific Disaster Center (PDC), deliver a deeper understanding of EWS capacity and gaps, and provide the basis for recommendations to enhancements across the region. The resulting EWS Assessment is designed as a reference document for informing targeted capacity building on E2E-EWS and its components across ASEAN.

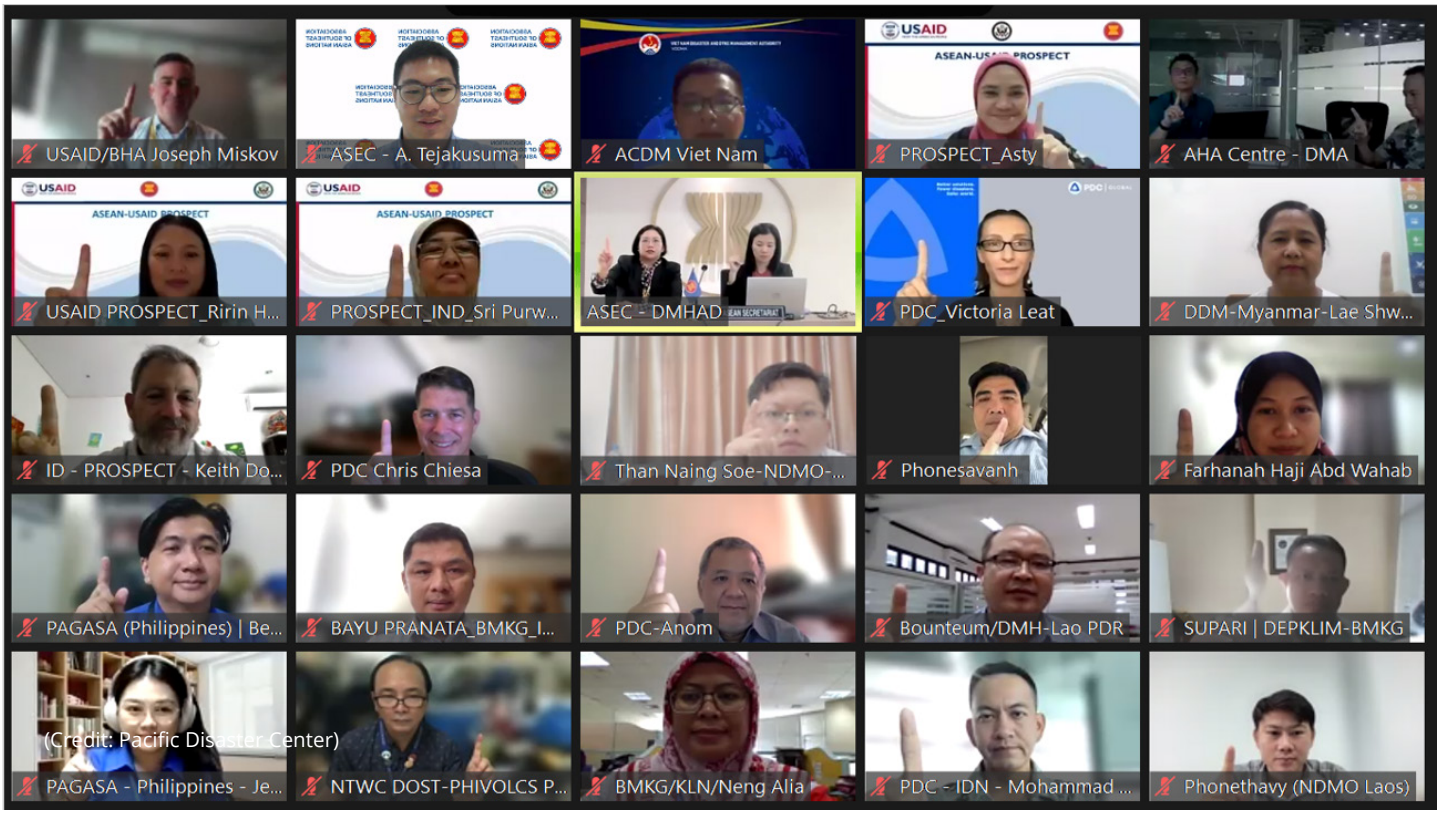
Philippines Flooding, 2022 (Credit: REUTERS)

ASEAN REGION

DISASTERS AFFECTING THE ASEAN REGION (2021-2022)[1]



Floods	**2,068**	(77.6%)
Tornadoes	**316**	(11.8%)
Severe Storms	**100**	(3.7%)
Landslides	**77**	(2.8%)
Earthquakes	**32**	(1.2%)
Tropical Cyclones	**46**	(1.7%)
Droughts	**12**	(.45%)
Volcanic Eruptions	**9**	(.33%)
Wildfires	**0**	(0%)
Storm Surge	**2**	(.07%)
Tsunami	**0**	(0%)



STRENGTHENING ASEAN MULTI-HAZARD END TO END EARLY WARNING SYSTEM FOR NATURAL DISASTERS

BACKGROUND AND METHODOLOGY

BACKGROUND AND METHODOLOGY

An effective multi-hazard E2E-EWS encompasses many interconnected components including:

- Disaster Risk Knowledge
- Hazard Detection, Monitoring, Analysis, and Forecasting Capacity
- Warning Dissemination and Communication
- Preparedness and Response Capabilities

The effective functioning of these components is critical to providing essential lead time to aid decisions and reduce the potentially destructive impact of hazard events, including loss of life, destruction of property, and damage to livelihoods. Breakdowns or gaps in any of the EWS components can lead to failure of the entire system, with potentially disastrous impacts. This assessment's systematic consideration and analysis of these early warning components across all ASEAN Member States, as well as at the regional level, provides valuable insight into existing capacities and gaps in the region's early warning fabric. The inclusion of a subcomponent analysis within the assessment allows for a more granular and richer understanding of EWS capacity, supporting more effective targeted interventions to build regional resilience and a safer ASEAN.

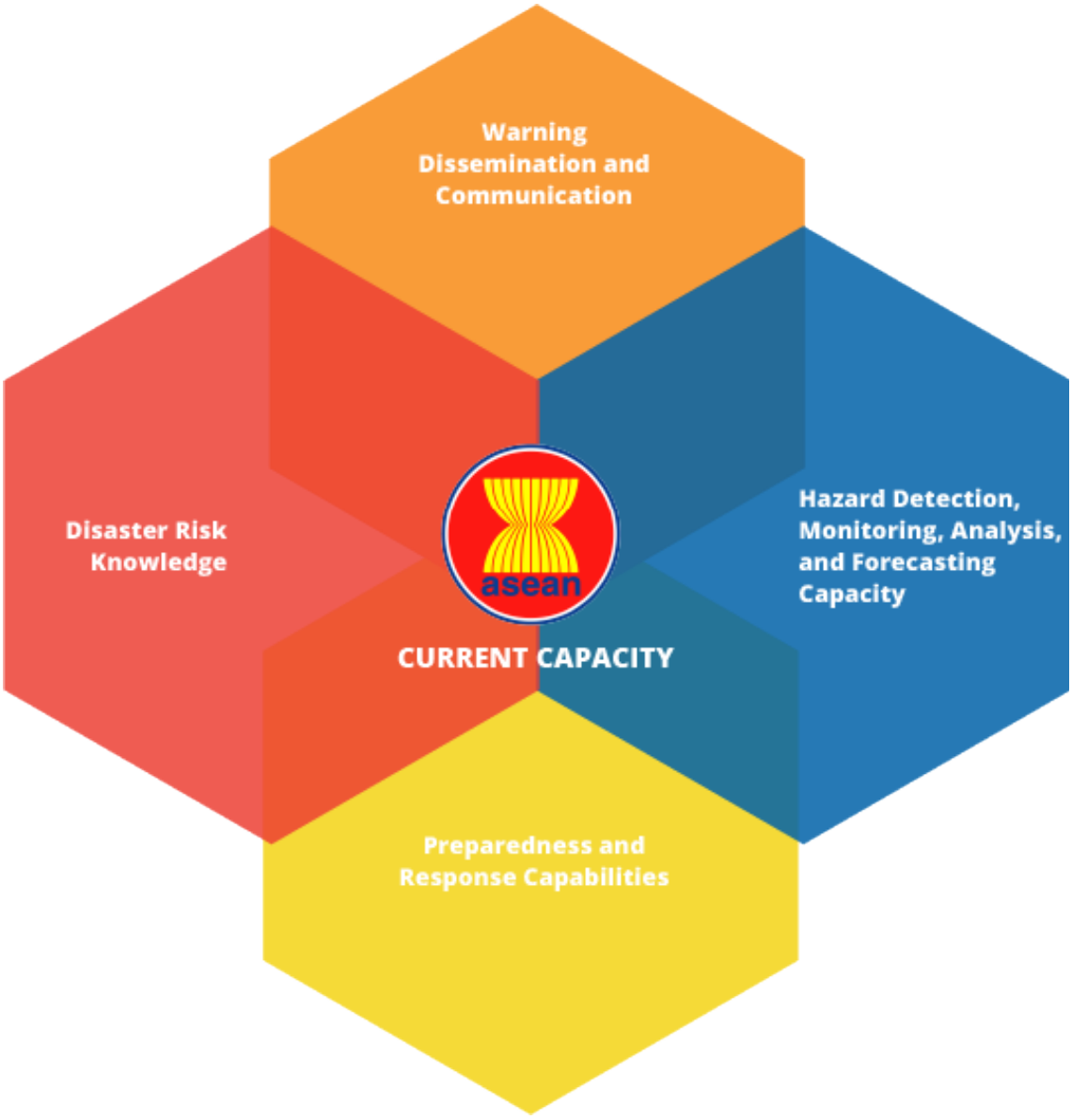
The importance of early warning is well established and recognized by the ASEAN Member States, explicitly acknowledged in the ASEAN Agreement on Disaster Management and Emergency Response (AADMER)[2]. Article 4 highlights the objective to enhance regional cooperation and coordination in disaster management, including EWS, while Article 8 focuses on prevention and mitigation measures, which underscores the significance of EWS as a key component in disaster risk reduction.

Article 8 also emphasizes the need for ASEAN Member States to develop and strengthen early warning capabilities to provide timely and accurate information to at-risk populations and facilitate proactive measures to mitigate the impacts of disasters.

BACKGROUND AND METHODOLOGY

OVERVIEW

The E2E-EWS Assessment provides a critical analysis of early warning systems to inform targeted capacity building on E2E-EWS and its components across the ASEAN region. The assessment leverages the World Meteorological Organization (WMO) Multi-hazard Early Warning Systems Checklist[3], undertaking capacity assessment across four thematic areas:



BACKGROUND AND METHODOLOGY

DEFINITIONS

Disaster Risk Knowledge: Comprehensive information on all the dimensions of disaster risk, including hazards, exposure, vulnerability and capacity, related to persons, communities, organizations, and countries, as well as their assets.

- Are key hazards and related threats identified?
- Are exposure, vulnerabilities, capacities, and risks assessed?
- Are roles and responsibilities of stakeholders identified?
- Is risk information consolidated?
- Is risk information properly incorporated into the early warning system?

Hazard Detection, Monitoring, Analysis, and Forecasting Capacity: Multi-hazard monitoring and forecasting services with a sound scientific and technological basis.

- Are there monitoring systems in place?
- Are there forecasting and warning services in place?
- Are there institutional mechanisms in place?

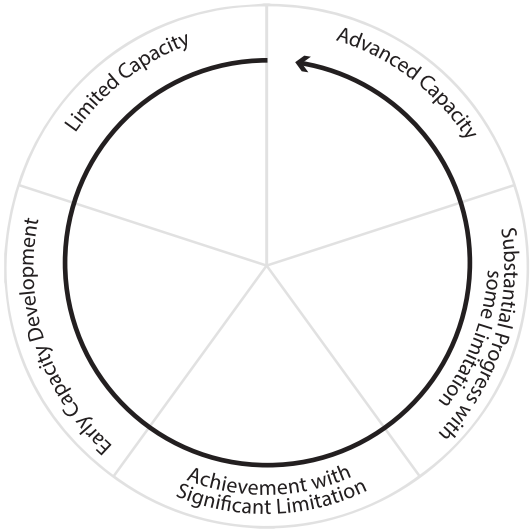
Warning Dissemination and Communication: Communication and dissemination systems (including the development of last-mile connectivity) ensuring people and communities receive warnings in advance of impending hazard events, and facilitating national and regional coordination and information exchange.

- Are organizational and decision-making processes in place and operational?
- Are communication systems and equipment in place and operational?
- Are impact-based early warnings communicated effectively to prompt action by target groups?

Preparedness and Response Capabilities: Institutions and people enabled to act early and respond to a warning through enhanced risk education.

- Are disaster preparedness measures, including response plans, developed and operational?
- Are public awareness and education campaigns conducted?
- Are public awareness and response tested and evaluated?

BACKGROUND AND METHODOLOGY



Through the lens of the Sendai Framework, for each thematic area, several sub-components supporting early warning were considered and assessed across pre-established capacity criteria ranging from limited to advanced capacity.

Assessing regional capacity along a sliding scale of achievement allows for an understanding of where additional research may be required prior to future targeted capacity-enhancement investments.

The assessment considers existing literature and documentation on early warning across the ASEAN region, as well as written and verbal inputs provided by the region's early warning stakeholders, including ASEAN Member State governments.

A participatory approach is used to strengthen the assessment, providing stakeholders with opportunities to share their inputs and review findings to ensure the accuracy and completeness of research, and the inclusion of diverse perspectives.[4]

A full list of stakeholders is provided in Appendix B.

STAKEHOLDER PARTICIPATION OPPORTUNITIES

- Stakeholder/key informant surveys
- Review of initial assessed capacity based on desk study and submission of written inputs/materials
- Focus group discussions to review assessed capacity
- Submission of written inputs/ materials
- Review of amended capacity assessment and submission of additional written inputs/materials
- Review of draft Assessment Report and submission of additional written inputs/materials
- Stakeholder consultation meeting
- Submission of additional written inputs/materials

BACKGROUND AND METHODOLOGY

Participation in the assessment varied across the region, with engagement from national disaster management organizations, technical agencies, and United Nations/non-governmental organizations differing between ASEAN Member States. To account for this in the assessment findings, an Analysis Confidence Index was developed. Given the range of confidence levels assigned across the region, it is recommended that further research and engagement be undertaken with ASEAN Member States where assessment participation was lower.

Very High Confidence	• Participation of NDMO and science/technical agencies in focus group discussions • Participation of NDMO and science/technical agencies in survey
High Confidence	• Participation of NDMO and science/technical agencies in focus group discussions • Participation of either NDMO and/or science/technical agencies in survey
Medium Confidence	• Participation of NDMO but not science/technical agencies in focus group discussions • Participation of either NDMO and/or science/technical agencies in survey
Low Confidence	• Participation of science/technical agencies but not NDMO in focus group discussions • Participation of either NDMO and/or science/technical agencies in survey
Very Low Confidence	• No participation of NDMO, nor science/technical agencies in focus group discussions • Participation of either NDMO and/or science/technical agencies in survey

ASEAN
ASSOCIATION OF SOUTHEAST ASIAN NATIONS

BRUNEI DARUSSALAM

CAMBODIA

INDONESIA

LAO PDR

MALAYSIA

MYANMAR

PHILIPPINES

SINGAPORE

THAILAND

VIET NAM

STRENGTHENING ASEAN MULTI-HAZARD END TO END EARLY WARNING SYSTEM FOR NATURAL DISASTERS

ASSESSMENT FINDINGS

DISASTER RISK KNOWLEDGE

Advanced Capacity | Substantial Progress with Some Limitation | Achievement with Significant Limitation | Early Capacity Development | Limited Capacity

Disaster risk knowledge is an essential component of EWS, requiring an understanding of hazards, and the vulnerabilities and coping capacities of exposed people and assets. Assessment of these components of risk requires the systematic collection and analysis of data and should account for the dynamic elements that may compound or mitigate such risk. Disaster risk knowledge should also include consideration of the varying needs, capacities, and abilities of different groups. Resulting risk assessments should be used to prioritize needs and inform the planning and development of disaster risk management measures.

Key Findings

Legislative frameworks: Across the region, all ASEAN Member States display some capacity achievement in disaster risk knowledge, as do regional early warning partners. Substantial capacity was observed in the identification of early warning roles and responsibilities of stakeholders, with the roles of key national agencies defined, and coordination for risk assessment generally assigned to one national agency. This suggests that a relatively strong legislative framework for risk assessment exists across the ASEAN region.

The role of scientific and technical experts: In general, strong legislation exists for the

43rd ACDM Conference (Credit: ASEAN Secretariat)

preparation of risk assessments across the ASEAN region, although the incorporation of scientific and technical review of such risk data and information is in the early stages of development in many of the ASEAN Member States.

Furthermore, across all ASEAN Member States, scientific and technical best practices for the development and implementation of national standards for the collection, sharing, and assessment of risk information require further capacity development. Malaysia's establishment of the Science Expert Panel (SET) under the Science and Technology Expert Panel (STEP) provides a powerful example of how academic institutions, the private sector, and technical agencies or departments can be systematically integrated into early warning system design, development, monitoring, maintenance, and updates.

Compound and secondary risks: While most ASEAN Member States demonstrate significant capacity in the understanding of risk for specific hazards in their respective countries, the awareness of compound risks and secondary risks associated with critical infrastructure impacts are not well considered or incorporated into disaster risk reduction activities.

Centralized repository: The assessment found significant variation in the handling of risk and hazard data across the ASEAN region. The majority of ASEAN Member States maintain multiple data repositories, across several national agencies. This results in data silos, challenges in data user access, a lack of interoperability of datasets, duplication of data efforts, and, in some cases, the development of multiple, inconsistent datasets.

At a regional level, the ASEAN Disaster Monitoring and Response System (DMRS) provides a regional repository for hazard and relevant non-hazard data, available through its web interface, and is available to all ASEAN Member States for use in disaster risk reduction. Further efforts to integrate other regional data into the system, including ASEAN Member State data and regional hazard information such as AEIC earthquake data and ASMC prediction data, would further enhance this regional data repository.

Engagement and consideration of different groups: All ASEAN Member States were observed to disaggregate standardized vulnerability data and information by sex and age, but disability data is notably absent from this disaggregation in many of the ASEAN Member States' data collection

activities. Additionally, across the region, there is limited evidence of the systematic engagement of rural and urban communities in risk assessments, leading to limited consideration of the needs of different groups (women, children, older people, individuals with disabilities, urban and rural communities, minorities, etc.) in disaster risk reduction efforts.

An effective example of the integration of sex, age, and disability disaggregated data was identified in Viet Nam, where this data is systematically recorded and is being integrated into their Vietnam Natural Disaster Monitoring System (VNDMS) for use in planning for, and responding to, hazard events.

Incorporation of risk information into EWS: Despite ASEAN Member States exhibiting capacity achievements in the development of hazard and risk assessments, many countries in the region display limited or early capacity development in the incorporation of this information into EWS. The Philippines is the only ASEAN Member State to exhibit substantial progress in this area. Nearly all ASEAN Member States exhibit low capacity in the use of risk information on different types of assets to outline procedures to minimize damage or loss of such assets once a warning is issued, with Singapore a notable exception.

Individual ASEAN Member State findings are provided in Appendix A.

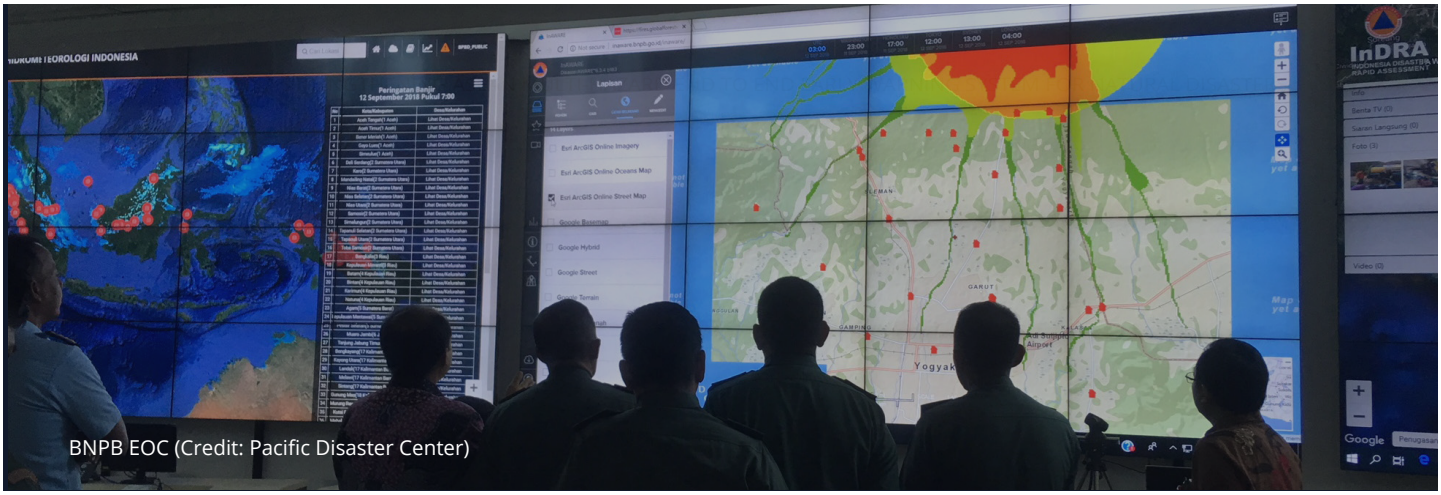
HAZARD DETECTION, MONITORING, ANALYSIS, AND FORECASTING

EWS rely heavily on warning services that can forecast or detect hazard events and deliver warnings on a timely, continuous, and reliable basis. A sound scientific foundation, consistent technology, and trained operators underpin the effectiveness of such warning services. Where possible, services should be automated to increase warning times and reduce potential errors. Strict quality controls and regular maintenance, updates, and testing help ensure a robust and reliable warning network. Strong coordination of warning service components further enhances overall detection, monitoring, analysis, and forecasting.

Key Findings

Significant variation in caspacity: While average capacity for detection, monitoring, analysis, and forecasting across the region appears high, this thematic area displays a wide range of capacities across individual ASEAN Member States. This observed range highlights the significant disparity in the availability of forecasting and warning service capacities between ASEAN Member States.

Hardware and software maintenance and sustainment: Across the region, limited capacity was observed in the maintenance of monitoring hardware and software, with limited planning



BNPB EOC (Credit: Pacific Disaster Center)

for the allocation of total lifecycle costs and resources from the beginning to ensure optimal operation over time. For some ASEAN Member States, this has resulted in aging systems, the loss of warning services, or limitations in detection and forecasting of hazards. Additionally, there was little evidence that EWS software is updated periodically or to high security standards across most of the ASEAN Member States.

System and service upgrades and enhancements: The assessment observed limited capacity in the implementation of systems and services that can integrate new data analysis and processing, modelling, prediction and warning products as science and technology evolve. This has led to limitations in service functionality, resulting in the precipitous obsolescence of systems over time and missed opportunities to leverage early warning scientific and technological advances, undermining national investment in this area. Indonesia and the Philippines are noteworthy exceptions, displaying substantial progress in this area.

System monitoring: While effective monitoring and detection systems are in operation across the region, many ASEAN Member States demonstrate limited capacity in the continuous monitoring of these systems for data gaps, connection outages, or processing issues. Such a lack of monitoring may result in ineffective and incomplete detection of hazard events, leading to gaps in alerting. Malaysia presents a model for system monitoring, with daily logs completed to ensure systems are functioning as expected.

Warning system partner awareness: Significant capacity was observed in warning system partners' awareness of, and respect for, which organizations are responsible for the generation and issuance of warnings across ASEAN Member States. Such capacity supports the dissemination of warning messages to affected communities. Thailand, with its community-based landslide warning network spearheaded by the Department of Mineral Resources, provides an excellent regional example of a country's warning issuer working with regional and community partners to build partner awareness to reduce hazard risk.

Interagency agreements and protocols: The assessment identified a pronounced lack of established agreements and interagency protocols for the exchange of monitoring systems and baseline data to ensure consistency of warning language and communication responsibilities across many ASEAN Member States, with only Indonesia and the Philippines demonstrating

more substantial capacity in both of these areas. A lack of such interagency coordination measures limits early warning capacity, even where individual detection, monitoring, analysis, and forecasting capacities are high.

Cross-border exchange: Only five of the ASEAN Member States have significant capacity development in relation to the cross-border exchange of warnings and observation data realized through bilateral/multilateral agreements. Given the boundaryless nature of hazards, the absence of such exchanges between the other half of ASEAN Member States presents a real risk to early warning throughout the region.

Individual ASEAN Member State findings are provided in Appendix A.

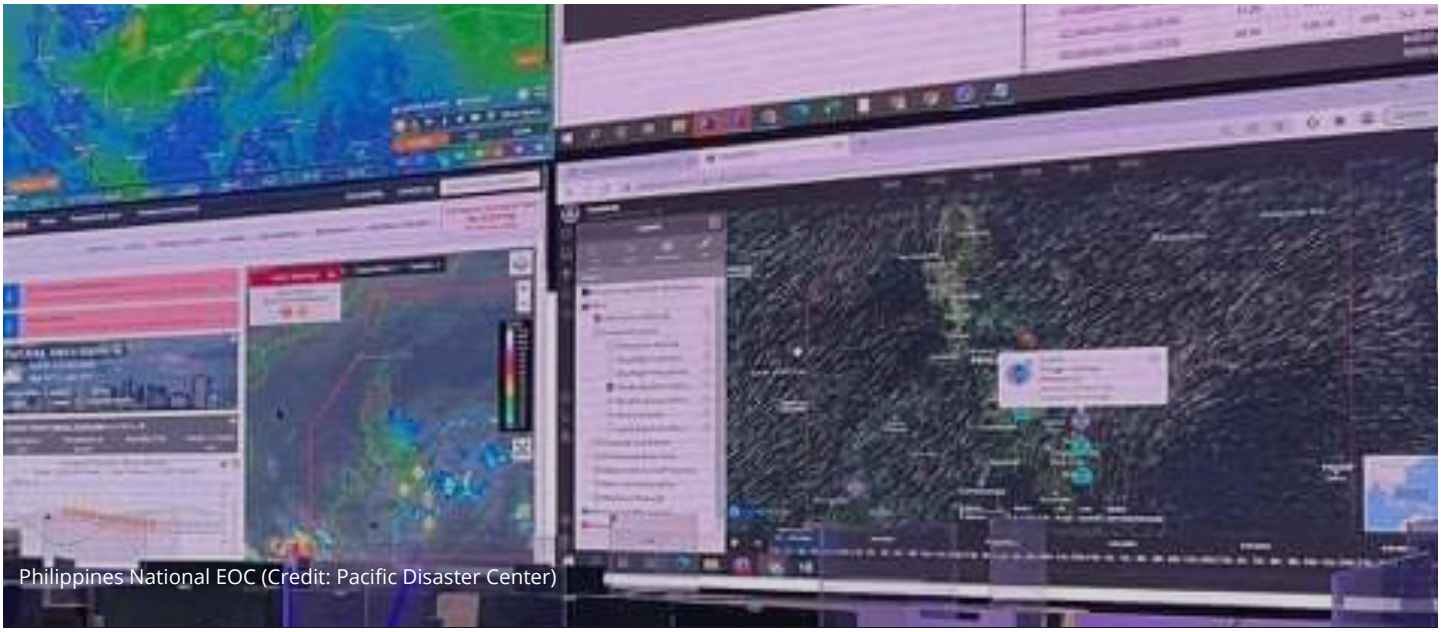
WARNING DISSEMINATION AND COMMUNICATION

Effective detection, monitoring, analysis, and forecasting are only useful if they can be used to inform at-risk communities of potential hazards and provide guidance on how to respond to protect lives and livelihoods. Warning messages to the public should be clear, actionable, and delivered in a timely and effective manner. Trust in warning providers underpins such messages.

Key Findings

Significant limitation across the region: The majority of ASEAN Member States have significant limitations in capacity in warning dissemination and communication. The Philippines and Singapore are notable exceptions, exhibiting substantial progress in this area.

Tailoring of communication and dissemination systems: A variety of warning dissemination and communication tools are employed across the region with Lao PDR demonstrating a strong multi-channel approach to reach a wide audience. Despite such efforts, the assessment suggests a region-wide capacity gap in the tailoring of communication and dissemination systems to the different needs of specific groups such as urban and rural populations, women and men, older



Philippines National EOC (Credit: Pacific Disaster Center)

people and youth, individuals with disabilities, etc. Such a lack of consideration of these differing needs leads to patchy warning dissemination and the increased vulnerability of certain groups to hazard events.

Actionable warnings: While all ASEAN Member States disseminate warnings to the public in various forms and using a range of delivery methods, the assessment observed a lack of inclusion of clear guidance to trigger reactions in warning messages for many of the ASEAN Member States (e.g., evacuation). This results in limitations in the public's response to such events, therefore limiting the effectiveness of such messages. Singapore's Public Warning System presents an effective example of country-wide actionable warning dissemination. The system can broadcast a number of different signals to the public via its network of sirens, with the public educated on what each of the different signals means, and what action to take in response.

Coverage and effectiveness of communication channels: Efforts are required across the region to assess the coverage of communication channels and multiple-channel systems to identify gaps and possible points of failure that may increase vulnerability. Additionally, the assessment found a lack of capacity in the evaluation of the resilience of communication channels and EWS hardware to reduce the impact of events on the infrastructure, with the exception of Cambodia and Singapore. Furthermore, assessment and feedback mechanisms to verify that warnings have been received and reach the entire population were noted as particularly necessary in many of the ASEAN Member States where this information could be used to address warning failures and gaps in the receipt of warning messages.

Warning needs of different groups: The assessment found there was a lack of capacity to identify, and accommodate for, the different risks and needs of subpopulations, including differential vulnerabilities (e.g., urban and rural, women and men, older people and youth, individuals with disabilities, etc.). Such a lack of consideration for these varying needs results in gaps in warning message effectiveness, increasing the potential impact of hazard events.

Warning coordination: Indonesia, the Philippines, and Singapore have established regular coordination, planning, and review meetings between the warning issuers, the media, and other

stakeholders. Other ASEAN Member States were observed as having limited capacity in this area, resulting in significant restrictions in warning dissemination and communication capacity within the stakeholder agencies, as well as limitations in the understanding of how these systems are intended to work and be accessed by the target populations.

Lack of trust: Almost two thirds of ASEAN Member States exhibit significant limitations in the public and other stakeholders' awareness of which authorities issue warnings and trust their messages.

Individual ASEAN Member State findings are provided in Appendix A.

PREPAREDNESS AND RESPONSE CAPABILITIES

Advanced Capacity	Substantial Progress with Some Limitation	Achievement with Significant Limitation	Early Capacity Development	Limited Capacity

Understanding of risk, trust in warning services, and knowledge of how to respond to warning messages are critical to successful EWS. These elements are developed through effective planning, educational programs, community awareness and outreach activities, and the regular exercising of plans to ensure they are effective and protect different groups within communities.

Key Findings

Legislative framework: Overall, the assessment observed well-developed legislation regarding the enforcement of functions, roles, and responsibilities of each actor in the warning dissemination process across the ASEAN region. This indicates a robust framework on which preparedness and response capabilities are being developed by ASEAN Member States.

Community communication: Limited capacity was observed in the majority of ASEAN Member States' assessment of communities' abilities to communicate in response to early warnings across the region. Such limitations in understanding of the present potential for local-level communication failures or breakdowns can undermine community resilience and increase vulnerability.

ARDEX regional exercise (Credit: ASEAN Secretariat)

In Indonesia and the Philippines, respectively, Petabencana.id and Mapakalamidad.ph leverage social media and mobile technologies to obtain crowd-sourced real-time alerts or warnings which are then disseminated to decision makers and the public. Such innovative use of technology presents an effective model for supporting community-level communication during disasters.

Testing and exercising: Lao PDR, Myanmar, and Viet Nam all demonstrated substantial capacity in the development and implementation of disaster preparedness plans and procedures. Further capacity in this area could be developed through regular testing and exercising of plans to assess and optimize the effectiveness of early warning dissemination processes, preparedness, and response to warnings. In several ASEAN Member States, capacity gaps were also observed in the evaluation and update of public awareness strategies and programs. This calls into question the robustness and effectiveness of disaster preparedness plans and standard operating procedures, which were observed to be relatively well developed across many of the ASEAN Member States.

Utilization of risk assessments: Variable utilization of multi-hazard risk assessments to develop and design evacuation strategies (evacuation routes, demarcation of safe areas, location of temporary shelters, etc.) was observed in the assessment, with only the Philippines and Singapore exhibiting substantial capacity in this area. In some cases, this limited capacity has resulted in flood inundation of evacuation shelters or the blockage of planned evacuation routes, retarding efforts to keep the public safe.

Tailored planning and programming: The majority of ASEAN Member States demonstrate limited accounting for the needs of people with different degrees of vulnerability in disaster preparedness measures, including plans and standard operating procedures. Additionally, across nearly all ASEAN Member States, a lack of integration of the specific needs of vulnerable groups (e.g., women, children, older people, and individuals with disabilities) into education and awareness-raising programs was observed.

A creative example of expanding public awareness was observed in Cambodia, Lao PDR, Thailand, and Viet Nam where the Mekong River Commission started the Mekong Flood and

Drought Forecast TV Channel to increase public awareness on the Mekong River conditions. To further encourage the buy-in of people, the TV channel includes public figures and social media influencers in its promotional activities.

Early action and response: Half of the ASEAN Member States demonstrate low capacity or significant capacity limitations in the development of early action and response options across time and geographical scales linked to the provision of funding to support them. This represents a critical consideration for the mobilization of emergency resources to help communities respond to, and recover from, hazard events.

Individual ASEAN Member State findings are provided in Appendix A.

CROSS-CUTTING CONSIDERATIONS

Disaster risk knowledge provides critical information for the effective development of other EWS elements. Risk knowledge includes an understanding of the types of hazards, and most effective way to monitor them, as well as the development of risk mapping to support effective disaster preparedness and response plans.

Detection, monitoring, analysis, and forecasting tools not only facilitate early hazard identification and assessment, but also inform the maintenance and updating of risk knowledge, providing the "triggers" for warning communication mechanisms and vital information needed by communities to take action to protect themselves and their property.

Warning dissemination and communication ensures communities receive the necessary warnings to take mitigating actions to protect themselves and their families from the worst impacts of hazard events. Assessment of warning dissemination and communication processes and systems also provides information on weaknesses and strengths of communication channels. Assessments can be used to inform disaster risk knowledge and to develop consistent and trusted warning language in forecasts and warning messages—a vital component of preparedness and response planning.

Preparedness and response capabilities help ensure institutions and people are capacitated to act early and respond effectively to warning messages. Additionally, feedback from lessons learned through exercises and testing of systems can enhance disaster risk knowledge by identifying strengths and weaknesses in EWS. This leads to increased efficiencies in hazard detection, monitoring, analysis, and forecasting, and helps build effectiveness of warning dissemination and communication processes and systems.

Cross-Cutting Findings

While importance of the cross-cutting nature of early warning elements are now well established, the assessment revealed the limited interconnectedness of the four early warning components by ASEAN Member States. This lack of harmonization across the various early warning elements creates potential for missed early warning capacity-building opportunities, misinformed early warning planning activities, and the duplication of efforts and resources. The most significant challenges to this interconnectedness identified by the assessment are outlined below.

Risk assessments: Even in ASEAN Member States where risk assessment capacities are well developed, there was limited evidence of the use of these assessment outputs in the development of other aspects of early warning, including evacuation planning, construction of warning messages, and warning dissemination strategies. While the assessment of risk in the majority of ASEAN Member States is underpinned by well-developed legislation, guidance and direction on the use of these assessments to inform other early warning activities remains largely omitted from ASEAN Member States' legal frameworks. Further, updates to risk assessments were generally not well informed by assessment, testing, or exercising of other elements of the early warning chain, and there remains a paucity of legislation or policy to compel this process.

Siloed data: Hazard and risk data availability and quality vary across the ASEAN Member States. However, all ASEAN Member States lack one centralized repository to store all event/disaster and risk information. Furthermore, across the region, a propensity for data silos was identified. This presents challenges to the effective implementation of early warning across its various components, as lack of access to data to inform activities can result in exacerbation of vulnerability, a reduction in resilience, and an undermining of early warning initiatives.

Last mile alerting: The assessment revealed the lack of understanding by both the national disaster management organizations and technical agencies as to what extent they have effective means to truly alert affected populations, even where robust and effective detection, monitoring, analysis, and forecasting tools and systems exist. While, across the region, individual agencies and departments have clear warning and alerting mandates, the lack of feedback, assessment, and analysis of the dissemination processes, procedures, and technologies by these agencies creates a knowledge gap that retards improvements and enhancements to last-mile alerting.

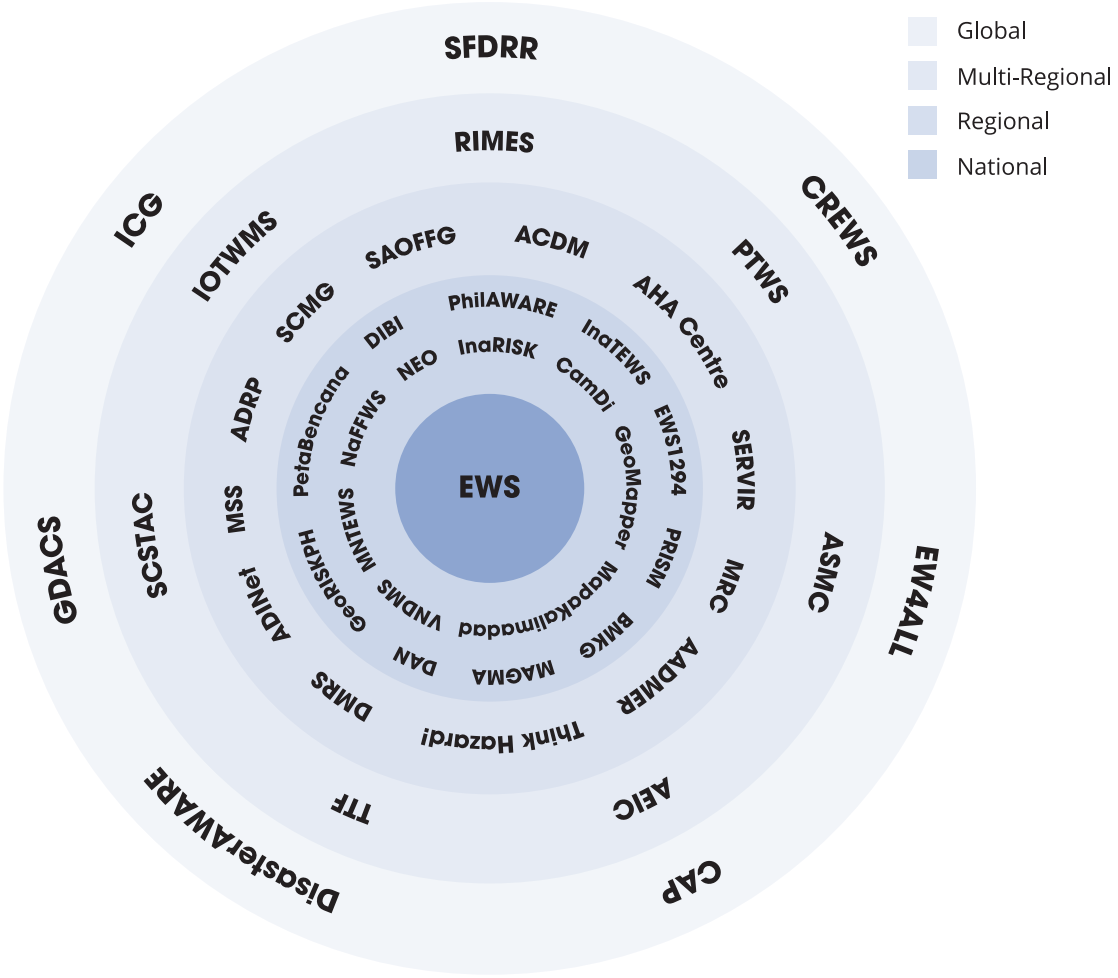
ASSESSMENT LIMITATIONS

Stakeholder engagement: From the outset, a participatory approach was applied to the research design, as detailed in the Methodology and Background section of this report. While significant efforts were made to engage all identified stakeholders and key informants, this proved challenging. As noted earlier in the report, an Analysis Confidence Index was developed to highlight where participation was more limited and, therefore, confidence in the capacity assessment is more limited. It is recommended that, for ASEAN Member States ranking Low or Very Low in the Analysis Confidence Index, further research and assessment be undertaken in advance of any early warning intervention to ensure the suitability of any future targeted capacity-enhancement investments.

Information availability: The assessment leveraged available published materials, documentation, and legislation to assign capacity achievement ratings for each component of the assessment. Additionally, stakeholders provided verbal and written inputs, as well as shared additional internal materials to help inform the assessment. Despite this, there remained a paucity of information to confidently assign ratings to some aspects of the assessment—particularly for selected countries such as Cambodia and Myanmar, where digitalization of materials is less complete, and a language barrier exists. Where possible, the research team engaged with national and regional stakeholders to try and fill these information gaps. While this was partially successful, some information gaps persist. Where this has presented a challenge to the final ratings, this has been noted in the individual ASEAN Member State findings.

GLOBAL AND REGIONAL CONTEXT

As part of the assessment of ASEAN early warning system capacity, the regional and global EWS context were considered, with key global, multi-regional, regional, and national initiatives, systems, and frameworks mapped to embed the assessment within these existing structures and best practice.



As the graphic indicates, a number of international agreements and initiatives exist to support early warning aimed at enhancing disaster preparedness and response on a global scale. These instruments provide a structured approach to identifying, assessing, and communicating potential threats and hazards, enabling timely action to mitigate their impacts.

To ensure that the assessment recommendation and initiatives align with global and regional activities, the linkages between the suggested initiatives and key EWS activities and frameworks are noted.

Details of the listed global, multi-regional, regional, and national initiatives, systems, and frameworks can be found at Apendix D.

43rd Meeting of the ASEAN Committee on Disaster Management (Credit: ASEAN Secretariat)

STRENGTHENING ASEAN MULTI-HAZARD END TO END EARLY WARNING SYSTEM FOR NATURAL DISASTERS

RECOMMENDATION AND PROPOSED INITIATIVES

RECOMMENDATION

The regional findings led to a recommendation to **strengthen and harmonize regional early warning system components to build an effective and resilient ASEAN end-to-end early warning system**. This recommendation is developed in recognition of, and appreciation for, the substantial EWS efforts already undertaken across the region.

In support of this overarching recommendation, a number of suggested initiatives have been developed to knit together existing frameworks, tools, and systems, specifically addressing identified capacity gaps, to build a more resilient and safer ASEAN. Further, the suggested initiatives leverage global best practices and regional knowledge and experience, fostering further coordination and collaboration of ASEAN Member States with their regional neighbors and, more widely, with the global disaster risk reduction community.

Four programmatic activities are proposed for the effective implementation of the suggested initiatives in support of the recommendation:

Suggested Programmatic Activities

1

Policy Enhancement

Enhance and supplement existing regional EWS policies, building on in-place and ongoing national and regional efforts. Achievable through refinement of current instruments, regional harmonization and expansion, and deeper linkages of such efforts with multi-regional and global EWS initiatives and systems.

2

Institutional Strengthening

Enhance institutional systems and structures required for effective functioning, mandate delivery, and sustainability. Achievable through developing capacities, systems, tools, and structures to enhance institutions' abilities to effectively deliver EWS services.

3

Capacity Enhancement

Enhance technical and institutional capacities to enhance the ability of ASEAN Member States and regional organization/bodies to effectively design, develop, deploy, maintain, refine, and sustain early warning systems across the region. Achievable through targeted training and knowledge sharing opportunities.

4

Technical Assistance

Provide targeted assistance for the delivery of planned initiatives, particularly those of a highly technical or specialized nature. Achievable through engagement of technical experts and organizations who share best practices, encourage sustainable approaches, and build local capacity.

SUGGESTED INITIATIVES

Drawing on the assessment findings and written and oral stakeholder inputs, recommendations for regional or multi-ASEAN Member State early warning initiatives have been developed along programmatic lines defined above. These recommendations are synergized with existing and ongoing initiatives to build on successful efforts to-date and avoid duplication of efforts. They are rooted in the region's stated early warning—and broader disaster risk reduction—goals and priorities. Additionally, the proposed initiatives leverage regional partnerships, cooperative agreements, and established coordinating bodies to further build vital connections and cooperation to ensure a "whole-of-ASEAN" approach to EWS capacity enhancement efforts. Furthermore, the proposed initiatives align with global EWS initiatives, leveraging best practices and global standards which will support the long-term goal of a safer, more resilient ASEAN region.

With a mandate to facilitate cooperation and coordination of disaster management amongst ASEAN Member States, the ASEAN Coordinating Centre for Humanitarian Assistance on disaster management (AHA Centre) is considered a key partner in the design, development, delivery, and coordination of many of the proposed initiatives. Where it is recommended that initiatives be led or coordinated by the AHA Centre, this in indicated by the presence of the AHA Centre logo:

AHA CENTRE
ONE ASEAN

Further, in recognition of the pivotal role academic institutions play in providing their regional expertise, as well as advancing research and development, linkages with these institutions is also recommended for many of the initiatives detailed below. Where such linkages are proposed, this is indicated by the inclusion of this symbol:

Initiative 1: Apply risk and vulnerability assessments to EWS processes

The development of the ASEAN Regional Risk and Vulnerability Assessment (RVA) Guidelines[2] in 2017 has provided an effective tool to guide ASEAN Member States in the implementation of a regionally consistent approach to RVA to enhance disaster risk knowledge by ASEAN Member States. However, the observed incomplete or partial utilization of these outputs to inform other early warning system components (e.g., evacuation mapping, shelter location identification, communication dissemination strategies, etc.) fails to make full, effective use of these powerful early warning tools. The strengthening of the application of disaster risk knowledge to inform early warning services and measures would more effectively utilize the substantial efforts already undertaken by ASEAN Member States.

SUGGESTED PROGRAMMATIC ACTIVITIES

Policy Enhancement

- Enhance the existing ASEAN RVA Guidelines with supplementary guidance on the application of risk and vulnerability assessments to support EWS for use at the national level.
- Ratify national guidance for the application of RVAs to support warning and dissemination.

Institutional Strengthening

- Strengthen national processes and regional policies for the sharing of data for RVA application to EWS activities.
- Enhance the applicaton of RVAs to EWS.

Capacity Development

- Deliver knowledge transfer training, led by the AHA Centre, with support from regional academic institutions, to build national capacity for the application of RVAs to EWS.
- Provide training to national warning dissemination actors on the application of RVAs to enhance early warning communications to all populations.

Technical Assistance

- Provide technical assistance to support national application of RVAs warning dissemination and communication efforts.

Global and Regional Linkages

- **AADMER:** Articles 3(4), 5(1), 6(1), 6(2), 7(1), and 18(1)
- **AADMER Workplan:** Sub Priority 1.1, Outcome 1.1.1 and Outcome 1.1.2; Sub Priority 2.5, Outcome 2.5.2; Sub Priority 2.6, Outcome 2.6.1; Sub Priority 4.1, Outcome 4.1.1; Sub Priority 5.1, Outcome 5.1.1 and Outcome 5.1.2; Sub Priority 5.2, Outcome 5.2.1
- **ASEAN Vision 2025 on DM:** Strategic Element – Institutionalization and Communications
- **EW4All:** Pillar 1
- **SFDRR:** Targets B, C, D, F, and G

Initiative 2: Enhance regional academic exchange and engage experts in knowledge sharing

With the role of scientific and technical experts in early warning varying across the region, enhancing the engagement with, and utilization of, the region's scientific community would strengthen EWS through the systematic review and application of best practice, lessons learned, and emerging technologies.

PROGRAMMATIC ACTIVITIES

Policy Enhancement

- Enhance regional policies on engagement with the scientific and technical community on EWS activities.
- Building on the regional policy enhancements, develop national strategies for the integration of the scientific community in disaster risk knowledge, as well as hazard detection and forecasting planning, development, sustainment, and enhancement activities.

Institutional Strengthening

- Promote knowledge exchange activities on EWS national processes, best practices, and lessons learned. To include ASEAN Member State NDMOs and technical agencies, as well as regional EWS bodies, academic organizations, UN agencies, and other key EWS partners.
- Leverage the ASEAN Disaster Resilience Platform (ADRP) for the review and application of EWS best practice, lessons learned, and emerging technologies.

Global and Regional Linkages

- **AADMER:** Article 3(6), 7(1), 18(1), and 19(1)
- **AADMER Workplan:** Sub Priority 1.1, Outcome 1.1.2 and 1.1.3; Sub Priority 1.2, Outcome 1.2.1; Sub Priority 2.1, Outcome 2.1.1; Sub Priority 2.2, Outcome 2.2.2; Sub Priority 2.5, Outcome 2.5.3; Sub Priority 2.6, Outcome 2.6.1; Sub Priority 4.1, Outcome 4.1.1; Sub Priority 5.1, Outcome 5.1.1; Sub Priority 5.2, Outcome 5.2.1
- **ASEAN Vision 2025 on DM:** Strategic Element – Partnerships and Innovation
- **EW4All:** Pillars 1, 2, 3, and 4
- **SFDRR:** Target F

Initiative 3: Build linkages between national and regional EWS

The observed lack of interoperability between ASEAN Member States and regional warning tools and systems, as well as the limited exchange of data across the region, undermines regional early warning efforts. With significant regional investment in new early warning equipment and technologies, this presents a timely opportunity for the building of robust linkages between ASEAN Member States', as well as between national and regional, early warning initiatives, tools, and services, including the AIM-Net initiative.

PROGRAMMATIC ACTIVITIES

Policy Enhancement

- Enhance regional policies to support interoperability of EWS systems and the effective exchange of data.

Institutional Strengthening

- Leverage the existing Disaster Monitoring and Response System (DMRS) for the storage, sharing, and national and regional utilization of hazard and non-hazard data by all ASEAN Member States.

Global and Regional Linkages

- **AADMER:** Article 4, 5(4), 6(3), 7(1), 7(2), 18(1), and 18(2)
- **AADMER Workplan:** Sub Priority 1.2, Outcome 1.2.1, Sub Priority 3.1, Outcome 3.1.2; Sub Priority 3.2, Outcome 3.2.3 and Outcome 3.2.4; Sub Priority 4.1, Outcome 4.1.2
- **ASEAN Vision 2025 on DM:** Strategic Element – Institutionalization and Communications
- **EW4All:** Disaster risk knowledge and management pillar,
- **SFDRR:** Target G

Initiative 4: Increase reliability, availability, and sustainability of EWS services and tools

Many of the ASEAN Member States acknowledged limited provision for the long-term maintenance and upgrade of EWS and services, both in terms of resources and required personnel. Cloud services present an opportunity to both increase system reliability and prevent system obsolescence, eliminating the need to account for regular hardware maintenance and resources for hardware redundancy. Cloud services also provide enhanced cyber security standards, which the assessment found to be limited or patchy across the region.

PROGRAMMATIC ACTIVITIES

Capacity Development

- Deliver training on the maintenance and administration of cloud services for both national and regional technical agencies who provide hazard monitoring, forecasting, and warning services.

Technical Assistance

- Provide technical support to assist ASEAN Member States and regional bodies in this transition of their existing services and tools to the cloud, as required.

Global and Regional Linkages

- **AADMER:** Article 7(1) and 18(1)
- **AADMER Workplan:** Sub Priority 1.1, Outcome 1.1.2; Sub Priority 1.2, Outcome 1.2.1; Sub Priority 1.3, Outcome 1.3.1; Sub Priority 3.2, Outcome 3.2.3 and Outcome 3.2.4; Sub Priority 5.1, Outcome 5.1.2
- **ASEAN Vision 2025 on DM:** Strategic Element –Partnerships and Innovation
- **EW4All:** Pillar 2
- **SFDRR:** Targets F and G

Initiative 5: Formulate actionable, targeted, and localized messages

Across the region, ASEAN Member States demonstrate substantial progress in the generation and distribution of warning messages to at-risk communities. However, few nations provide tailored messages to their populations based on the specific needs or vulnerabilities of various groups within these populations. Further, many of the warning messages provide limited or no actionable content (e.g., evacuation orders, etc.). Enhancements to the content and tailoring of messages would lead to more effective early warning communication to at risk populations.

PROGRAMMATIC ACTIVITIES

Policy Enhancement

- Enhance regional policies to support the enhancement of warning messages to improve actionable and localized warning communications.

Capacity Development

- Deliver training for enhanced actionable and localized warning services to national warning providers.
- Deliver training on the effective utilization of actionable and localized warning messages for enhanced response capabilities of national response personnel.

Global and Regional Linkages

- **AADMER:** Article 7(1)
- **AADMER Workplan:** Sub Priority 1.2, Outcome 1.2.1; Sub Priority 1.3, Outcome 1.3.1; Sub Priority 2.5, Outcome 2.5.2; Sub Priority 5.1, Outcome 5.1.2
- **ASEAN Vision 2025 on DM:** Strategic Element – Institutionalization and Communications
- **EW4All:** Pillars 3 and 4
- **SFDRR:** Targets B, C, D, and G

Initiative 6: Reduce EWS last mile challenges

With the broad use of smartphones and their inherent "location awareness," there is an opportunity to extend the reach of EWS messages—further reducing last mile gaps and targeting the delivery of EWS messages to those within active hazard exposure zones. Additionally, simple-to-use reporting applications can effectively supplement official monitoring equipment to provide timely understanding of the extent and severity of impacts following major disaster events. These devices and technologies also offer opportunities to address other message-understanding challenges through the use of simple, universal graphics, and automatic language translations. They can also aid in understanding delivery and receipt of EWS by the sending agency.

PROGRAMMATIC ACTIVITIES

Institutional Strengthening

- Develop and implement mobile technologies within ASEAN Member States to enhance the dissemination, receipt, and verification of early warning messages.

Capacity Development

- Deliver training on the utilization of mobile technologies to improve early warning communications to national warning providers.

Technical Assistance

- Provide technical assistance to develop and implement mobile technologies to enhance last mile EWS.

Global and Regional Linkages

- **AADMER:** Article 6(1), 6(2), 7(1), and 18(1)
- **AADMER Workplan:** Sub Priority 1.2, Outcome 1.2.1; Sub Priority 1.3, Outcome 1.3.1; Sub Priority 2.5, Outcome 2.5.2; Sub Priority 5.1, Outcome 5.1.2
- **ASEAN Vision 2025 on DM:** Strategic Elements – Institutionalization and Communications, Partnerships and Innovation
- **EW4All:** Pillar 3

Initiative 7: Standardize early warning message dissemination protocols

The Common Alerting Protocol (CAP) is a standardized digital format for the exchange of emergency alerts, allowing for consistent alert messages to be disseminated simultaneously over multiple communication pathways. With the range of warning system formats and messaging arrangements observed across the ASEAN region, the implementation of standardized alerting services would support the timely and effective dissemination of alerts and increase the level of interoperability between services and systems. CAP implementation across the region would also facilitate achievement of Initiative 3 goals to build linkages between national and regional EWS.

Programmatic Activities

Capacity Development

- Provide CAP training for warning providers at the regional and national level.

Technical Assistance

- Provide technical assistance for the establishment of CAP alerting processes for national and regional warning providers/bodies, as required.

Global and Regional Linkages

- **AADMER:** Article 7(1) and 18(1)
- **AADMER Workplan:** Sub Priority 1.2, Outcome 1.2.1; Sub Priority 1.3, Outcome 1.3.1; Sub Priority 5.1, Outcome 5.1.2
- **ASEAN Vision 2025 on DM:** Strategic Element – Institutionalization and Communications
- **EW4All:** Pillars 2 and 3
- **SFDRR:** Targets F and G

Initiative 8: Strengthen and enhance public awareness campaigns and educational programs

While efforts have been undertaken to advance public education on risk reduction, including the development of the ASEAN Common Framework for Comprehensive School Safety (ACFCSS)[5], the assessment observed a paucity of regionally coordinated public awareness strategies and programs. This finding presents an opportunity for the enhancement of public awareness campaigns and educational programs across the ASEAN region, particularly with consideration for specific subpopulations' needs and vulnerabilities. These campaigns and programs should focus on risk knowledge and identification, preparedness measures, and actions following warnings.

PROGRAMMATIC ACTIVITIES

Policy Enhancement

- Enhance the existing ACFCSS with supplementary guidance to specifically address the incorporation of the needs of specific sub-populations and vulnerable groups into school education programs.
- Enhance regional and national disaster risk reduction policies on public awareness raising.

Capacity Development

- Support delivery of national training programs to enhance national publidisaster risk reduction education.

Global and Regional Linkages

- **AADMER:** Article 6(2), 7(1), and 18(1)
- **AADMER Workplan:** Sub Priority 1.3, Outcome 1.3.1; Sub Priority 2.5, Outcome 2.5.1 and Outcome 2.5.2; Sub Priority 5.1, Outcome 5.1.2
- **ASEAN Vision 2025 on DM:** Strategic Element – Partnerships and Innovation
- **EW4All:** Pillar 4
- **SFDRR:** Targets B, C, D, and G

SUGGESTED INITIATIVES BY PROGRAMMATIC AREA

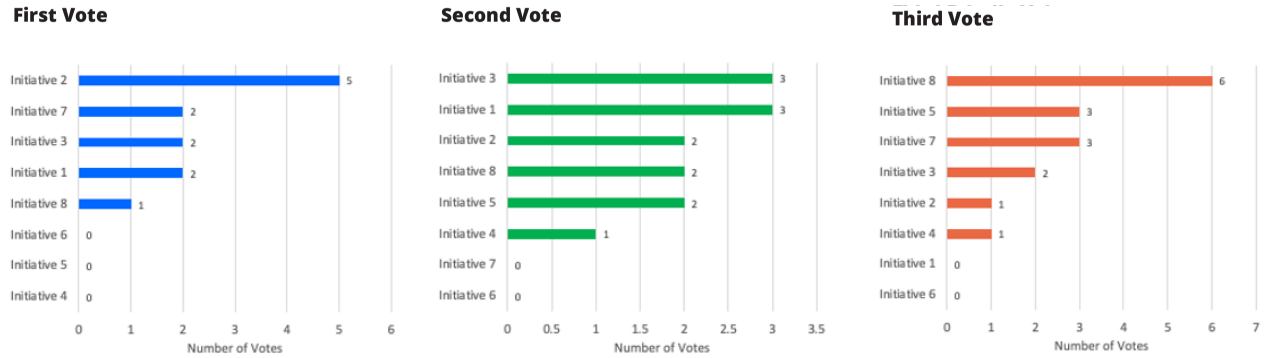
Programmatic Areas	WMO Thematic Areas: Disaster Risk Knowledge	Hazard Detection, Monitoring, Analysis, Forecasting	Warning Dissemination and Communication	Preparation and Response Capabilities
Policy Enhancement	1, 2, 3	2, 3	1	5, 8
Institutional Strengthening	1, 2, 3	2, 3	1, 3, 6	
Capacity Development	1	4	1, 4, 5, 6, 7	5, 8
Technical Assistance	1	4	1, 4, 6, 7	6

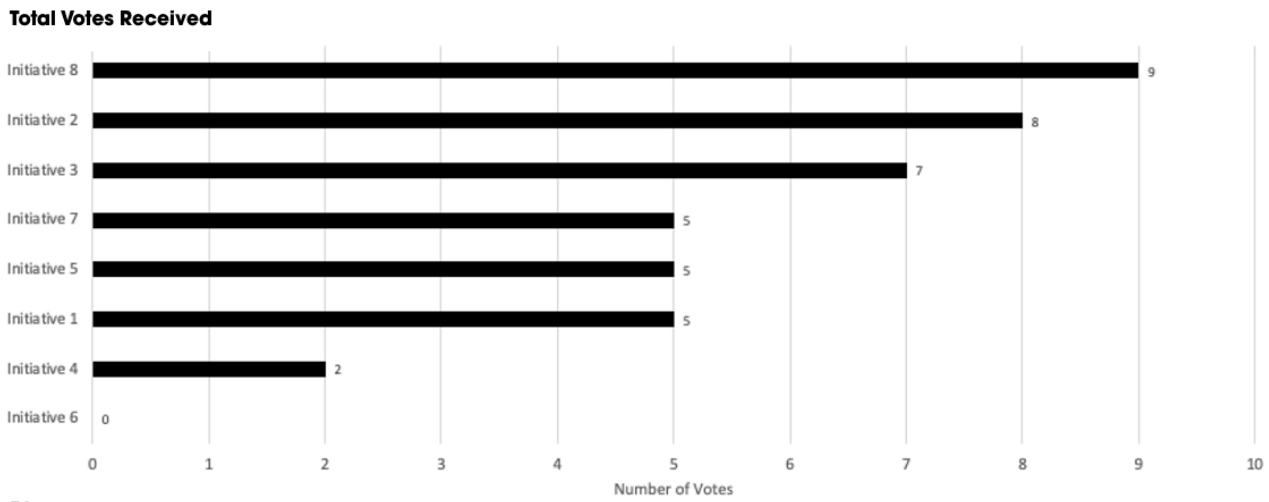
Initiative Number and Scope — National | Regional | Both

ASEAN MEMBER STATE INTEREST IN INITIATIVES

The stakeholder consultation meeting provided an opportunity for key informants to share their feedback on the draft report and indicate their level of support for the report findings and interest in the suggested initiatives. Broadly, stakeholders expressed agreement with the national and regional findings. During the event, stakeholders voted to indicate their interest in the suggested initiatives to enhance early warning systems across the region, as detailed below.

Stakeholder Interest in Suggested Initiatives





SUGGESTED INITIATIVES

Initiative 1: Apply risk and vulnerability assessments to EWS processes

Initiative 2: Enhance regional academic exchange and engage experts in knowledge-sharing

Initiative 3: Build linkages between national and regional EWS

Initiative 4: Increase reliability, availability, and sustainability of EWS services and tools

Initiative 5: Formulate actionable, targeted, and localized messages

Initiative 6: Reduce EWS last mile challenges

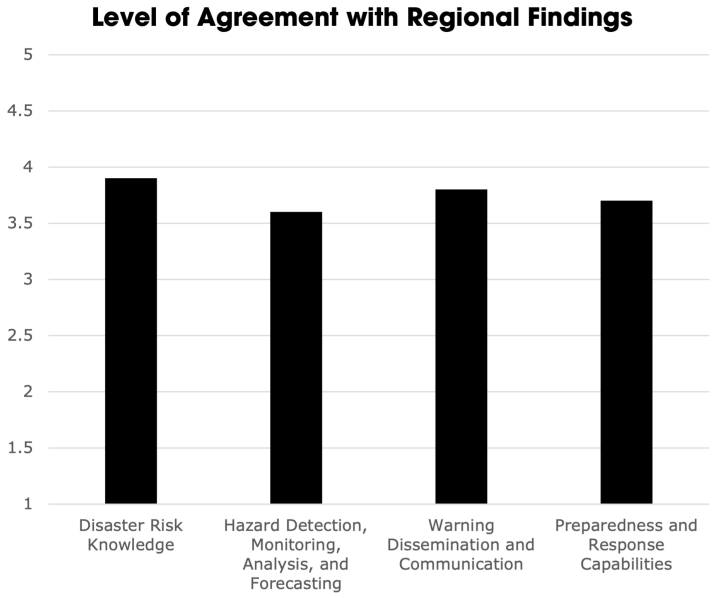
Initiative 7: Standardize early warning message dissemination protocols

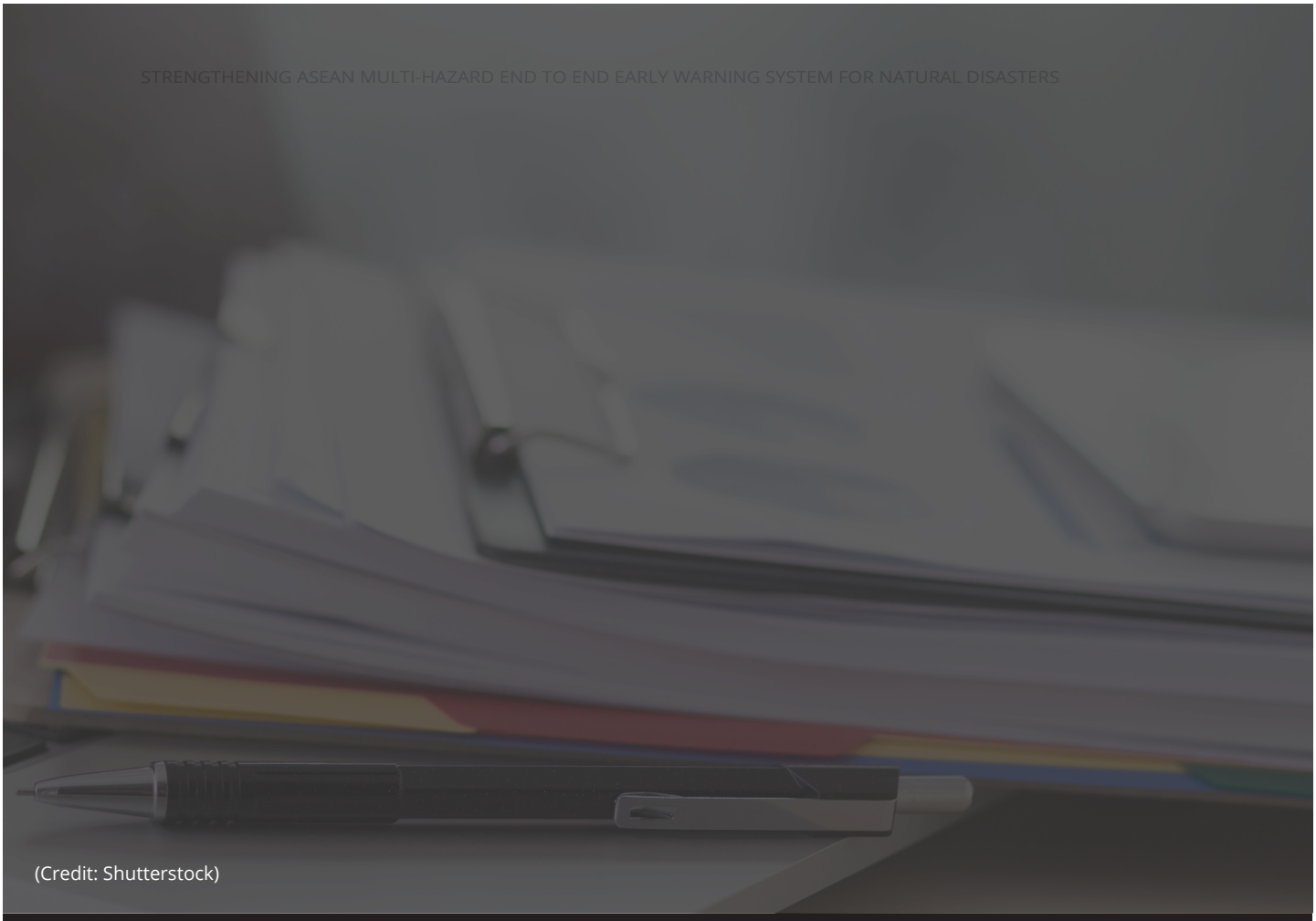
Initiative 8: Strengthen and enhance public awareness campaigns and educational programs

STAKEHOLDER AGREEMENT WITH FINDINGS

1 = strongly disagree

5 = strongly agree





(Credit: Shutterstock)

STRENGTHENING ASEAN MULTI-HAZARD END TO END EARLY WARNING SYSTEM FOR NATURAL DISASTERS

APPENDICES

APPENDICES

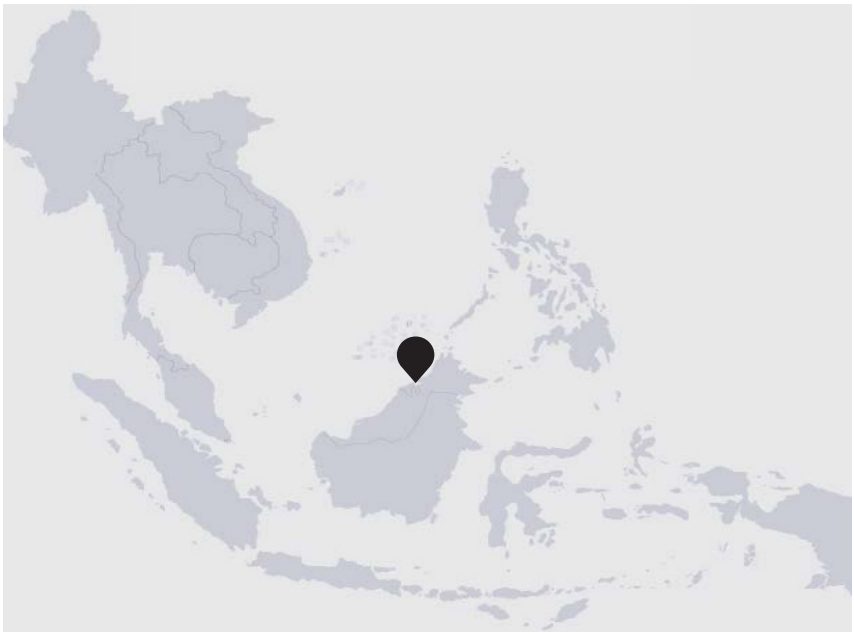
Additional findings and detailed analyses are provided in the Appendices, giving deeper insight into national-level assessment findings, the processes employed, and the participants engaged in the study. Appendices Include:

- **ASEAN Member State Findings**
- **Stakeholder Engagement List**
- **Raw Data Score Sheets**
- **Global and Regional Initiatives, Systems, and Frameworks**
- **Desk Study Bibliographies**

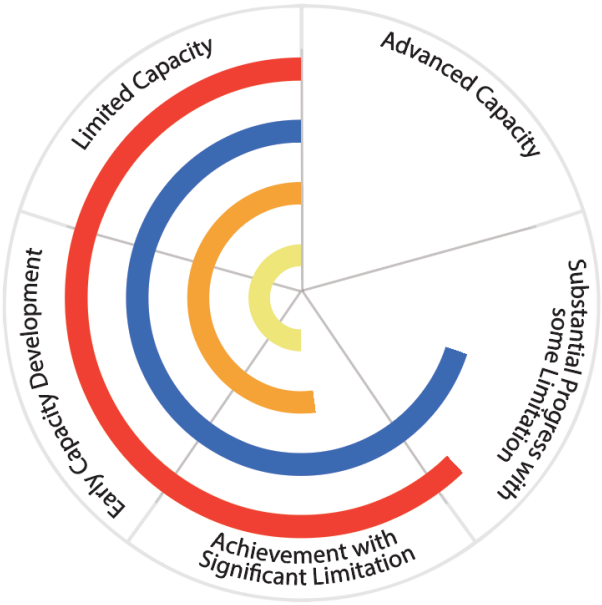
APPENDIX A:
ASEAN MEMBER STATE FINDINGS

Brunei Darussalam

Progress Towards Advanced Capacity Development

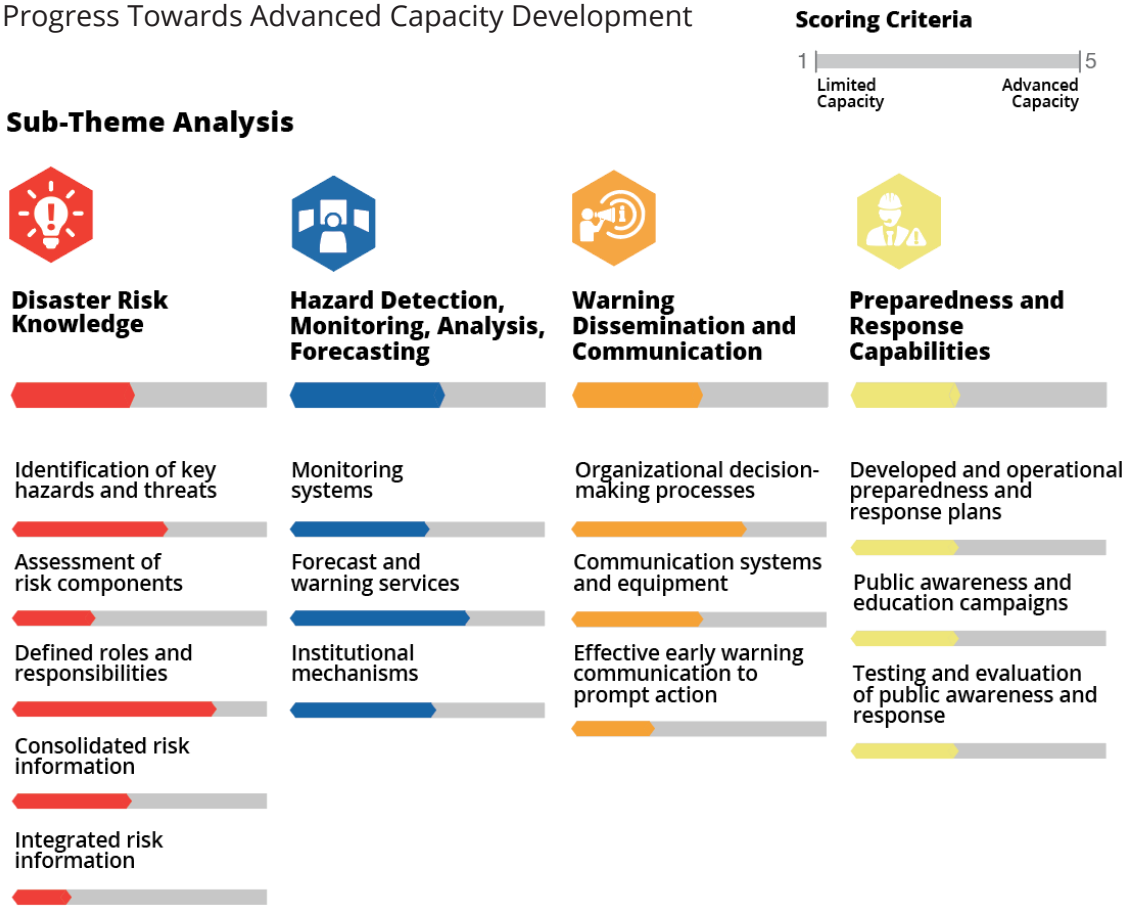


Disaster Risk Knowledge
Hazard Detection, Monitoring, Analysis, Forecasting
Warning Dissemination and Communication
Preparedness and Response Capabilities



Brunei Darussalam

Progress Towards Advanced Capacity Development



Early Warning Summary

Brunei Darussalam has a very low risk profile according to the 2023 Index for Risk Management (INFORM) Global Risk Index (GRI)[6]. While the country's hazard profile is relatively limited compared to many of its regional neighbors, Brunei Darussalam experiences floods, storms, and landslide events, and is also at risk of tsunami threats. In response to anticipated increases in climate change-associated risks, Brunei Darussalam has launched an initiative to establish the ASEAN Centre for Climate Change, aimed at strengthening regional coordination and cooperation on climate change through research and development of policymaking recommendations for the region.

In recent years, Brunei Darussalam has been proactive in developing EWS and disaster management strategies to protect its population and mitigate the impact of potential hazards. Efforts have focused substantially on structural measures, including large-scale flood mitigation works along coastal areas. Other efforts are underway to enhance the country's detection technologies and communication channels to disseminate early warnings.

Brunei Darussalam

Progress Towards Advanced Capacity Development

Early Warning Assessment Findings

Brunei Darussalam has achieved capacity in early warning in recent years, with notable successes in the following areas:

1. A strong legislative framework has been developed across the disaster risk knowledge and warning and dissemination components of early warning, with roles and responsibilities of key agencies and bodies clearly outlined and understood.
2. The country's warning centers are operational at all times, with appropriate national and international standards implemented by well-trained personnel.
3. Warnings are generated and disseminated in an efficient and timely manner for each of the main types of hazards experienced by Brunei Darussalam.
4. Brunei Darussalam works closely with international and regional partners—such as through its membership to the Southeastern Asia-Oceania Flash Flood Guidance (SAOFFG) System—to strengthen its monitoring and early warning network. These partnerships are realized through bilateral and multilateral agreements that support the long-term and sustainable nature of such cooperation.
5. Brunei Darussalam has established warning communication strategies at the national, subnational, and local levels to ensure coordination across warning issuers and dissemination channels. These strategies include the establishment of networks to receive and disseminate warnings widely in a timely manner.

Remaining early warning gaps that require capacity development have been identified:

1. Brunei Darussalam remains reliant on external bodies for monitoring and alerting, particularly for tsunamis. While agreements exist for such cooperation, during the assessment, national stakeholders noted the need to further strengthen their own internal hazard detection systems to reduce reliance on outside partners.
2. Limitations were observed in the assessment of risk, particularly in the consideration of critical infrastructure and secondary risks, social vulnerability factors, and vulnerabilities of the economic sector. Furthermore, developed risk assessments are not systematically utilized to guide EWS planning, undermining such efforts. In the most demonstrable example of this, designated flood evacuation shelters have been inundated by flood waters, leaving evacuees stranded and without access to supplies.
3. In recent years, Brunei Darussalam has dedicated resources to the modernization and enhancement of its detection, monitoring, analysis, and forecasting systems. However, efforts are required for the establishment of interagency protocols for the exchange of monitoring systems data and baseline data, as well as the establishment of agreements and interagency

Brunei Darussalam
Progress Towards Advanced Capacity Development

protocols to ensure consistency of warning language and communication.

4. The country's detection, monitoring, analysis, and forecasting systems provide timely alerting for hazard events. However, warning messages lack the vital guidance to trigger reactions to save lives and livelihoods. Furthermore, the assessment found no evidence that Brunei Darussalam has established feedback mechanisms or undertakes evaluations of its warning communication strategies to ensure messages are reaching the entire population, nor that communication strategies account for the different risks and needs of subpopulations, resulting in gaps in the communication of warnings.
5. Preparedness and response capabilities in Brunei Darussalam were assessed as in the early stages of development, driven significantly by limited public awareness and educational activities and exercises. This is, in part a function of the country's limited hazard profile, which has led to public complacency regarding hazards. However, the anticipated increase in risk associated with climate change indicates a need for significant investment in this area in the coming years.

While considerable efforts were made to analyze early warning along the assessment criteria, some significant gaps in information remained, leading to limitations in the overall assessment of Brunei Darussalam's early warning capacities. It is recommended that further stakeholder engagement be undertaken to build a more complete understanding of early warning capacity in areas where information for this assessment remained limited.

A detailed breakdown of the ASEAN Member State's assessment can be found in Appendix C.

Early Warning Legislative Framework

Brunei Vision 2035[7]—Establishes the country's long-term development plan, providing a framework for Brunei Darussalam's early warning activities.

Disaster Management Order (2006)[8]—Outlines the mandate of the National Disaster Council (NDC), including its role in development of the country's early warning strategies and policies.

Disaster Management Strategic Policy Framework (DMSPF)—With an all-hazard, whole-of-government approach, articulates the country's planned direction for disaster management.

National Disaster Management Plan—Consisting of the Strategic National Action Plan (SNAP) for Disaster Risk Reduction (DRR) and the National Standard Operating Procedures (NaSOP), detailed below.

Strategic National Action Plan (SNAP) for Disaster Risk Reduction 2012-2025—Outlines Brunei Darussalam's commitment to disaster preparedness and mitigation, with the country's National Disaster Management Centre (NDMC) implementing its community-based disaster risk management (CBDRM) program to operationalize the SNAP.

Brunei Darussalam

Progress Towards Advanced Capacity Development

National Standard Operating Procedures (NaSOP)—Establishes the roles and responsibilities of all agencies involved in disaster risk management, including early warning activities.

Key Early Warning Stakeholders

National Disaster Council (NDC)—Responsible for the development of national disaster management policy and strategic direction, including the country's approach to early warning.

National Disaster Management Centre (NDMC)[9]—Serves as the Secretariat of the NDC, responsible for the provision of assistance to communities affected by disaster or crisis. Along with other duties, the NDMC Operations Unit undertakes testing and exercising of plans and procedures.

Disaster Command Centre (DCC)—Housed within the NDMC, the operations center is staffed 24 hours a day, supporting operations, planning, and logistics.

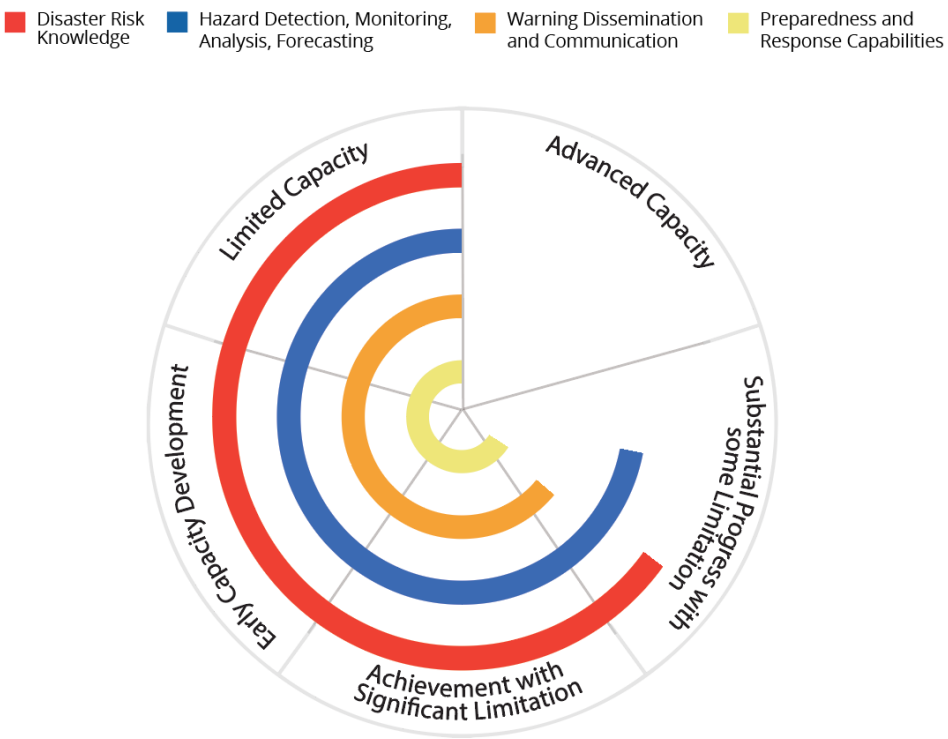
Brunei Darussalam Meteorological Department (BDMD)[10]—Responsible for monitoring and forecasting weather and issuing warnings or advisories ahead of a potential emergency.

Royal Brunei Police Force (RBPF)[11]—Provides last-mile alerting to at-risk populations.

[THIS PAGE LEFT BLANK INTENTIONALLY.]

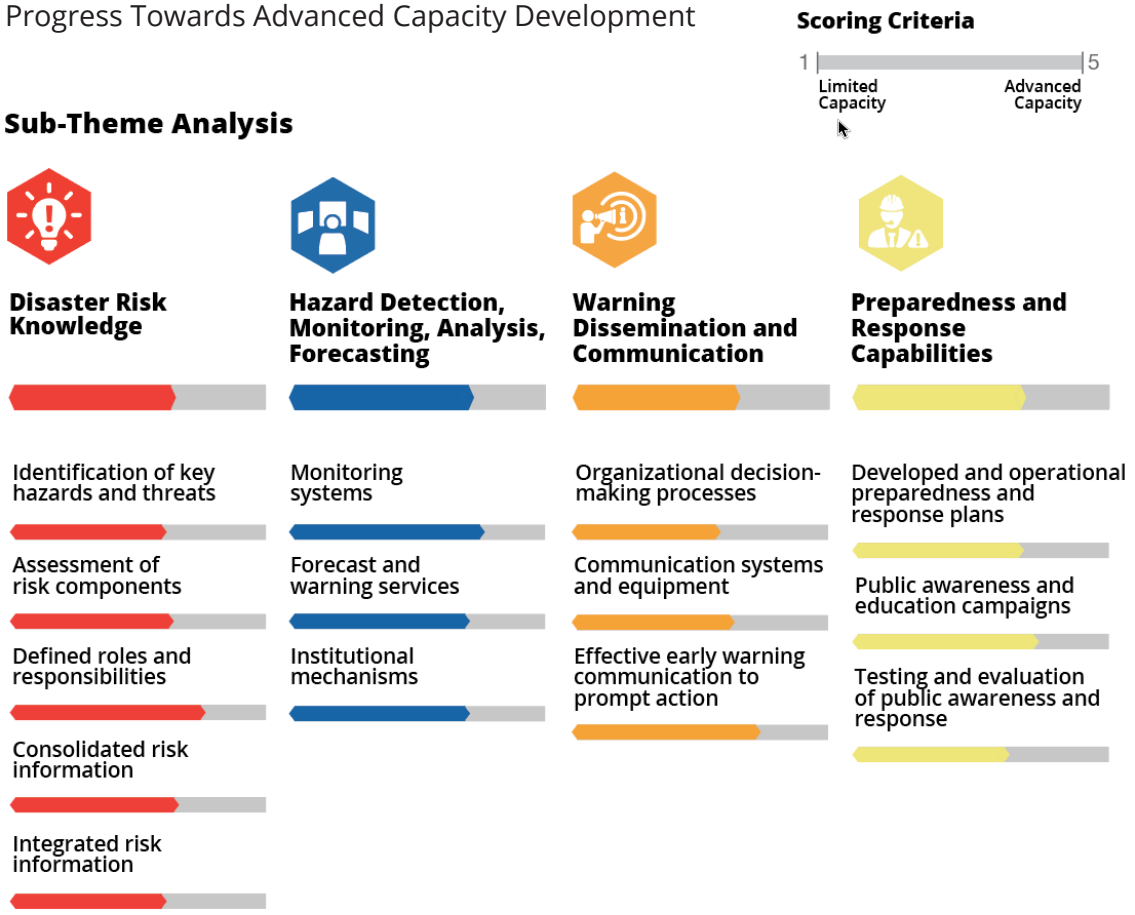
Cambodia

Progress Towards Advanced Capacity Development



Cambodia

Progress Towards Advanced Capacity Development



Early Warning Summary

According to the latest INFORM GRI[12], Cambodia is considered a medium risk country, with limited coping capacity a significant driver of this ranking. The country is subject to a range of flood, drought, and storm events, with climate risk an increasing concern in the coming years[13].

As a result of these continuing and increasing risks, Cambodia has undertaken efforts to enhance its EWS across the country. With support from international partners, the country has seen important developments in tools to support disaster risk knowledge and warning dissemination to the public. The innovative “EWS 1294” service—developed by People in Need (PIN)—delivers multi-hazard early warning messages on floods, earthquakes, and other hazards to the public via SMS. The World Food Programme (WFP)-developed PRISM (Platform for Real-time Impact and Situational Monitoring) aids disaster risk reduction and early warning efforts through its ability to produce real-time risk and impact maps that are made available to DRR decision makers via a dashboard.

Cambodia

Progress Towards Advanced Capacity Development

Early Warning Assessment Findings

Cambodia has developed its early warning capacity in recent years, with notable successes in the following areas:

1. Cambodia is one of the few ASEAN Member States to show significant capacity in the utilization of historical and indigenous knowledge in its assessment of risk.
2. The country has clearly defined roles and responsibilities of key national government agencies involved in risk assessments, supported by legislation that mandates the preparation of hazard, vulnerability, and capacity assessments for all areas.
3. The assessment observed that Cambodia has established processes to maintain, regularly review, and update risk data, including information on any new or emerging vulnerabilities and hazards resulting in relatively up-to-date risk assessments.
4. Cambodia demonstrates capacity in warning dissemination and communication, with the country's warning system partners aware of, and displaying respect for, organizations responsible for generation and issuance of warnings. Furthermore, warning messages provide clear guidance to trigger reactions such as evacuation, while the public demonstrate trust in these warning messages. Additionally, effective media are utilized to improve public awareness. Together, these factors increase the likelihood that the public will heed warnings and respond appropriately to such messages.
5. Cambodia's population appear well-educated in the recognition of hydrometeorological and geophysical hazard signals and disease signs and symptoms, supporting community surveillance. Furthermore, the assessment found strong public awareness programs to educate individuals on how warnings will be disseminated.

The assessment found that additional early warning capacity development is required, as outline below:

1. While substantial efforts have been undertaken by the National Committee on Disaster Management (NCDM) and development partners to increase disaster risk knowledge in the country, these efforts have focused primarily on flood hazards. A fuller understanding of other hazard types (particularly drought hazards) is required.
2. Substantial advancements have been made in the development of Cambodia's monitoring and detection services. However, there is limited evidence that back-up systems are in place in case of failure, plans and budgets are in place for periodic upgrades, or that such systems are continuously monitored to ensure they are functioning effectively.

Cambodia

Progress Towards Advanced Capacity Development

3. Key warning providers play a vital role in protecting Cambodia's citizens; however, the assessment observed a lack of warning communication strategies, limiting capacity in coordination across warning issuers and dissemination channels. Development of a more consolidated and integrated approach would enhance capacity in this area.
4. The assessment observed that, while Cambodia appears to have well-developed public awareness and education programs, no formal processes are in place to test and evaluate their effectiveness.

With extremely limited participation from government stakeholders in this EWS assessment, the understanding of Cambodia's current EWS capacity is based primarily on available literature and non-governmental/United Nations stakeholder inputs. It is highly recommended that further assessment be undertaken in advance of the implementation of any early warning initiatives in the country to ensure a more complete understanding of capacity and gaps.

A detailed breakdown of the ASEAN Member State's assessment can be found in Appendix C.

Early Warning Legislative Framework

National Action Plan for Disaster Risk Reduction (NAP-DRR) 2019-2023[14]—Aims to improve disaster coordination and communication, as well as provide guidance on disaster risk governance, disaster financing, and disaster preparedness.

Law on Disaster Management (2015)[15]—Serves as the legal framework for defining the roles and responsibilities of ministries and other key disaster risk management factors and mandates the development and implementation of hazard risk prevention programs on disaster management and climate change adaptation on a national scale.

Key Early Warning Stakeholders

National Committee for Disaster Management (NCDM)[16]**—**Responsible for the administration and coordination of disaster management activities in the country.

Ministry of Water Resources and Meteorology (MOWRAM)[17]—Charged with predicting abnormal meteorological phenomenon and the issuance of alerts to enable people and agencies to be better prepared for hazard events.

Department of Meteorology[18]—Under MOWRAM, manages the country's meteorological stations and provides current weather information and warnings, as well as forecasts.

Cambodia

Progress Towards Advanced Capacity Development

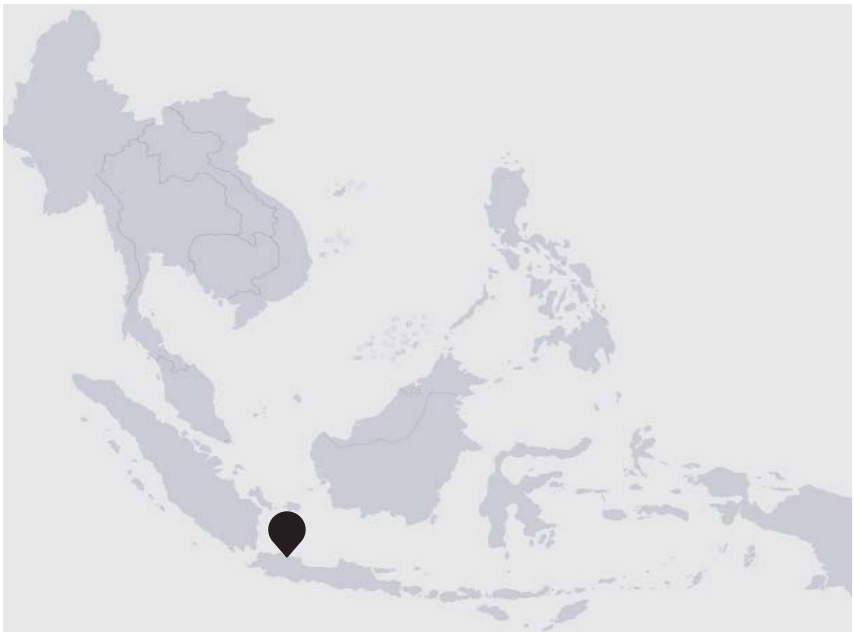
People in Need (PIN)[19]—A non-governmental organization responsible for the development of the country's EWS 1294 mobile alerting service.

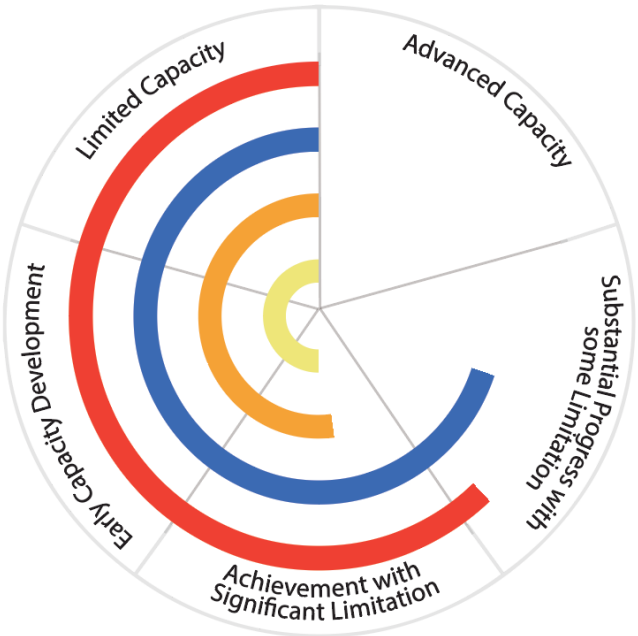
World Food Programme (WFP)[20]—United Nations agency supporting government early warning initiatives including the Platform for Real-time Impact and Situation Monitoring (PRISM).

[THIS PAGE LEFT BLANK INTENTIONALLY.]

Indonesia

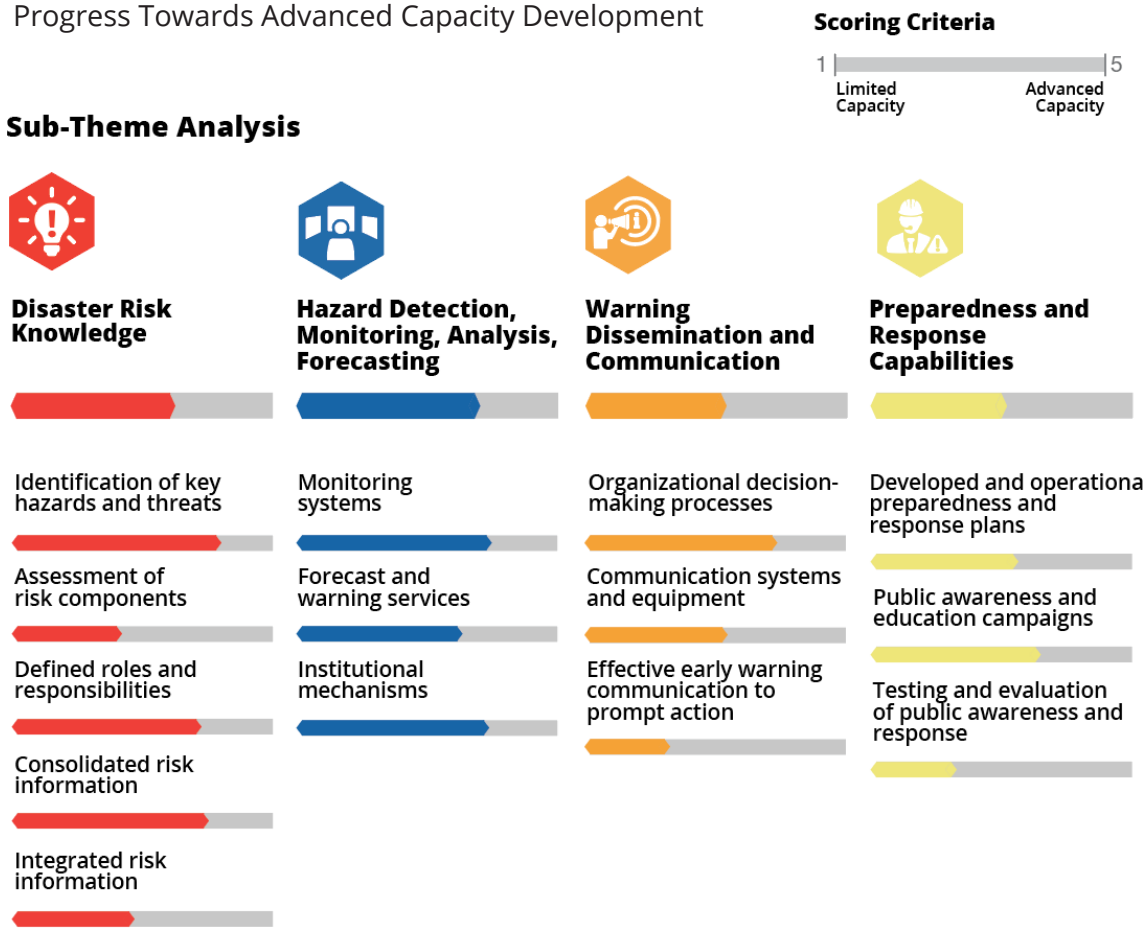
Progress Towards Advanced Capacity Development





Indonesia

Progress Towards Advanced Capacity Development



Early Warning Summary

Indonesia is considered a medium risk country according to the most recent INFORM GRI[21]. The country is subject to a range of hydrometeorological and geophysical hazard events, which have resulted in large numbers of casualties in recent years, with many more people impacted. The 2050 Indo-Pacific Climate Change Impact Analysis[22] ranks Indonesia as one of the countries with the highest multi-hazard climate risks by 2050, anticipated to further increase the impact of hazard events on the country's population.

Following the 2004 Indian Ocean earthquake and tsunami, Indonesia underwent rapid and significant developments in its early warning capacity, with support of the international community. The country has made effective use of available technologies to monitor, detect, analyze, and forecast hazard events, as well as leveraging early warning and decision-making tools including PDC's DisasterAWARE platform.

Early Warning Assessment Findings

The assessment found that Indonesia has made substantial progress in early warning capacity, with notable capacity in the following areas:

Indonesia

Progress Towards Advanced Capacity Development

1. Indonesia has developed a strong understanding of the geographical extent, magnitude, intensity, frequency, and probability of the country's key hazards, including possible cascading hazardous events.
2. The assessment found strong capacity in the use of risk information on different types of assets to outline procedures to minimize damage or loss of such assets once a warning is issued.
3. A well-developed network of monitoring systems has been established across Indonesia, with technical equipment considered well-suited to the local environment. Monitoring data is received, processed and available in an interoperable format in real time or near real time, and is largely interoperable with new and older technology allowing for exchange of data among countries with different technical capabilities. It is notable that the country's Meteorology, Climatology and Geophysics Agency (BMKG) undertakes regional responsibilities as the ASEAN Earthquake Information Center (AEIC) and performs the role of the tsunami service provider for countries in the Indian Ocean, while its monitoring and forecast data are used across the region by its neighbors to support their only hazard monitoring activities.
4. Indonesia has developed effective strategies at the national, subnational, and local levels that ensure coordination across warning issuers and dissemination channels. Additionally, regular coordination, planning, and review meetings are undertaken between the warning issuers, the media, and other stakeholders.

The assessment highlighted several key early warning capacity gaps in Indonesia:

1. According to the country's legislation, Indonesia's early warning dissemination mandates are divided across the national disaster management agency, BMKG, and the Ministry of Communication and Informatics (KOMINFO), creating a lack of legislative clarity that has created potential for gaps or conflicting warning messages in the dissemination process. Not only may this impact the initial issuance of warning messages but may also create a lack of public trust in early warning messages, which can result in a lack of response to alerts.
2. As outlined above, Indonesia has effectively leveraged a wide range of tools to support hazard detection, monitoring, analysis, and forecasting. However, the recent expansion of such technologies has resulted in a multitude of individual, disconnected systems across the various government bodies responsible for monitoring the country's different hazards.
3. The assessment found that, while Indonesia has been open to, and effectively leveraged, early warning tools and technologies, a significant capacity gap exists in the consideration of the long-term sustainment of such systems in terms of ongoing resourcing and maintenance. Efforts are required to ensure budgeting, human resource sustainment, and long-term maintenance and updates are built into system design and development from the outset.
4. Capacity gaps have been identified in Indonesia's warning strategies, which requires further

Indonesia
Progress Towards Advanced Capacity Development

consideration of the needs of different populations and the integration of risk and impact information. Additionally, limited feedback mechanisms are built into warning dissemination to determine if messages have been received by the population. As a result of these gaps, required adjustments may be overlooked, resulting in patchy communication of warning messages across the country.

5. A lack of assessment of communities' abilities to communicate in response to early warnings, as well as a lack of testing and evaluation of public awareness and response drives Indonesia's lower capacity in preparedness and response. Testing and assessment of these key preparedness and response elements would allow for targeted enhancement of capacity in this area.

A detailed breakdown of the ASEAN Member State's assessment can be found in Appendix C.

Early Warning Legislative Framework

Presidential Decree 87/2020—Presidential Regulation on Disaster Management Masterplan (Rencana Induk Penanggulangan Bencana) guiding all disaster stakeholders in the understanding of the Disaster Management Plan from 2020 to 2044.

Law No. 31/2009—Defines the roles and responsibilities of BMKG, broadcasters, and other stakeholders regarding EWS implementation.

Law 24/2007[23]—The first law in Indonesia concerning disaster management, creating a framework for disaster management, including early warning, and establishing the country's national disaster management agency, BNPB.

National Action Plan for Disaster Risk Reduction (RAN PRB)[24]—Outlines planning and budgeting provisions for disaster risk reduction.

Key Early Warning Stakeholders

Badan Nasional Penanggulangan Bencana (BNPB)[25]—National disaster management organization, mandated to provide hazard early warning of disasters to the public.

Badan Meteorologi, Klimatologi, Dan Geofisika (BMKG)[26]—Indonesia's meteorology, climatology, and geophysics agency, responsible for data and information services in the fields of meteorology, climatology, and geophysics, as well as delivery of information and early warning to relevant agencies and parties regarding disasters caused by meteorological, climatological, and geophysical factors. Built and operating the impact-based weather prediction system, Signature and the country's Earthquake and Tsunami Warning System, InaTEWS.

Indonesia

Progress Towards Advanced Capacity Development

Badan Informasi Geospasial (BIG)[27]—The country's geospatial information agency, charged with managing Indonesia's hazard and disaster thematic spatial data, as well as operating, managing, testing, and innovating for the continuous Global Positioning System (cGPS) and tide gauges to support the country's earthquake information and tsunami early warning systems.

Pusat Vulkanologi & Mitigasi Bencana Geologi (PVMBG)—Under the Ministry of Energy and Mineral Resources, the Center for Volcanology and Geological Hazard Mitigation (CVGHM) is tasked with conducting research, investigation, engineering, and services in the field of volcanology and geological disaster mitigation, as well as the dissemination of disaster-related information to the relevant government agencies. Developed MAGMA, the Monitoring System for volcano activity in Indonesia.

Kementerian Komunikasi & Informatika (KOMINFO)[28]—Under the Ministry of Communication, the Ministry of Communication and Informatics has authority over all mass media and telecommunications, making it a key stakeholder in early warning dissemination.

Lembaga Penerbangan dan Antariksa Nasional (LAPAN)[29]—Indonesia's National Institute of Aeronautics and Space utilizes remote sensing technology to prepare geospatial maps for the development of evacuation maps and mapping of flood susceptibility.

Kementerian Energi Sumber Daya Mineral (ESDM)[30]—The Ministry of Energy and Mineral Resources provides disaster risk knowledge regarding geophysical hazards.

Direktorat Jenderal Pengendalian Perubahan Iklim (DJPPI)—The Directorate General of Climate Change Control is a functional unit under the Ministry of Environment and Forestry responsible for mitigation actions and control of forest and land fires. Developed and administers the wildfire monitoring system, SiPONGI.

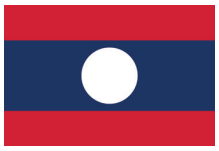
Directorate for River and Coasts[31]—Under the Ministry for Public Works and Human Settlements, is mandated to provide planning, preparation, and execution of operations and maintenance of rivers, coastlines, and major urban drainage systems.

Ministry of Home Affairs (DEPDAGRI)[32]—Coordinates public disaster education, awareness, and preparedness programs.

PetaBencana.id[33]—Developed a crowdsourced multi-hazard reporting and alerting system of the same name.

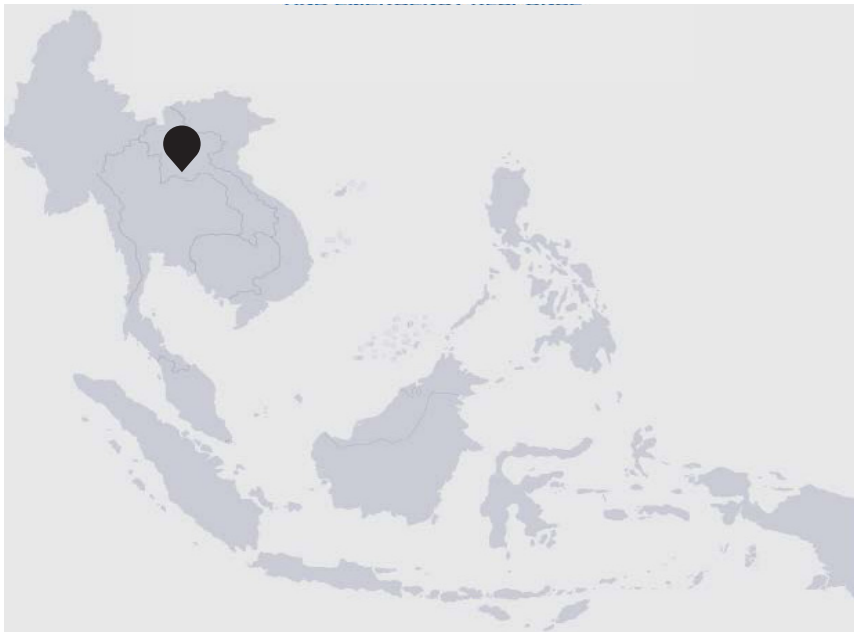
Pacific Disaster Center (PDC)[34]—Built and customized BNPB's early warning and decision support tool, InAWARE.

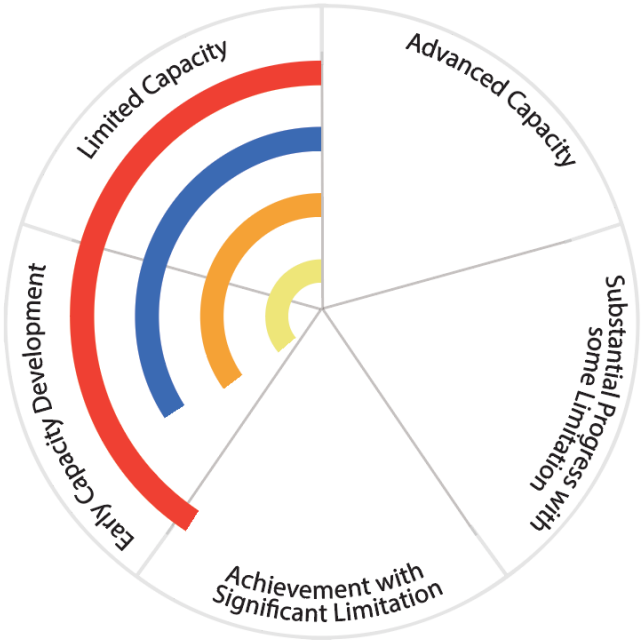
[THIS PAGE LEFT BLANK INTENTIONALLY.]



Lao PDR

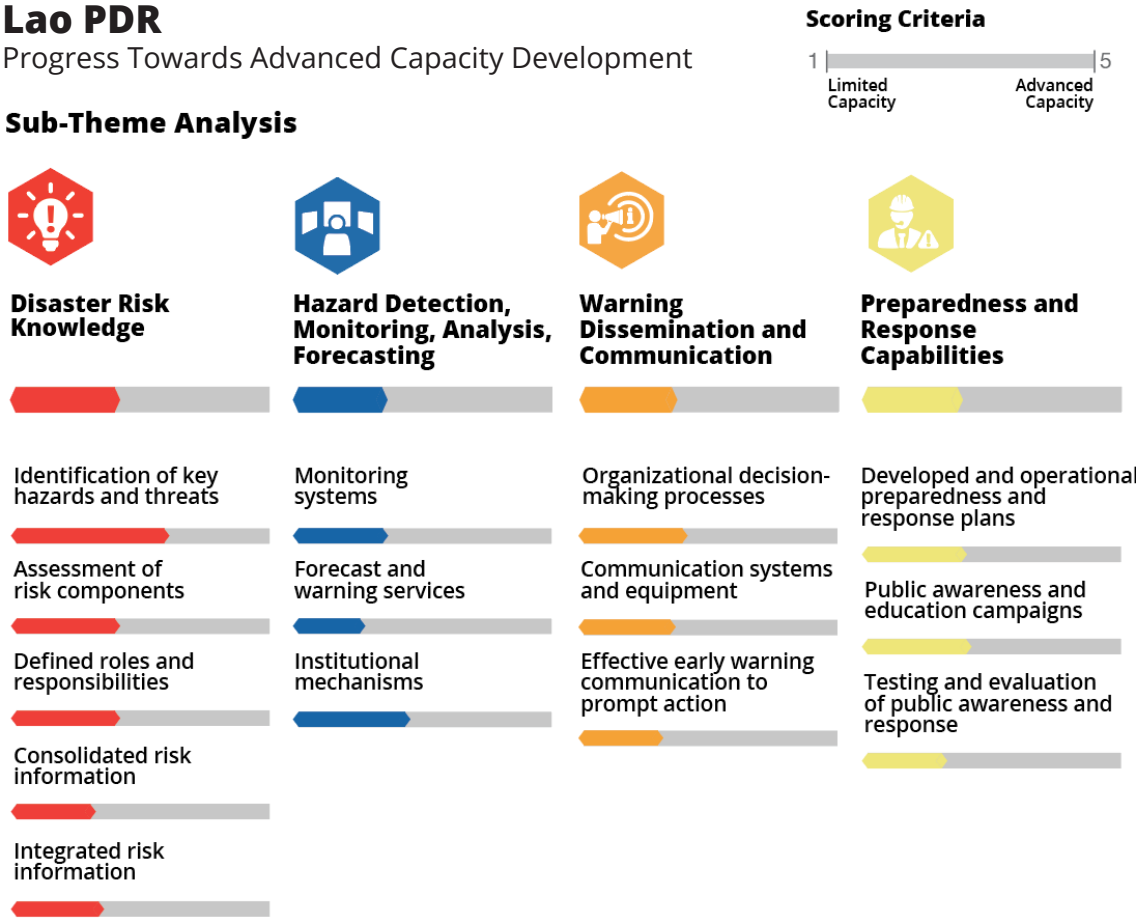
Progress Towards Advanced Capacity Development





Lao PDR

Progress Towards Advanced Capacity Development



Early Warning Summary

The INFORM GRI 2023 assessment[35] ranked Lao PDR as a medium risk nation. The country is subject to range of natural hazard events, including storms, floods, landslides, droughts, strong winds, and small earthquakes. The frequency and intensity of extreme weather events has increased in recent years, exacerbated by climate change. In response to these hazard events, Lao PDR has undertaken several institutional changes to more effectively manage disaster risk—a testament to the nation's commitment to disaster risk reduction.

The Flood and Drought Management and Early Warning System (FDM-EWS), managed by the Department of Meteorology and Hydrology (DMH) under the Ministry of Natural Resources and Environment (MoNRE), represents the nation's resourceful approach to disaster management. Furthermore, the country has shown commitment to community-level disaster risk management through the Community Based Early Warning Systems (CBEWS).

Lao PDR

Progress Towards Advanced Capacity Development

Early Warning Assessment Findings

Lao PDR's early warning capacity was assessed as being in the early stages of development, with notable advancements in the following areas:

1. Lao PDR demonstrates capacity achievement in disaster risk knowledge, particularly in relation to organizational and decision-making processes, which are underpinned by a strong legislative framework. The country's National Risk Profile was established in 2010 to provide a comprehensive assessment of the nation's natural hazards and overall impacts. It includes analyses and assessments of exposure, vulnerability, and risks to people, property, and affected sectors including key facilities, infrastructure, and economic activities, as well as maps of all hazard-prone locations.
2. The country's risk knowledge is underpinned by well-developed and documented measurement parameters and specifications for each of the country's key hazards. This provides clear risk understanding and guidance, which can be utilized to support the other core elements of early warning.
3. Lao PDR has established strong processes and procedures for the cross-border exchange of warnings and observation data through bilateral and multilateral agreements. The country works closely with regional and sub-regional bodies that support disaster risk reduction and promote regional synergies, such as the Mekong River Commission, the AHA Center, the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)/WMO Typhoon Committee, and the Southeast Asia Disaster Risk Insurance Facility (SEADRIF).
4. Functions, roles, and responsibilities of each component in warning dissemination are clearly established in the country's legislation, supporting the effective dissemination of warnings to the public.
5. Lao PDR has made good use of its disaster risk knowledge and developed risk assessments, which have been used to establish risk priorities for national catastrophe risk reduction initiatives.

The assessment found that further capacity development is required in a number of key areas:

1. While Lao PDR demonstrates capacity in the development of risk knowledge, with a strong legislative base, responsibility for coordinating hazard identification and risk information is spread across multiple government agencies—leading to limitations in the consolidation of approaches and monitoring linkages and cascading impacts.
2. Disaster and risk information, while collected and produced, remains spread disparately across multiple repositories, under the administration of various government agencies. Capacity development through the establishment of a central standardized repository to store all disaster and risk information would greatly enhance Lao PDR's disaster risk knowledge.

Lao PDR

Progress Towards Advanced Capacity Development

3. The assessment found that Lao PDR's forecasting and warning service capacity is in the early stages of development and that significant efforts should be undertaken to enhance the technical equipment suited to local conditions and circumstances and to build personnel capacity in its use and maintenance. Such technical systems should be developed with consideration of interoperability, with ongoing maintenance and upgrade costs and resources considered from the beginning to ensure optimal operation of systems over time.
4. A lack of capacity was observed in the incorporation of needs of all population groups (e.g., women, children, elderly, individuals with disabilities, urban and rural, etc.) into Lao PDR's EWS. This includes their consideration in the development of local hazard and risk assessments and early warning dissemination strategies.
5. As is noted across the ASEAN region, Lao PDR displays limited capacity in the implementation of mechanisms to verify that warning messages have been received. This limitation in the understanding of warning dissemination effectiveness creates potential for failures in dissemination and communication, with limited awareness of how to correct or enhance capacity over time.
6. While Lao PDR demonstrates significant improvements in raising public risk awareness and educational programs, the effectiveness of such programs is not evaluated regularly nor updated. As a result, necessary adjustments are not systematically incorporated to enhance these efforts, potentially resulting in limitations and ineffective use of educational resources.

A detailed breakdown of the ASEAN Member State's assessment can be found in Appendix C.

Early Warning Legislative Framework

Prime Minister's Decree on Climate Change (PM Decree No. 372) (2021)[36]—Strategic guide for integrating climate change adaptation and mitigation measures into national and sectoral development strategies.

National Strategic Plan for Disaster Risk Reduction (2010-2020)[37]—A long term, phased master plan for disaster risk reduction.

Law on Disaster Management No. 148/NA (2019)[38]—Outlines the government's obligation for the establishment, operation, and maintenance of an EWS for natural hazards.

Law No. 36/NA on Meteorology and Hydrology (2017)[39]—Defines principles, rules, and measures on the management, monitoring, and evaluation of hydrometeorological activities in Lao PDR, with the aim to prevent and reduce the impacts of natural disasters on lives and properties of the state, public, and individuals.[40]

Early Warning Standard Operating Procedures (2017)[41]—Systematically outlines the roles, responsibilities, and tasks to be undertaken by key early warning stakeholders.

Lao PDR

Progress Towards Advanced Capacity Development

Key Early Warning Stakeholders

National Disaster Management Committee (NDMC)[42]—Mandated to coordinate early warning, preparedness, response, and recovery efforts.

National Disaster Management Organization (NDMO)[43]—Under the Ministry of Labour and Social Welfare, acts as Secretariat to the NDMC.

Central Disaster Management Committee (CDMC)[44]—Supports the implementation of disaster risk reduction activities.

Department of Meteorology and Hydrology (DMH)[45]—Under the Ministry of Natural Resources and Environment (MoNRE), is chiefly responsible for the technical aspects of early warning, including hydrometeorological data collection, analysis, and risk communication.

National Early Warning Centre (NEWC)[46]—Under DMH, provides technology-based monitoring and forecasting for hazard events.

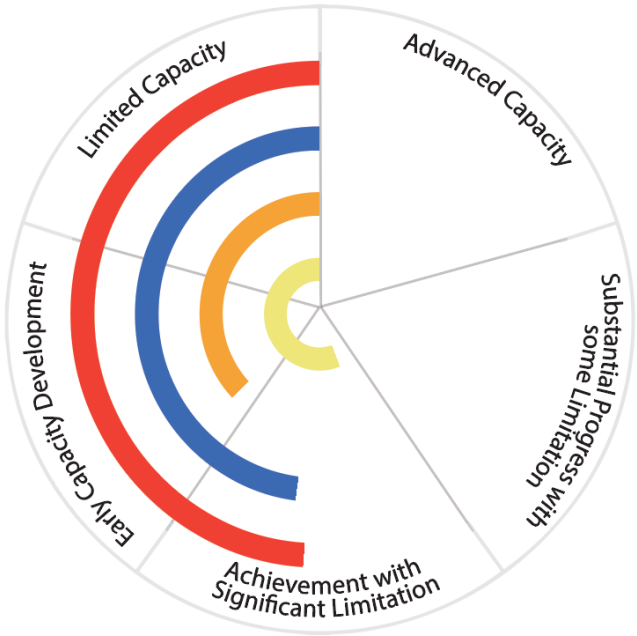
Ministry of Labour and Social Welfare (MLSW)[47]—Contributes to disaster response, recovery, and social protection measures.

Pacific Disaster Center (PDC)[48]—Built and customized the ASEAN DMRS, which is used by Lao PDR's NDMO.

[THIS PAGE LEFT BLANK INTENTIONALLY.]

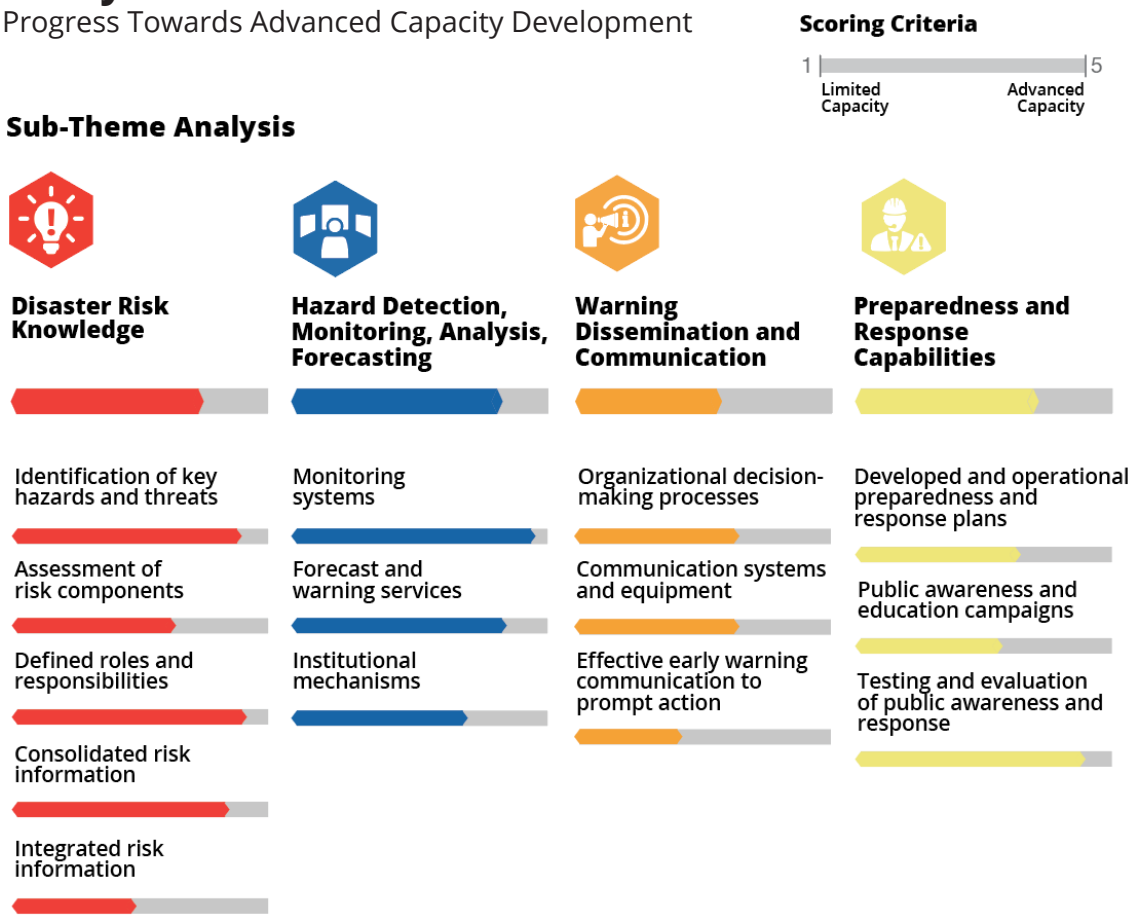
Malaysia

Progress Towards Advanced Capacity Development



Malaysia

Progress Towards Advanced Capacity Development



Early Warning Summary

The INFORM GRI 2023 analysis[49] ranks Malaysia as a low-risk nation, exhibiting limited hazard exposure and demonstrating relatively low vulnerability. Flooding is the most significant hazard risk in the country, with rainfall intensity having increased substantially in recent decades. As with other affected countries in the region, the 2004 Indian Ocean earthquake and tsunami proved a moment of national reflection on the country's disaster management approaches, resulting in concerted efforts to understand risk more fully, and increasing emphases on hazard detection, monitoring, and early warning.

In support of the country's early warning priorities, Malaysia's National Disaster Management Agency (NADMA) and various other government and auxiliary partners collect and exchange information via an integrated platform at the National Disaster Command Centre (NDCC). NADMA and the Department of Irrigation and Drainage (DID) are among the key government agencies with oversight over technical data that can inform early warning bulletins. Malaysia's government and

Malaysia
Progress Towards Advanced Capacity Development

its ASEAN partners share information networks that allow them to exchange details regarding disaster responses, humanitarian needs, and capabilities.

Early Warning Assessment Findings

The assessment of Malaysia EWS capacities found significant strengths, detailed below:

1. Substantial progress in disaster risk knowledge was observed, with roles and responsibilities of key risk knowledge stakeholders well established and supported by a robust legislative framework. The country's understanding of risk is underpinned by the Science and Technology Expert Panel (STEP), which supports engagement of the scientific community and experts to develop disaster risk management in line with national and international best practice, and the latest scientific and technological advances. This panel could serve as a useful model for other ASEAN Member States requiring capacity enhancement in this area.
2. Malaysia shows advanced capacity in hazard detection, monitoring, analysis, and forecasting, with the Malaysian National Tsunami Early Warning System (MNTEWS) and the National Flood Forecasting and Warning System (NaFFWS) providing receipt and processing of hazard information in an interoperable format in real time or near real time.
3. Not only has Malaysia established a strong network of hazard detection, monitoring, analysis, and forecasting tools, but the country has also implemented processes and procedures to ensure these systems are continuously monitored for any data gaps, or connection or processing issues.
4. The functions, roles, and responsibilities of each component of the warning dissemination process are enforced through government policy and legislation at all levels and are included in standard operating procedures. Effective agreements have been developed to utilize private sector resources, where appropriate, to disseminate warnings.
5. Malaysia demonstrates substantial progress in the incorporation of previous emergency and disaster events and responses and lessons learned into preparedness and response plans and capacity-building strategies to enhance early warning.

Areas of Malaysia's early warning systems that have been identified as requiring capacity development are outlined below:

1. Malaysia has yet to draft a national disaster risk reduction policy or law, limiting legislative capacity to support early warning. However, it is noted that the current NADMA 5-Year Strategic Plan (2019-2023) includes the goal of developing these legal instruments.
2. The country was assessed as having a robust understanding of hazards and risk. However, limited capacity was observed in the integration of risk knowledge into the identification of safe areas and evacuation zones and the design and development of evacuation strategies. Additionally, efforts are required to institutionalize the regular and continuous update of risk

Malaysia
Progress Towards Advanced Capacity Development

information based on new or emerging risk information.

3. The country's considerable forecasting and warning service network provides a strong basis for the development of public warning messages. However, the assessment observed limitations in the clarity of warning messages, and a lack of actionable guidance to trigger reactions (e.g., evacuation).
4. Hazard detection, monitoring, analysis, and forecasting capabilities in Malaysia could be enhanced through the establishment of a multi-hazard coordination strategy to obtain mutual efficiencies and effectiveness across and between different warning systems.
5. A need for greater coordination and planning between the country's warning issuers, the media, and other stakeholders is required to build communication and dissemination effectiveness. Furthermore, the incorporation of feedback mechanisms to verify that warnings have been received and to correct potential failures in dissemination and communication would further enhance Malaysia's early warning capacity.
6. Limited capacity was observed in the consideration of the needs and specific vulnerabilities of different population groups throughout all components of early warning, including the identification of evacuation routes and location of temporary shelters, warning message construction and dissemination, and disaster preparedness plans and standard operating procedures.

A detailed breakdown of the ASEAN Member State's assessment can be found in Appendix C.

Early Warning Legislative Framework

NADMA 5-Year Strategic Plan (2019-2023)—Outlines national disaster management intentions on a five-year basis.

Directive No. 20: National Policy and Mechanism on Management Relief (Framework) (2012)[50]—Provides a comprehensive overview of Malaysia's disaster management mechanism for all stages of the disaster cycle.

Key Early Warning Stakeholders

National Disaster Management Agency (NADMA)[51]**—**Oversees all facets of management of disaster risks in Malaysia.

National Disaster Command Centre (NDCC)—Monitors information and data received from the country's technical agencies to support the identification and early warning for hazard events.

Malaysian Meteorological Department (Met Malaysia)[52]**—**Responsible for the provision of reliable meteorological information and services to the government, society, and related sectors,

Malaysia
Progress Towards Advanced Capacity Development

including forecasts and weather alerts.

Department of Irrigation and Drainage (DID)[53]—Plays a crucial role in water resources and drainage systems management including managing the country's flood risks through flood monitoring, EWS, and flood forecasting to provide timely information and alerts to the public.

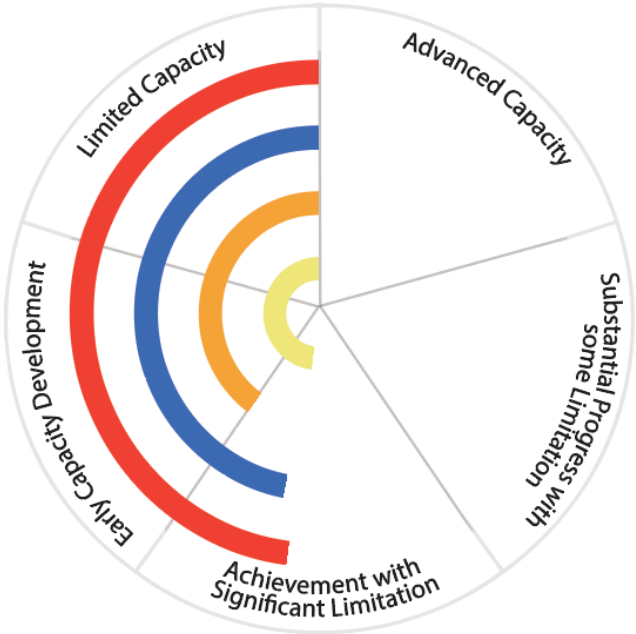
Malaysian National Tsunami Early Warning System (MNTEWS)[54]—Supports tsunami monitoring and alerting, equipped with a processing system referred to as the Advanced Decision and Dissemination Malaysia Seismic and Tsunami Information System, which is able to deliver earthquake information to disaster management stakeholders and the public.

Malaysia Minerals and Geoscience Department (JMG)[55]—Assesses and monitors geophysical hazards, such as landslides, subsidence, and geological fault zones, to identify areas prone to potential risks. Provide geohazard maps and information to relevant authorities, developers, and the public.

[THIS PAGE LEFT BLANK INTENTIONALLY.]

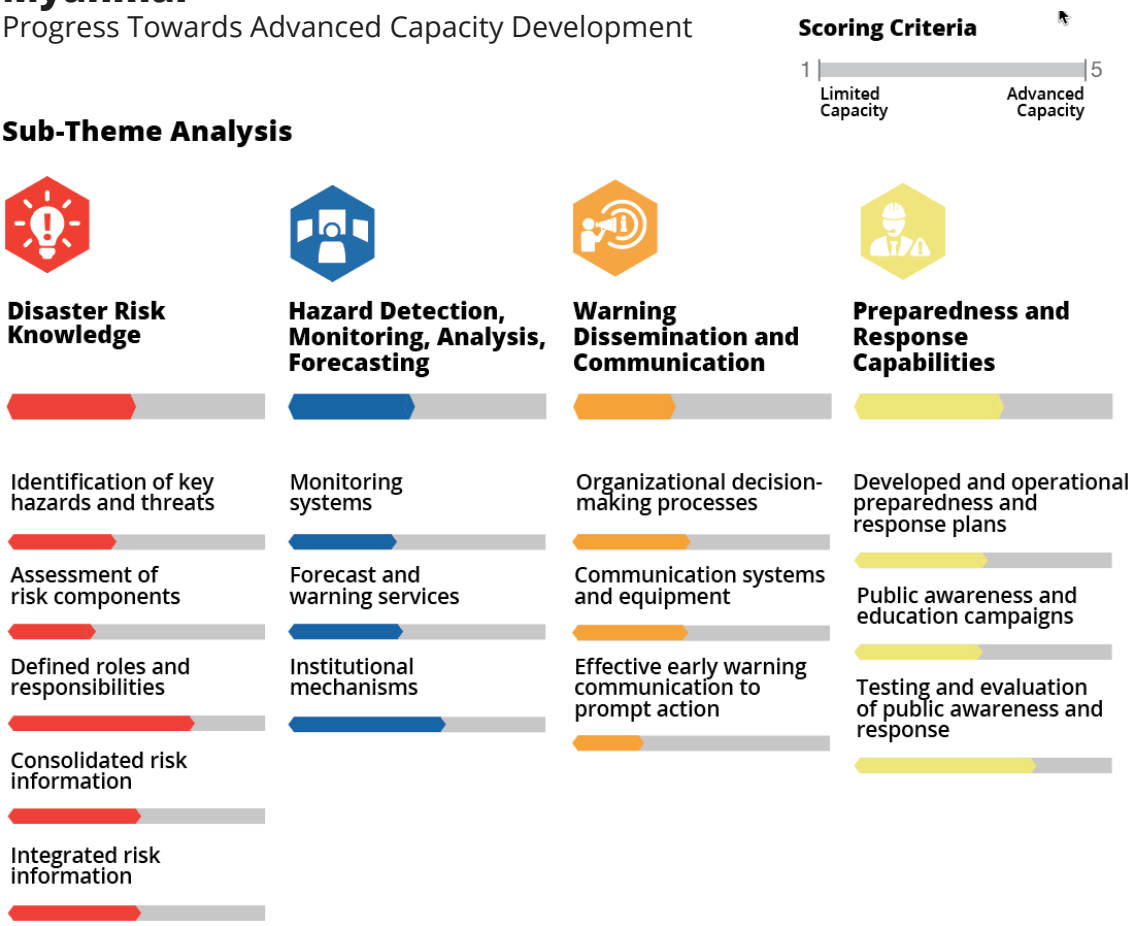
Myanmar

Progress Towards Advanced Capacity Development



Myanmar

Progress Towards Advanced Capacity Development



Early Warning Summary

Myanmar is ranked as a very high-risk country according to the INFORM GRI 2023 assessment[56]. This ranking is the function of the country's high hazard exposure, significant vulnerability, and limited coping capacities. Myanmar is subject to a wide variety of natural hazards including earthquakes, tsunamis, tropical cyclones, storm surges, floods, landslides, droughts, and forest fires. Additionally, ongoing conflict and internal displacement create vulnerabilities that exacerbate potential hazard impacts. The 2050 Indo-Pacific Climate Change Impact Analysis[57] assessed Myanmar as having one of the highest multi-hazard climate risks in the Indo-Pacific region, indicating the potential for increasing frequency and intensity of hydrometeorological hazard events in the coming years.

In response to these risks, Myanmar, with support from international partners, has implemented several initiatives to inform the public of hazard events including Disaster Alert Notification (DAN), a collaborative initiative between the Ministry of Social Welfare, Relief, and Resettlement and

Myanmar

Progress Towards Advanced Capacity Development

United Nations Development Programme (UNDP) providing hazard warnings and notifications. Additionally, through collaboration between the Department of Meteorology and Hydrology and United Nations Office for Project Services (UNOPS), a forecasting web application known as NEO (formally known as Myanmar's National Metrological Service) was established. The country's Department of Meteorology and Hydrology (DMH) utilizes the ASEAN DMRS to share hazard information with both national and regional stakeholders.

Early Warning Assessment Findings

The assessment of Myanmar observed some capacity in early warning, with substantial limitations. The country demonstrated notable capacities in the following areas:

1. Myanmar's responsibility for coordinating hazard identification and risk information (exposure, social and physical vulnerability, and capacity) are assigned to one national organization, which supports the consolidation of approaches and monitoring linkages and cascading impacts.
2. Through collaboration with international partners, Myanmar has developed effective processes for scientific and technical experts to assess and review the accuracy of risk data and information.
3. Where risk information exists, it is used by disaster management stakeholders to identify and define evacuation routes and location of temporary shelters.
4. Institutional mechanisms are in place to support hazard detection, monitoring, analysis, and forecasting, with capacity observed in the establishment of agreements and interagency protocols within the country for the exchange of monitoring systems data and baseline data. Additionally, the assessment noted warning system partners' awareness of, and respect for, organizations responsible for the generation and issuance of warnings.
5. Myanmar demonstrates some capacity in the understanding of last-mile connectivity to know which population groups can be reached by different services, supporting effective and efficient warning dissemination.
6. Recent updates to Myanmar's legislation provide for a more participatory approach for the development of disaster preparedness plans at all levels.
7. The country has undertaken substantial public awareness and education programs in communities to help build public awareness of, and resilience to, hazard events that may impact them. Additionally, the assessment observed some capacity in the testing and evaluation of these activities, supporting the incorporation of lessons learned into future preparedness and response planning and capacity-building strategies.

Despite these significant early warning achievements, the assessment identified several gaps in Myanmar's early warning capacities, as detailed below:

Myanmar

Progress Towards Advanced Capacity Development

1. Risk knowledge capacity is limited by the incomplete characterization of key hazards, including possible cascading hazardous events.
2. A gap in capacity was observed in the integration of risk assessment results into local risk management plans and warning messages in clear and easy-to-understand language. As observed in many of the other ASEAN Member States, these plans and warning messages also did not fully consider how different people assess information to ensure effective messaging.
3. Myanmar has made considerable strides in recent years in the development of monitoring systems and forecast and warning services. However, significant capacity gaps remain in this component of early warning. Efforts are required to strengthen and expand these systems to encompass all key hazard types affecting the country, as well as to ensure best practice in the receipt, processing, and interoperability of such systems.
4. The observed absence of assessment of potential gaps and possible points of failure in early warning communication channels and multiple-channel systems may increase vulnerability, as mitigation or resilience measures may be misaligned with required needs, leading to persistent gaps and potential failures in the dissemination of early warning messages to at-risk communities.

While efforts were undertaken to fully assess Myanmar's EWS capacities, and inputs were received from the country's early warning stakeholders to support the analysis, a number of significant information gaps remain. This has impacted the country's capacity assessment, resulting in limited reliability in the findings. It is recommended that additional efforts be undertaken to address these information gaps and to reassess early warning capacities with this additional information before any interventions are undertaken.

A detailed breakdown of the ASEAN Member State's assessment can be found in Appendix C.

Early Warning Legislative Framework

Standing Order on Natural Disaster Management (2022)[58]—Defines roles and responsibilities of national-level disaster management institutions.

Myanmar Action Plan on Disaster Risk Reduction 2017 (MAPDRR)[59]—Action plan for disaster risk reduction and management, with associated targets through to 2030.

Disaster Management Law and Rules (2013 and 2015)[60]—Sets out the legal basis for Myanmar's key disaster risk management government stakeholders.

Key Early Warning Stakeholders

National Disaster Management Committee (NDMC)—The leading body for Disaster Risk Management in Myanmar.

Myanmar

Progress Towards Advanced Capacity Development

Department of Disaster Management (DDM)[61]—Part of the Myanmar Ministry of Social Welfare, Relief and Resettlement, provides coordination on disaster risk reduction measures.

Department of Meteorology and Hydrology (DMH)[62]—Under the Ministry of Transport and Communications, is responsible for monitoring and providing warning services for both hydrometeorological and geophysical hazards in Myanmar.

Disaster Risk Reduction Working Group (DRR WG)—Provides a platform for disaster risk reduction information sharing and coordination.

Myanmar Information Management Unit (MIMU)[63]—A service of the United Nations, maintaining a common data and information repository with data from various sources on all sectors.

Myanmar Red Cross[64]—Provides technical assistance to the government on disaster management legislation and strategies.

[THIS PAGE LEFT BLANK INTENTIONALLY.]

Philippines

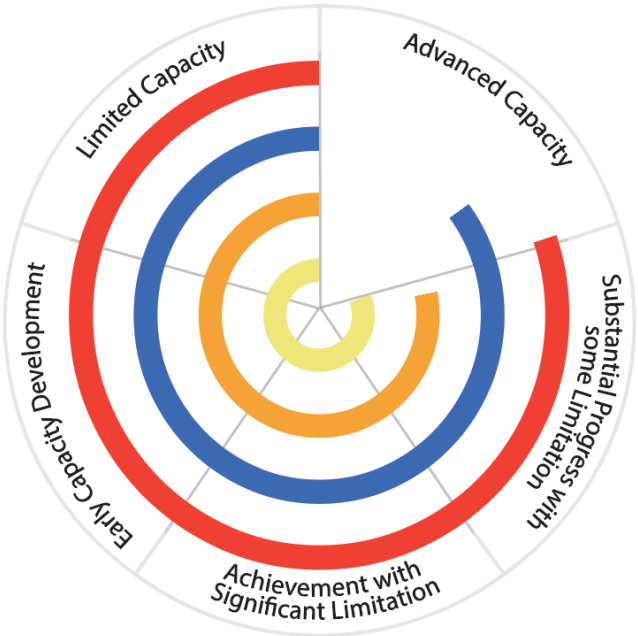
Progress Towards Advanced Capacity Development

Disaster Risk Knowledge

Hazard Detection, Monitoring, Analysis, Forecasting

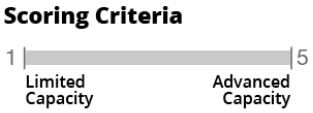
Warning Dissemination and Communication

Preparedness and Response Capabilities

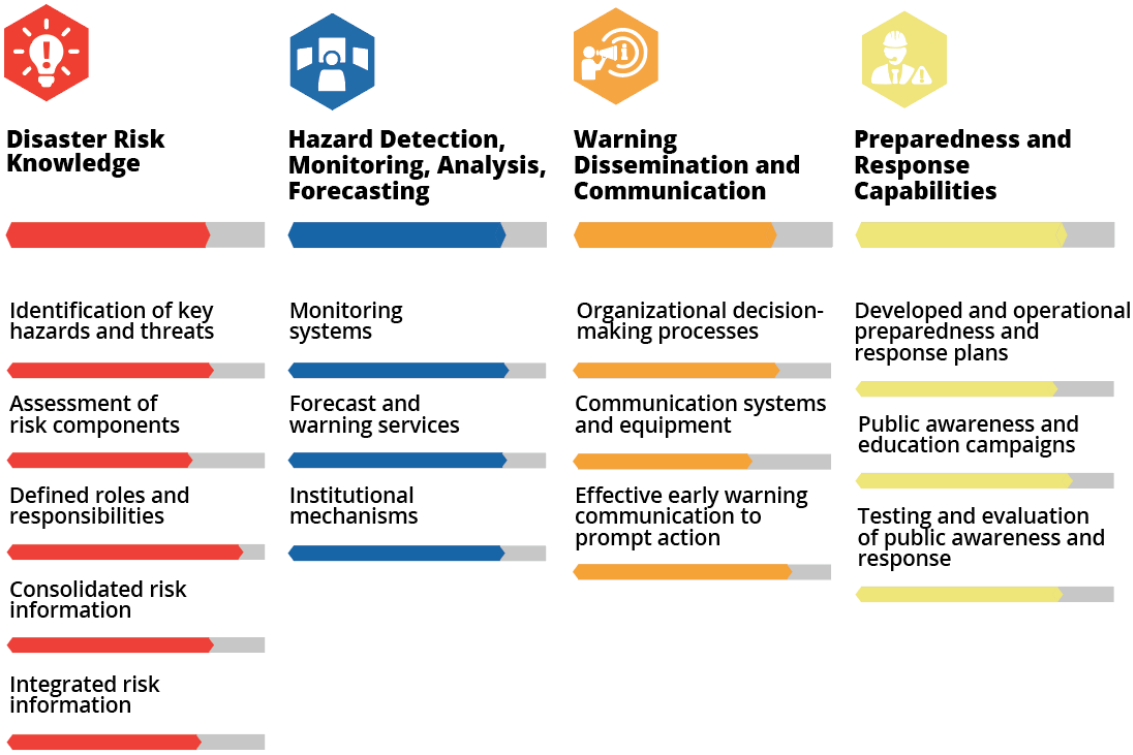


Philippines

Progress Towards Advanced Capacity Development



Sub-Theme Analysis



Early Warning Summary

According to the INFORM GRI 2023 report[65], the Philippines ranks as a high-risk nation, primarily because of its significant hazard profile. Located in the Pacific Ring of Fire, it is prone to earthquakes, volcanic eruptions, and tsunamis, as well as a wide range of hydrometeorological hazards. The 2050 Indo-Pacific Climate Change Impact Analysis[66] concluded that the country has a high climate risk due to its geography, exposure to various climate-related hazards, and socioeconomic vulnerabilities.

With hazard events impacting the country on a seemingly regular basis, the Philippines has made disaster risk reduction and early warning a top domestic priority. Along with other warning tools, the Office of Civil Defense (OCD) has implemented a customized version of PDC's DisasterAWARE, PhilAWARE, to support its monitoring and response operations.

Philippines

Progress Towards Advanced Capacity Development

Early Warning Assessment Results

Assessment of the Philippines found advanced early warning capacity across all thematic areas, with some notable achievements outlined below:

1. Roles and responsibilities for key national government agencies involved in risk assessments in the Philippines are identified and well defined, with a robust legislative framework established to mandate the preparation of hazard, vulnerability, and capacity assessments for all areas.
2. The Department of Science and Technology (DOST), through the Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA) and Philippine Institute of Volcanology and Seismology (PHIVOLCS), leads efforts in hazard identification and risk information (exposure, social and physical vulnerability, and capacity), helping ensure a consolidated approach to disaster risk knowledge.
3. The Philippines has developed effective processes and procedures to engage scientific and technical experts to assess and review the accuracy of risk data and information, resulting in more robust and complete assessments that conform to international standards.
4. The country's network of monitoring systems and forecast services are well developed, with technical equipment, suited to local conditions and circumstances established. Additionally, personnel are trained in the equipment's use and maintenance to ensure its effectiveness, accuracy, and long-term sustainment.
5. Both technical agencies and the country's OCD operate warning centers around the clock, with personnel trained to appropriate national and international standards.
6. The Philippines has established warning communication strategies at the national, subnational, and local levels that ensure coordination across warning issuers and dissemination channels. This coordination supports the issuance of effective and clear warnings to the public.

Despite the country's advanced capacity, gaps in EWS have been identified by the assessment:

1. While significant data development work has been undertaken in the Philippines, resulting in a wide range of data useful for early warning, the assessment noted that the sharing of data between data providers and users for planning and operational purposes remains a challenge.
2. A limited understanding of last-mile connectivity to know which population groups can be reached by different services was observed. Without such knowledge, it is not possible to effectively leverage these services to enhance early warning dissemination and address gaps in early warning receipt.
3. The assessment found evidence that the Philippines has only developed early action and response options across time and geographical scales in a partial capacity, with significant limitations observed in the linking of these options to the provision of funding to support them.

Philippines

Progress Towards Advanced Capacity Development

This may result in delayed or inadequate response efforts that could increase the impact of hazard events.

4. Further efforts are required to integrate ongoing public awareness and education programs into school curricula from primary through university level. Such initiatives should not only focus on hazards that could impact the population, but also build community understanding of vulnerabilities, exposure, and how to reduce disaster impacts.

A detailed breakdown of the ASEAN Member State's assessment can be found in Appendix C.

Early Warning Legislative Framework

Philippine Disaster Risk Reduction and Management Act of 2010 (RA 10121)[67]—Serves as the primary legislative document that outlines the country's all-hazard, multi-sectoral, interagency, and community-based approach to disaster management.

National Disaster Risk Reduction and Management Plan (NDRRMP) (2011-2028)[68]—A roadmap to achieve the goals and targets provided in the national disaster risk reduction and management framework, including disaster prevention and mitigation.

National Disaster Preparedness Plan (NDPP) (2015-2028)[69]—Supports disaster risk management stakeholders to achieve key objectives including increased awareness and resilience of communities, and the development of national and local preparedness and response plans.

Key Early Warning Stakeholders

National Disaster Risk Reduction and Management Council (NDRRMC)[70]—The lead agency for disaster response, coordinates all stages of the disaster cycle.

Office of Civil Defense (OCD)[71]—The implementing arm of the NDRRMC, charged with the issuance of disaster warnings and messages to the public through its 24/7 emergency operations center.

Department of Science and Technology (DOST)[72]—Leads the prevention and mitigation pillar in the NDRRMC, with an overall national mandate for the monitoring and forecasting of hazard events.

Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA)[73]—Under DOST, provides hydrometeorological warnings, bulletins, and advisories, as well as develops hazard and risk maps and assessments.

Philippines

Progress Towards Advanced Capacity Development

Philippine Institute of Volcanology and Seismology (PHIVOLCS)[74]—Under DOST, mandated to provide monitoring, analysis, and the issuance of warnings for geophysical events, as well as undertaking risk assessments through its GeoRisk portal and other tools.

Mines and Geoscience Bureau (MGB)[75]—Under the Department of Environment and Natural Resources (DENR), conducts engineering geological and geohazard assessments and mapping, and maintains geological database systems containing geospatial information.

Philippine Space Agency (PhilSA) - As an attached agency of the Office of the President, serves as the central government agency in addressing national issues and activities related to space science and technology applications in line with the Philippine Space Act.[76]

[THIS PAGE LEFT BLANK INTENTIONALLY.]

Singapore

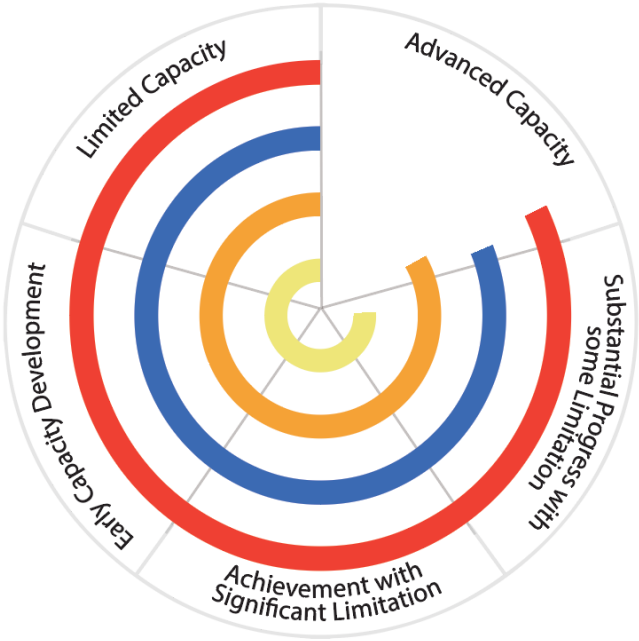
Progress Towards Advanced Capacity Development

Disaster Risk Knowledge

Hazard Detection, Monitoring, Analysis, Forecasting

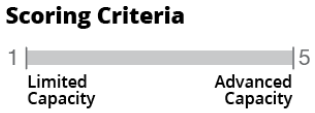
Warning Dissemination and Communication

Preparedness and Response Capabilities

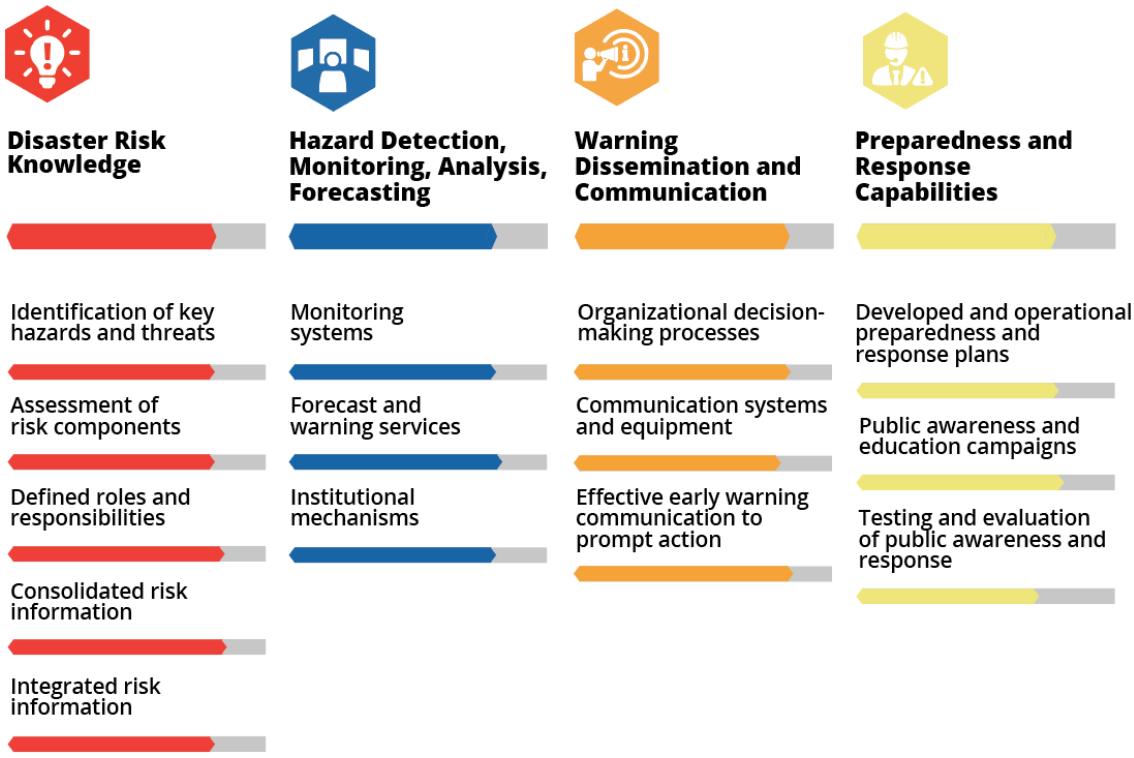


Singapore

Progress Towards Advanced Capacity Development



Sub-Theme Analysis



Early Warning Summary

The INFORM GRI 2023 report[77] ranks Singapore as the lowest risk country of all those evaluated, given its limited hazard exposure, low vulnerability, and significant coping capacity. However, climate change impacts represent a real risk for the future of the island nation, with increased intensity and frequency of heavy rainfall events anticipated[78]. While the risk of hazard events may be low, Singapore has developed its disaster risk management around a whole-of-government integrated approach to protect its citizens.

Early Warning Assessment Findings

Singapore's assessment indicates substantial progress in early warning capacity, with the following notable successes:

1. The country has developed robust assessments of exposure, vulnerabilities, capacities, and risks, which also consider compounding risks that may exacerbate hazard impacts. Additionally, consideration has been given to the evaluation of potential impacts to critical infrastructure and secondary risks associated with these impacts, with risk management solutions developed to increase resilience of such infrastructure.

Singapore
Progress Towards Advanced Capacity Development

2. Singapore has made effective use of the country's scientific community, having developed effective processes for scientific and technical experts to assess and review the accuracy of risk data and information.
3. Risk assessments consider legislative and cultural norms to identify gaps that may increase vulnerability, allowing for course correction to reduce vulnerability and increase resilience.
4. The use of impact-based early warnings to effectively communicate to prompt action, and the implementation of feedback mechanisms to verify that warnings have been received demonstrate Singapore's advanced capacity in warning dissemination and communication.
5. The assessment observed public and other stakeholder awareness of, and trust in, the authorities that issue the warnings. Such awareness and trust are vital for the public to receive, acknowledge, and respond to warning messages during a hazard event.
6. Singapore was observed to undertake regular exercises to test and optimize the effectiveness of early warning dissemination processes, preparedness, and response to warning messages.

The assessment also identified some limitations in Singapore's early warning capacities, as noted below:

1. The assessment found limited availability or integration of indigenous knowledge into risk assessments, which potentially limits disaster risk knowledge capacity.
2. The assessment identified a capacity gap in Singapore's monitoring network due to limitations in the abilities of monitoring systems to combine, and benefit from, new and older technology. Introducing such system flexibility would support a more robust and interconnected monitoring network across regions.
3. As with many other ASEAN Member States, Singapore's disaster preparedness measures would benefit from increased consideration of the needs of people with different degrees of vulnerability in the country's disaster preparedness measures, including plans and standard operating procedures.
4. Further efforts to develop early action and response options across different time periods would greatly enhance Singapore's preparedness and response capabilities.
5. The assessment found limited evidence of the incorporation of previous emergency and disaster events and lessons learned into preparedness and response plans and into capacity-building strategies. An understanding of the strengths and challenges of previous responses could build significant resilience into future planning efforts.

A detailed breakdown of the ASEAN Member State's assessment can be found in Appendix C.

Singapore

Progress Towards Advanced Capacity Development

Early Warning Legislative Framework

Whole-of-Government Integrated Risk Management (WOG-IRM) Policy Framework[79]—A cross-ministerial framework for disaster risk reduction and management.

Key Early Warning Stakeholders

Ministry of Home Affairs (MHA)[80]—Responsible for Singapore's disaster risk reduction policy and strategy.

Singapore Civil Defense Force (SCDF)[81]**—**Under MHA, acts as the main emergency manager for warning, protection, rescue, command and control and communications, and manages the island-wide Public Warning System (PWS).

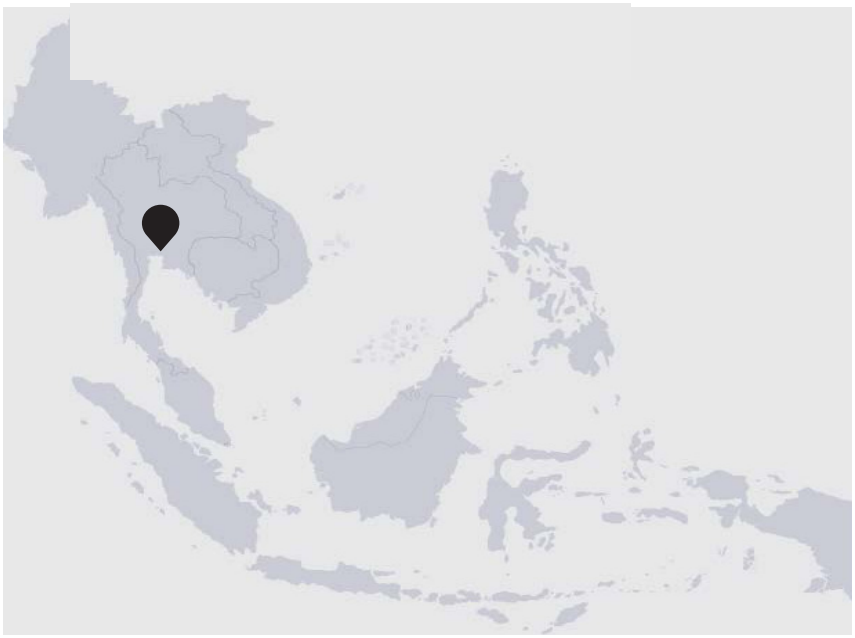
Meteorological Services Singapore (MSS)[82]—Singapore's national authority on weather and climate.

National Environment Agency (NEA)[83]**—**Under the MSS, responsible for weather and climate services, dissemination of weather forecasts and hazard warnings in a timely manner, as well as contribution towards climate adaptation efforts.

Public Utility Board (PUB)[84]**—**A statutory board under the Ministry of Sustainability and the Environment (MSE) mandated as the national water agency leading and coordinating whole-of-government efforts to protect Singapore from the threat of rising seas and the holistic management of inland and coastal flood risks, as well as providing information on flood-prone areas[85].

Thailand

Progress Towards Advanced Capacity Development

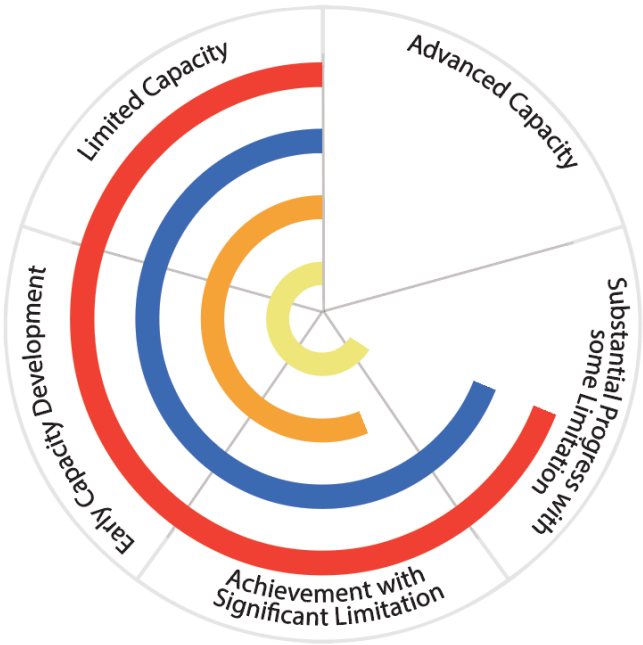


Disaster Risk Knowledge

Hazard Detection, Monitoring, Analysis, Forecasting

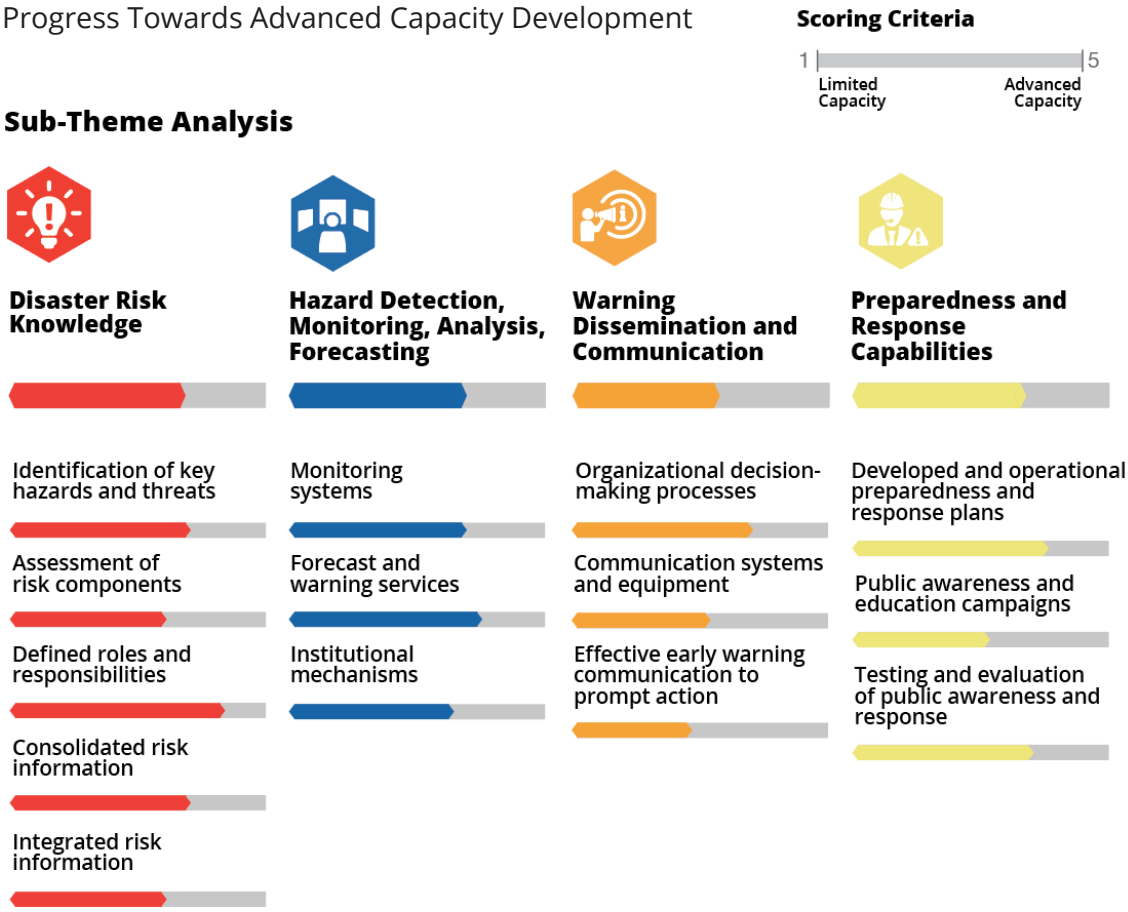
Warning Dissemination and Communication

Preparedness and Response Capabilities



Thailand

Progress Towards Advanced Capacity Development



Early Warning Summary

Thailand is considered a medium risk country, according to the latest INFORM GRI[86]. The country's hazard exposure is primarily driven by recurring hydrometeorological hazards such as storms, floods, landslides, and droughts[87]. According to the recently published Indo-Pacific Climate Change Impact Analysis[88], Thailand is anticipated to have one of the highest climate risk exposures in the Indo-Pacific region, predicted to result in greater climatic variability and an increase in hydrometeorological hazard events.

Following the devastating 2004 Indian Ocean tsunami, Thailand has significantly improved its EWS infrastructure. Furthermore, the country has invested in the establishment of community-based EWS, primarily in areas prone to high-risk disasters. These systems are developed and maintained by local communities in collaboration with non-governmental organizations, and with the support of different government agencies, all with the intent to address unique regional requirements and conditions.

Thailand

Progress Towards Advanced Capacity Development

Early Warning Assessment Findings

Thailand has made substantial progress in early warning capacity development, with these notable achievements:

1. The country has established clear roles and responsibilities for key national government agencies involved in risk assessments, with government policy mandating the preparation of hazard, vulnerability, and capacity assessments for all areas.
2. The assessment found that Thailand has implemented processes to maintain, regularly review, and update risk data, including information on any new or emerging vulnerabilities and hazards. Furthermore, appropriate evaluations from both external expert assessment and internal supervisory review are built into the assessment process, providing increased confidence in the country's disaster risk knowledge.
3. Thailand has established, and manages, a network of monitoring, surveillance, and hazard identification tools and services for hydrometeorological hazards. This network is underpinned by regulations, standard operating procedures, and budget systems that are flexible to the situational characteristics related to hydrometeorological hazards.
4. Advanced capacity was observed in Thailand's disaster preparedness measures, including plans and standard operating procedures. The country's national disaster law and national disaster plans mandate each province and district to establish a provincial disaster preventive and mitigation plan, as well as each local government organization to create a local disaster action plan. The law also requires the annual update of these plans to ensure consideration of emerging and new hazard risks and vulnerabilities.
5. Following international best practice, Thailand has incorporated protocols in its communication plans and standard operating procedures to ensure that they reach emergency and health services that need to be ready to respond to events promptly.

The assessment observed some capacity gaps in Thailand's EWS, in the following areas:

1. Despite Thailand displaying substantial progress in risk assessment, some limitations were observed in the legal framework for the consideration of vulnerability factors such as gender, disability, access to infrastructure, economic diversity, societal inequalities, and environmental sensitivities in such assessments. Additionally, risk analysis was observed to be broadly lacking effective mechanisms or systems for continuously assessing economic vulnerability, and their incorporation into assessments.
2. The assessment found a need for further capacity development for the use of vulnerable group risk information to identify and define evacuation routes and location of temporary shelters. This lack of capacity was assessed to be, in part, a result of the numerous, different agencies involved in such activities, as well as a limited understanding of the varied profiles and needs of such groups.

Thailand

Progress Towards Advanced Capacity Development

3. Thailand's network of warning systems and services support effective hazard detection, monitoring, and analysis. However, limited consideration of system sustainment measures was observed, particularly in relation to fiscal year maintenance and long-term update and replacement planning. This has resulted in ad hoc maintenance measures and limited upgrades, leading to ineffective uptake of new and emerging technologies to support early warning.
4. It was observed that Thailand possessed some capacity limitations in the implementation of agreements and interagency protocols established to ensure consistency of warning language and communication responsibilities. Additionally, at present, there exists no multi-hazard coordination strategy to obtain mutual efficiencies and effectiveness among different warning systems. However, it was noted that Thailand is currently working on an integrated digitalization of national early warning strategy for 2023-2027—which is expected to support such agreement and protocols—although the exact details of this strategy have yet to be published and require assessment following completion.
5. The assessment identified a need for further educational measures to support public recognition of hydrometeorological and geophysical hazard signals, as well as disease signs and symptoms, to contribute to community surveillance.

A detailed breakdown of the ASEAN Member State's assessment can be found in Appendix C.

Early Warning Legislative Framework

National Disaster Prevention and Mitigation Plan (2021-2027)[89]—Provides strategic guidance on the use of a multi-hazard approach, an increased focus on digitalization, the development of smart, disaster-resilient infrastructure, and the standardization of the national EWS.

Disaster Prevention and Mitigation Act B.E. 2550 (2007)[90]—Clarifies the roles and responsibilities of various governmental organizations in disaster management, including the propagation of early warnings.

Key Early Warning Stakeholders

National Disaster Prevention and Mitigation Committee (NDPMC)[91]—Leads on disaster management policy development.

Department of Disaster Prevention and Mitigation (DDPM)[92]**—**The national disaster management organization, undertaking the role of the chief coordinating body for national disaster management efforts, including EWS.

National Disaster Warning Center (NDWC)[93]—Under DDPM, oversees potential risk detection, formulates early warnings, and liaises with other governmental and non-governmental entities for

Thailand
Progress Towards Advanced Capacity Development

communication and dispersal of warnings.

Thailand Meteorological Department (TMD)[94]—Responsible for real-time weather forecasts and dissemination of advisories for weather-related risks including tropical storms, heavy rain, and floods.

Earthquake Observation Division of the TMD[95]—Monitors seismic activities with its network of automatic earthquake monitoring stations around the country.

Department of Water Resources[96]—Monitors the nation's water resources, playing an instrumental role in disseminating early warnings for water-related hazards.

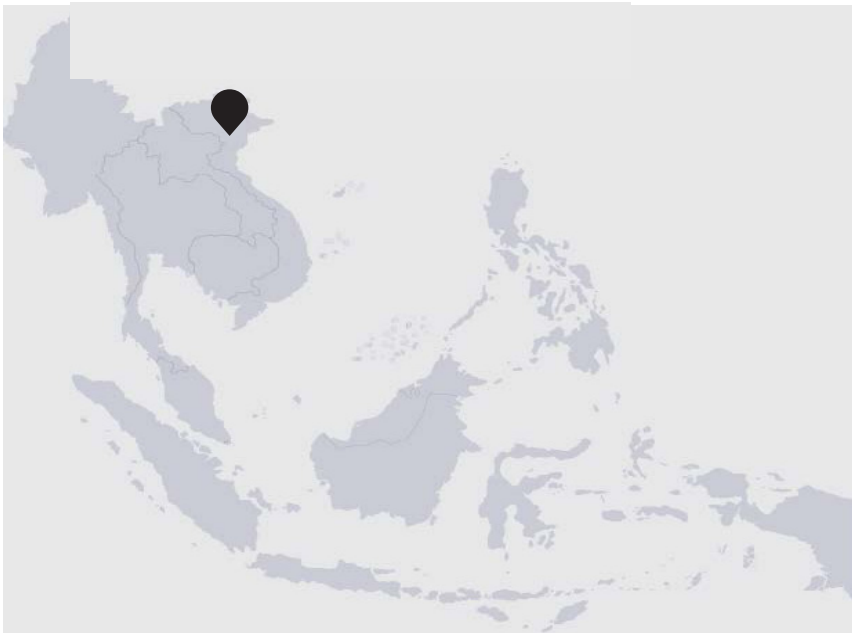
Royal Irrigation Department (RID)[97]—Mandated to provide prevention and mitigation of water hazards through flood forecasting, monitoring, and warning to the public.

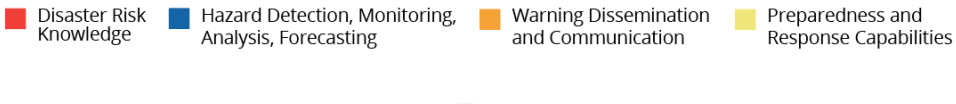
Thailand Red Cross Society[98]—Primary humanitarian organization in Thailand, supporting disaster preparedness activities, along with other activities.

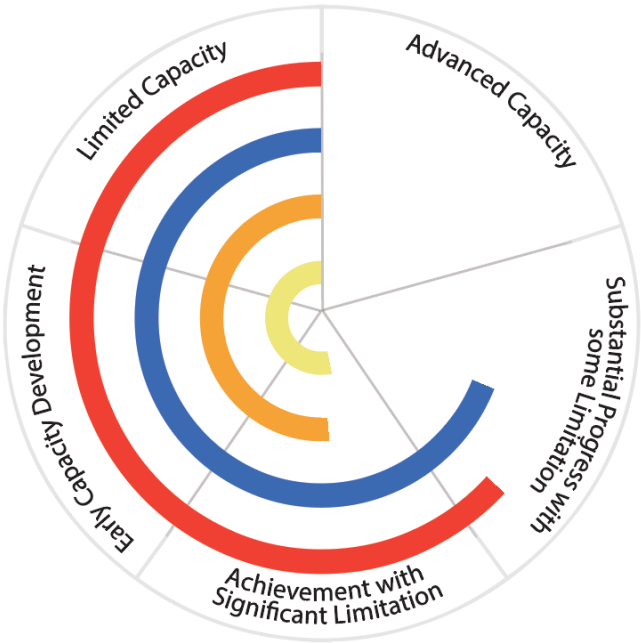
[THIS PAGE LEFT BLANK INTENTIONALLY.]

Viet Nam

Progress Towards Advanced Capacity Development

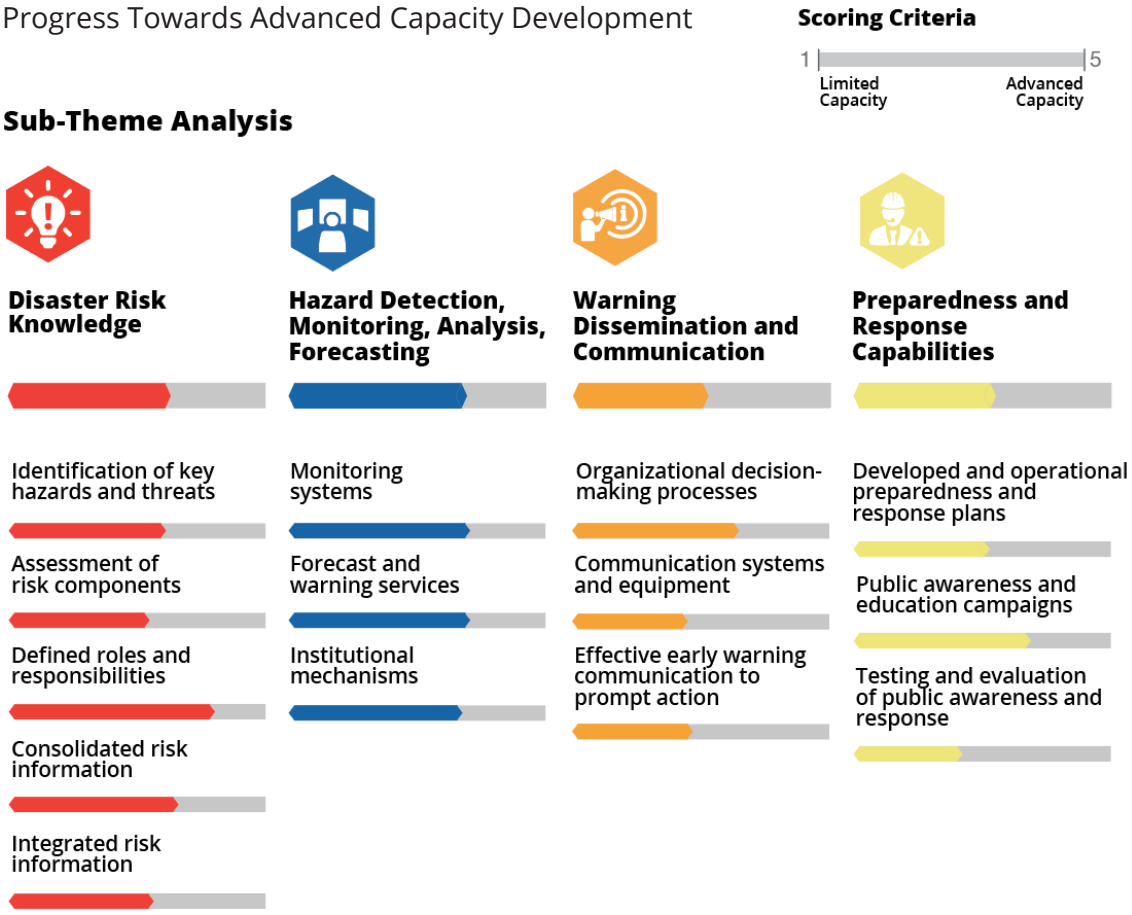






Viet Nam

Progress Towards Advanced Capacity Development



Despite having significant hazard exposure, Viet Nam is considered a low-risk country according to the INFORM GRI 2023 assessment[99], as a result of its limited vulnerability. The country is subject to a range of natural hazard events including tropical cyclones, floods, landslides, droughts, and coastal erosion. In addition, Viet Nam is located in a region prone to seismic activity, making it susceptible to earthquakes. Due to the country's low-lying coastal regions, the 2050 Indo-Pacific Climate Change Impact Analysis[100] considers Viet Nam at high climate change risk.

Following a substantial shift from a response-based, reactive disaster management paradigm, in recent decades, Viet Nam has made significant advancements in its provision of EWS—now encompassing radar technology, multi-hazard monitoring tools, and specialized hydrometeorological telecommunication networks.

Early Warning Assessment Findings

The assessment found that Viet Nam has made substantial progress in early warning capacity development, with the following notable achievements:

Viet Nam

Progress Towards Advanced Capacity Development

1. Viet Nam has implemented a strong legislative framework that underpins the country's disaster risk reduction activities, including risk assessment. This includes the clear identification of stakeholder roles and responsibilities, policies mandating the preparation of hazard, vulnerability, and capacity assessments for all areas, and the assignment of responsibility for coordinating hazard identification and risk information to one national organization.

2. Functions, roles, and responsibilities of each component in the warning dissemination process are clearly mandated through government policy or legislation at all levels and are included in the standard operating procedures.

3. The assessment noted significant capacity in Viet Nam's cross-border exchange of warnings and observation data realized through bilateral and multilateral agreements.

To further enhance early warning capacity, a number of early warning gaps require attention:

1. Viet Nam has made significant progress in the development of risk assessments and hazard maps. The assessment observed that capacity could be further enhanced through consideration of activities that increase or compound risks (e.g., urbanization, land use, etc.) and the utilization of disability data in assessments.

2. Additional early warning capacity could be built through the establishment of national standards for the systematic collection, sharing, and assessment of risk information and data related to hazards, exposures, vulnerabilities, and capacities, as well as the regular review and update of risk assessments to account for new or emerging vulnerabilities and hazards.

3. The assessment found a lack of capacity in the use of data related to vulnerability and the needs of specific groups in Viet Nam's EWS, including in the identification of evacuation routes and location of temporary shelters and the tailoring of communication and dissemination systems.

4. Viet Nam's advances in hazard monitoring and forecasting systems and services are at risk due to limited consideration of regular maintenance and associated resource allocation requirements of existing hardware and software, as well as limited planning for the upgrade and replacement of these systems and services in the future to incorporate new and emerging technologies.

5. The assessment identified a gap in the coordination between warning partners. This includes a lack of agreements and interagency protocols to ensure consistency of warning language and communication responsibilities, as well as the establishment of regular coordination, planning, and review meetings.

Viet Nam

Progress Towards Advanced Capacity Development

6. The country lacks a robust understanding of communities' abilities to communicate in response to early warnings, necessitating regular assessment and evaluation to ensure such communication is resilient, and to identify gaps for redress.

With limited engagement from Viet Nam stakeholders in this assessment, low confidence is assigned to the assessment findings for the country. It is strongly recommended that further stakeholder engagement be undertaken in advance of any programming or implementation of early warning initiatives.

A detailed breakdown of the ASEAN Member State's assessment can be found in Appendix C.

Early Warning Legislative Framework

Law on Disaster Prevention and Control, Law No. 33/2013/QH13 (LNDPC) and Amending Law No. 60/2020/QH14[101] **—** Comprehensive law on disaster management.

Decree No. 66/2021/ND-CP[102]—Outlines direction for comprehensive disaster management, supporting a coordinated approach to disaster risk management, and detailing roles and responsibilities of key stakeholders.

Decree No. 66/2021/ND-CP Supporting the LNDPC[103]—Details responsibilities of news broadcasting for early warning.

National Strategy for Natural Disaster Prevention and Control to 2030 with a Vision to 2050[104]—Articulates the country's long-term disaster risk reduction goals, including the promotion of proactive initiatives to reduce disaster risk.

Directive No. 42-CT/TW of the Politburo Secretariat on Strengthening the Party's Leadership in Natural Disaster Management[105]—Strengthens leadership on disaster prevention and response.

Prime Minister Decision No. 553/QD-TTg Dated 6 April 2021 Approving the "Project for Community Awareness Raising and Community-Based Natural Disaster Risk Management, with a Vision to 2030"[106] **—** Focuses on educational and community awareness raising activities to reduce disaster risk in communities.

Viet Nam

Progress Towards Advanced Capacity Development

Key Early Warning Stakeholders

National Steering Committee for National Disaster Prevention and Control (NSCNDPC)[107]— Responsible for disaster management policy development and decision-making.

Vietnam Disaster and Dyke Management Authority (VDDMA)[108]—Standing office of the NSCNDPC, under the Ministry of Agriculture and Rural Development (MARD).

Disaster Management Policy and Technology Center (DMPTC)[109]—The result of a merger between the previous Disaster Management Center and the Water Resource Consultant and Technology Transfer Center, responsible for planning and finance, information and database management, policy and science research, training, remote sensing and disaster simulation, material testing and disaster management, and dike safety management.

National Center for Hydro-meteorological Forecasting (NCHMF)[110]**—**Responsible for the forecasting of hydrometeorological hazards, under the Ministry of Natural Resources and the Environment (MONRE).

Vietnam Earthquake Information and Tsunami Warning Center (EITWC)[111]—Under the Institute of Geophysics of the Vietnam Academy of Science, mandated to monitor for geophysical events and disseminate associated warnings to the public, as well as provide public awareness and education on geophysical hazard prevention and preparedness.

[THIS PAGE LEFT BLANK INTENTIONALLY.]

Regional Level

Progress Towards Advanced Capacity Development

While each ASEAN Member State has established its own early warning institutions and frameworks, and each has its own mandate to deliver early warnings to their respective populations, the management of transboundary hazards is supported by several coordinating regional institutions and bodies that play a vital role in augmenting national early warning capabilities. This is achieved through the sharing and disseminating information, provisions of best practices and expert technical guidance, and support for interoperability between EWS. These regional bodies and institutions exist within a well-developed and established regional framework.

Regional-Level Early Warning Assessment Findings

Notable capacity achievements are detailed below:

1. Across regional early warning bodies and agencies, the assessment observed strong organizational and decision-making structures and processes, well grounded in regional early warning frameworks and agreements.
2. Through the network of regional EWS stakeholders, the characteristics of key hazards (e.g., geographical extent, magnitude, intensity, disease transmissibility, frequency, probability), including possible cascading hazardous events, are well understood and characterized to support early warning initiatives and interventions.
3. The ASEAN DMRS system provides valuable multi-hazard early warning information delivery and serves as central standardized repository to store regional hazard event and risk information.
4. The AHA Centre's emergency operations center is staffed by trained personnel following appropriate national and international standards, supporting effective regional coordination for disaster risk monitoring and response.
5. Regional warning messages issued to decision makers are disseminated in a timely manner and provide clear guidance to trigger reactions, supporting effective response to hazard events.

Regional Level

Progress Towards Advanced Capacity Development

6. Regional EWS groups were observed to make extensive use of international and regional best practices, as well as incorporate processes for expert review and assessment of early warning components. Such processes allow for the update and incorporation of the latest technologies and knowledge to enhance early warning capacity across the region.
7. Through the ASEAN Committee on Disaster Management (ACDM) Working Group on Prevention and Mitigation (WG-P&G), strong coordination on risk assessment and early warning has been established, helping ensure the sharing of ASEAN Member States' lessons learned, and providing opportunities for coordination and collaboration on early warning initiatives.

Some regional capacity gaps have been identified during the assessment:

1. Further capacity is required across all regional stakeholders for the incorporation of historical and indigenous knowledge into regional understanding of hazards and risks.
2. Regional data sharing for early warning purposes remains a challenge because of variable data standards and formats utilized across the region, a lack of regional legislation to support the sharing of data, and interoperability limitations between systems where data is held.
3. While individual regional stakeholders undertake curation of their own services and systems, there are no established regional standards for quality controls of monitoring data and metadata, nor continuously monitored for any data gaps, connection issues, or processing issues. Such continuous monitoring is vital for effective, timely, and trusted early warning.
4. There is a need for regional stakeholders to account for the needs of people with different degrees of vulnerability across the ASEAN region in disaster preparedness measures, including plans and standard operating procedures.
5. There remains a paucity of regionally coordinated public awareness strategies and programs, as well as a lack of evaluation of individual stakeholder educational and awareness raising activities to understand their effectiveness or the need for adjustment or correction.
6. Recent tsunami events in Central Sulawesi and the Sunda Strait have highlighted the need for a non-techtonic tsunami monitoring system to help reduce the impact of such events in the future.

For the assessment of regional early warning capacities, the AHA Centre provided valuable insights and information to support the assessment. Extremely limited stakeholder engagement from other regional stakeholders was observed. As a result, the regional assessment results have a very low analysis confidence rating, necessitating further engagement with regional stakeholders.

Regional Level

Progress Towards Advanced Capacity Development

Not all checklist components were relevant to the regional-level assessment of EWS capacity and, therefore, a simplified set of criteria were used to assess regional capacity. A detailed breakdown of the regional-level assessment can be found in Appendix C.

Regional Legislative Framework

ASEAN Socio-Cultural Community Blueprint 2025[112] – Guides the development of sustainable and resilient communities across the ASEAN region.

ASEAN Agreement on Disaster Management and Emergency Response (AADMER) – Legally-binding regional agreement, ratified by all ASEAN Member States, detailing the shared commitment to disaster risk reduction and resilience building. The agreement's strategic components include risk assessment, early warning, and monitoring, as well as other strategic elements.

ASEAN Vision 2025 on Disaster Management – Details the longer-term vision for regional disaster management cooperation.

ASEAN Declaration on Strengthening of Adaptation to Drought[113] – Supports enhanced collaboration between regional stakeholders to reduce drought impacts.

ASEAN Regional Framework on Protection, Gender, and Inclusion in Disaster Management (2021-2025)[114] **–** Conveys the common regional vision for the promotion of protection, gender, and inclusion considerations in disaster management.

Key Regional Early Warning Stakeholders

ASEAN Secretariat[115] – Oversees the day-to-day work of ASEAN.

Disaster Management and Humanitarian Assistance (DMHA) Division of the Secretariat[116] – Mandated to deliver strategic-level coordination for hazard response and recover efforts across ASEAN.

ASEAN Committee on Disaster Management (ACDM)[117] – Responsible for overseeing the implementation of ASEAN Agreement on Disaster Management and Emergency Response (AADMER) and its Work Programs.

ACDM Working Group on Prevention and Mitigation (WG-P&G)[118] – Working group for the fulfillment of the AADMER Work Programme 2021-2025 Priority Program 1 on Risk Assessment and Monitoring, and Priority Program 2 on Prevention and Mitigation.

Regional Level

Progress Towards Advanced Capacity Development

ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management (AHA Centre)[119] – Established to undertake regional disaster monitoring, preparedness and response, and capacity building, as well as to provide coordination during response. The AHA Centre maintains the regional custom version of DisasterAWARE, DMRS, for effective regional hazard monitoring and decision support.

ASEAN Earthquake Information Centre (AEIC)[120] – Managed by Indonesia's BMKG, AEIC provides early dissemination of information on large magnitude earthquakes occurring in the territories of ASEAN countries and provides scientific and technical training for the ASEAN Member States' seismologists.[121]

ASEAN Specialized Meteorological Center (ASMC)[122]—Supports the region's National Meteorological Services (NMS) by undertaking research and development to improve scientific understanding and prediction of weather and climate systems of significance to the region. ASMC also serves as the ASEAN regional center for monitoring and assessment of land/forest fires and haze, including provision of early warning for transboundary haze, as well as conducts regional capability development programs to enable ASEAN NMS to leverage advances in science and technology to support important economic sectors.

The Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (IOTWMS) & Pacific Tsunami Warning and Mitigation System (PTWS)[123]— Part of the United Nations Educational, Scientific and Cultural Organization (UNESCO) Intergovernmental Oceanographic Commission (IOC) Tsunami Program, IOTWMS and PTWS supports Indonesia, Singapore, Thailand, and Viet Nam (along with other IOC ASEAN Member States) in assessing tsunami risk, implementing tsunami EWS.

Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES)[124].—An intergovernmental institution owned and managed by its ASEAN Member States, for building capacities in the generation and application of user-relevant early warning.

APPENDIX B: STAKEHOLDER ENGAGEMENT LIST

Name	Designation	Country	Organization
Siti Joriahati Johari	Disaster Management Officer	Brunei Darussalam	National Disaster Management Centre (NDMC)
Hazimah Hamdani	Disaster Management Officer	Brunei Darussalam	National Disaster Management Centre (NDMC)
Muhammad Sahdan Abdullah Sungkai	Operation Officer, Operational Department	Brunei Darussalam	National Disaster Management Centre (NDMC)
Abu Mansor Al-Maturidi Bin Haji Zabandi	IT Technician, IT Unit	Brunei Darussalam	National Disaster Management Centre (NDMC)
Siti Joriahati Johari	Disaster Management Officer	Brunei Darussalam	National Disaster Management Centre (NDMC)
Afiq Aiman bin Jaya	Geologist	Brunei Darussalam	Geotechnical & Geological Section, Department of Technical Services, Public Works Department
Muhammad Asri Akmal bin Haji Suhip	Geologist	Brunei Darussalam	Department of Technical Services (DTS), Public Works Department, Ministry of Development
Farahanah binti Haji Abd Wahab	Executive Engineer	Brunei Darussalam	Department of Drainage and Sewerage (DDS), Public Works Department, Ministry of Development (PWD)
Marzeti binti Haji Mahadi	Meteorological Officer	Brunei Darussalam	Brunei Darussalam Meteorological Department
Shahrin Jawie	Acting Director	Brunei Darussalam	National Disaster Management Centre
Soem Pisey	Director of Disaster Information Management Department	Cambodia	National Committee for Disaster Management (NCDM)
Sam Poeu	Deputy-Director of Disaster Information Management Department	Cambodia	National Committee for Disaster Management (NCDM)
Thearith Thivuth	Bureau Chief of Information Technology, Disaster Information Management Department	Cambodia	National Committee for Disaster Management (NCDM)
H.E. Prak Kimhong	Deputy Secretary-General	Cambodia	National Committee for Disaster Management (NCDM)
Clare Conan	Country Director	Cambodia	World Food Programme (WFP)
Chanmoniroth Iv	Programme Policy Officer-EPR	Cambodia	World Food Programme (WFP)
Jan Ciupa	Cambodia Desk Officer	Cambodia	People in Need (PIN)
Ms. Linda Lestari	Associate Planner, Directorate of Early Warning,	Indonesia	Badan Nasional Penanggulangan Bencana (BNPB)

(Appendix B: Stakeholder Engagement List Continued...)

Name	Designation	Country	Organization
Dr. Raditya Jati	Deputy Minister of System and Strategy	Indonesia	Badan Nasional Penanggulangan Bencana (BNPB)
Bambang Surya Putra	Head of Emergency Operations Centre	Indonesia	Badan Nasional Penanggulangan Bencana (BNPB)
Jarot Widoyoko	DG for Water Resource Management	Indonesia	Ministry of Public Works and Public Housing
Devy Kamil Syahbana	Head of Eastern Indonesia Volcanic Disaster Mitigation Group	Indonesia	Ministry of Energy and Mineral Resources Center for Volcanology and Geological Hazard Mitigation
Dr. Ida Pramuwardani	-	Indonesia	Meteorology, Climatology, and Geophysics Agency (BMKG)
Dr. Agie Wandala Putra	-	Indonesia	Meteorology, Climatology, and Geophysics Agency (BMKG)
Dr. Supari	Coordinator	Indonesia	Meteorology, Climatology, and Geophysics Agency (BMKG)
Adi Ripaldi	Sub Coordinator	Indonesia	Meteorology, Climatology, and Geophysics Agency (BMKG)
Ir. R. Basar Manullang, M.M.	Directorate of Forest and Land Fire Control	Indonesia	Ministry of Environment and Forestry (for MHEWS related to Wildfire)
Bayu Pranata	Climate Early Warning Division	Indonesia	Meteorology, Climatology, and Geophysics Agency (BMKG)
Stella Mariska Yuncie	Disaster Analyst	Indonesia	Badan Nasional Penanggulangan Bencana (BNPB)
Phonesavanh Saysompheng	Director of Disaster Prevention Division	Lao PDR	National Disaster Management Office (NDMO)
Phonethavy Thammavongso	Technical Officer of Disaster Prevention Division	Lao PDR	National Disaster Management Office (NDMO)
Vilaykham Lathsaarth	Deputy Director of Disaster Control and Recovery Division	Lao PDR	National Disaster Management Office (NDMO)
Soupha Phommavanhthong	Deputy Director of DCR Division	Lao PDR	National Disaster Management Office (NDMO)
Sombath Douangsavanh	Deputy Director of Disaster Preparedness and Response Division	Lao PDR	National Disaster Management Office (NDMO)
Ms. Akhom Thamalangsy	Officer	Lao PDR	Department of Meteorology and Hydrology (DMH)
Ms. Phetsamone Sone	Deputy Head of LSB	Lao PDR	Lao Statistics Bureau
Mr. Latsamee Panyathong	Deputy Chief Division	Lao PDR	Lao Statistics Bureau
Mr. Phinthong Phoommalath	Senior Officer	Lao PDR	Lao Statistics Bureau

(Appendix B: Stakeholder Engagement List Continued...)

Name	Designation	Country	Organization
Nazaruddin bin Sharaai	Director of National Disaster Command Centre	Malaysia	National Disaster Management Agency (NADMA)
Li Ze Hui	Deputy Director General (Operational)	Malaysia	Malaysian Meteorological Department
Ir. Dr. Salwa binti Ramly	Senior Principal Assistant Director	Malaysia	Department of Irrigation and Drainage
Syed bin Omar	Geologist	Malaysia	Minerals and Geoscience Department
Mrs. Zurriyati	Information required	Malaysia	National Disaster Management Agency (NADMA)
Dr. Min Thein	Deputy Director General	Myanmar	Department of Disaster Management (DDM)
Mr. Win Htein Kyaw	Director	Myanmar	Department of Disaster Management (DDM)
Thiri Maung	Director	Myanmar	Department of Disaster Management (DDM)
Tin Mar Htay	Assistant Director	Myanmar	Department of Disaster Management (DDM)
Than Naing Soe	Deputy Director	Myanmar	Department of Disaster Management (DDM)
Dr. Tin Mar Htay	Deputy Director, Meteorological Matters	Myanmar	Department of Meteorology and Hydrology (DMH)
Kyaw Kyaw Lin	Deputy Director, Hydrological Matters	Myanmar	Department of Meteorology and Hydrology (DMH)
Dr. Yin Myo Min Htwe	Deputy Director, Earthquake Matters	Myanmar	Department of Meteorology and Hydrology (DMH)
Zin Min Tun	Information required	Myanmar	Myanmar Information Management Unit (MIMU) UNDP
Paolo Jonas Alan	Information Systems Analyst II	Philippines	Office of Civil Defense (OCD)
Deniece Krizia Ballesteros Manding	Civil Defense Officer III	Philippines	NDRRM Operations Center, Office of Civil Defense (OCD)
Sec Renato U Solidum Jr	Secretary	Philippines	Department of Science and Technology (DOST)
Bhernard Bhe Escala	Civil Defense Officer II, Philippines	Philippines	Office of Civil Defense (OCD)
Vicente Malano	Administrator	Philippines	Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)
Dr. Esperanza O. Cayanan	Civil Defense Officer II	Philippines	Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)

(Appendix B: Stakeholder Engagement List Continued…)

Name	Designation	Country	Organization
Teresito Bacolcol	Officer in Charge	Philippines	Philippine Institute of Volcanology and Seismology (Phivolcs)
Roy Albert Kaimo	Project Chief Technical Specialist	Philippines	Philippine Institute of Volcanology and Seismology (Phivolcs)
Pauline Pagaduan	Project Technical Senior Specialist	Philippines	Philippine Institute of Volcanology and Seismology (Phivolcs)
Antonia Yulo-Loyzaga	Secretary	Philippines	Department of Environment and Natural
Robert E A Borje	Secretary	Philippines	Climate Change Commission
Joel Joseph S Marciano Jr	Director General	Philippines	Philippine Space Agency
Lorenzo A. Moron	Assistant Weather Services Chief	Philippines	Philippine Atmospheric, Geophysical and Astronomical Services
Roy Albert Kaimo	Project Chief Technical Specialist	Philippines	Philippine Institute of Volcanology & Seismology - Dynaslope Project
Ariel C. Blanco	Director, Space Information Infrastructure Bureau	Philippines	Philippine Space Agency
Roel M. de la Cruz		Philippines	Philippine Space Agency
Kenneth Menor	Civil Defense Officer III	Philippines	Office of Civil Defense (OCD)
Atty. Analiza Rebuelta-Teh	Undersecretary for Finance, Information Systems, and Climate Change	Philippines	Department of Environment and Natural Resources
Bernard Punzalan II	International Science Relations Officer III	Philippines	Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)
Sophia A. Manzano	Development Management Officer II	Philippines	Climate Change Commission
Edrick Lim	SSO International Relations	Singapore	Singapore Civil Defense Force (SCDF)
Zulkifli Bin Abdullah	SSO Regulatory & Compliance Informatics	Singapore	Technology Department, Singapore Civil Defense Force (SCDF)
Liu Yongqiang	Head Plans	Singapore	Changi Regional HADR Coordination Centre (RHCC)
Goh Wee Poh	Forecast Operations Department, Weather Services Division	Singapore	Meteorological Service Singapore (MSS)
Wee Leng TAN	Research Scientist	Singapore	Meteorological Service Singapore (MSS)
Public contact	Public contact	Singapore	Institute of Catastrophe Risk Management (ICRM)

(Appendix B: Stakeholder Engagement List Continued...)

Name	Designation	Country	Organization
Public contact	Public contact	Singapore	Earth Observatory of Singapore (EOS)
Eugene Chong	Senior Meteorologist	Singapore	ASEAN Specialised Meteorological Centre
Matthew Goh	SSO Operations Development	Singapore	Singapore Civil Defense Force (SCDF)
Chatchadaporn Boonpiranat	Deputy Director-General	Thailand	Department of Disaster Prevention and Mitigation (DDPM)
Air Chief Marshal Somnuk Sawattuek	Specialist in communication and information for early warning	Thailand	Department of Disaster Prevention and Mitigation (DDPM)
Saharat Wongsakulwiwat	Director of Research and International Cooperation Bureau	Thailand	Department of Disaster Prevention and Mitigation (DDPM)
Sujinphorn Panukan	Plan and Policy Analyst, Senior Professional Level	Thailand	Department of Disaster Prevention and Mitigation (DDPM)
Phisut Wannachatrasiri	Plan and Policy Analyst, Senior Professional Level	Thailand	Department of Disaster Prevention and Mitigation (DDPM)
Mr.Prasarn Sangwaldej	Director of the Earthquake Surveillance Division	Thailand	Thai Meteorological Department (TMD)
Thinnakorn Thathong	Inspector General / Senior Specialist	Thailand	Department of Mineral Resources
Thanyathorn Thonrat	Director of Information and Communication Technology Center	Thailand	Department of Mineral Resources
Bùi Quang Huy	Deputy Director, Disaster Management Policy, and Technology Center	Viet Nam	Vietnam Disaster and Dyke Management Authority (VDDMA)
Trần Trung Kiên	Official, Department of Remote Sensing Technology and Disaster Simulation, Disaster Management Policy, and Technology Center	Viet Nam	Vietnam Disaster and Dyke Management Authority (VDDMA)
Nguyễn Minh Thái	Official, Department of Science, Technology, and International Cooperation	Viet Nam	Vietnam Disaster and Dyke Management Authority (VDDMA)
Sithu Pe Thein	Director Of Operations	Regional	ASEAN Coordinating Centre for Humanitarian Assistance on disaster management (AHA Centre)
Lawrence Dimailig	ADR of Disaster Monitoring Unit	Regional	ASEAN Coordinating Centre for Humanitarian Assistance on disaster management (AHA Centre)
Dr. Thea Turkington	Information required	Regional	ASEAN Specialised Meteorological Centre (ASMC)
Eugene Chong	Senior Meteorologist	Regional	ASEAN Specialised Meteorological Centre (ASMC)

(Appendix B: Stakeholder Engagement List Continued...)

Name	Designation	Country	Organization
Public Contact		Regional	ASEAN Earthquake Information Center - BMKG
Mr. Sopheak	Information Required	Regional	Mekong River Commission (MRC)
Public Contact		Regional	Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES)
Public Contact		Regional	The Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS)
Sadhu Zukhruf Janottama	Disaster Monitoring and Analysis Officer	Regional	ASEAN Coordinating Centre for Humanitarian Assistance on disaster management (AHA Centre)

APPENDIX C: RAW DATA SCORE SHEETS

Brunei

Summary

Thematic Area	Original Desk Study Score	Revised Score Based on FGD	Final Score
A. Disaster Risk Knowledge			
A.1 Are key hazards and related threats identified?	5.0	3.0	3.0
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?	4.7	1.5	1.5
A.3 Are roles and responsibilities of stakeholders identified?	5.0	4.0	4.0
A.4 Is risk information consolidated?	4.5	2.3	2.3
A.5 Is risk information properly incorporated into the early warning system?	5.0	1.0	1.0
Thematic Area Score	**4.8**	**2.4**	**2.4**
B. Detection, Monitoring, Analysis			
B.1 Are there monitoring systems in place?	5.0	4.7	2.7
B.2 Are there forecasting and warning services in place?	5.0	4.9	3.5
B.3 Are there institutional mechanisms in place?	5.0	5.0	2.8
Thematic Area Score	**5.0**	**4.9**	**3.0**
C. Warning Dissemination and Communications			
C.1 Are organizational and decision-making processes in place and operational?	5.0	5.0	3.4
C.2 Are communication systems and equipment in place and operational?	4.4	4.3	2.5
C.3 Are impact-based early warning communicated effectively to prompt action by target groups?	5.0	3.7	1.5
Thematic Area Score	**4.8**	**4.3**	**2.5**
D. Preparedness and Response			
D.1 Are disaster preparedness measures, including response plans, developed and operational?	5.0	5.0	2.0
D.2 Are public awareness and education campaigns conducted?	5.0	5.0	2.0
D.3 Is public awareness and response tested and evaluated?	5.0	5.0	2.0
Thematic Area Score	**5.0**	**5.0**	**2.0**

(Appendix C: Raw Data Score Sheets Continued…)
Brunei

Disaster Risk Knowledge

No.	Sub-Element	Desk Study Score	Stakeholder Inputs					SH Score Average	Post-FGD Adjusted Score	Final Score
			BR1	BR2	BR3	BR4	BR5			
A.1 Are key hazards and related threats identified?		**5.0**	**-**	**-**	**-**	**3.5**	**5.0**	**4.3**	**3.0**	**3.0**
A.1.A	Characteristics of key hazards (e.g., geographical extent, magnitude, intensity, disease transmissibility, frequency, probability), including possible cascading hazardous events, are analyzed, historical data evaluated, and potential future risks assessed	5	-	-	-	3	5	4.0	3	3
A.1.2	Hazard maps (dynamic and multi-hazard, when possible) are developed that identify the geographical areas/people that could be affected by hazards	5	-	-	-	4	5	4.5	3	3
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?		**4.7**	**2.0**	**5.0**	**4.0**	**2.7**	**3.7**	**3.3**	**1.5**	**1.5**
A.2.1	Assessment and quantification of exposed people, services (e.g., hospitals) and critical infrastructure (e.g., electricity and water works, quality of building stock) conducted and mapped for all relevant hazards, as well as of any compounding risks, at local level in both rural and urban areas and coastlines	5	-	-	-	2	4	3.0	2	2
A.2.2	Impacts to critical infrastructure and secondary risks associated with these impacts are evaluated, and risk management solutions considered to increase resilience	5	-	-	-			-	1	1
A.2.3	Vulnerability factors such as gender, disability, access to infrastructure, economic diversity, societal inequalities, and environmental sensitivities considered	3	-	-	-	2	3	2.5	1	1
A.2.4	Vulnerabilities of key economic sectors at national to local levels assessed	5	-	-	-	-	-	-	3	3
A.2.5	Historical and indigenous knowledge integrated into risk assessments	5	-	-	-	4	4	4.0	-	-
A.2.6	Activities that increase or compound risks (e.g., urbanization and land use) identified and evaluated	5	-	-	-	-	-	-	1	1
A.2.7	Risk assessment results integrated into local risk management plans and warning messages in a clear and easy-to-understand language with attention to how different people assess information	-	2	5	4			3.7	1	1
A.2.8	Legislation and cultural norms assessed to identify gaps that may increase vulnerability	-	-	-	-			-	-	-
A.3 Are roles and responsibilities of stakeholders identified?		**5.0**	**-**	**-**	**-**	**2.0**	**3.0**	**2.5**	**4.0**	**4.0**
A.3.1	Key national government agencies involved in risk assessments (including hazard, vulnerability, and capacity assessments) are identified and roles defined	5	-	-	-	-	-	-	5	5
A.3.2	Legislation or government policy mandating the preparation of hazard, vulnerability and capacity assessments for all areas are in place	5	-	-	-	-	-	-	5	5
A.3.3	Responsibility for coordinating hazard identification and risk information (exposure, social and physical vulnerability, and capacity) assigned to one national organization with a view to consolidating approaches and monitoring linkages and cascading impacts	5	-	-	-	-	-	-	5	5
A.3.4	Process developed for scientific and technical experts to assess and review the accuracy of risk data and information	5	-	-	-	2	3	2.5	3	3
A.3.5	Process developed to actively engage rural and urban communities in local hazard and risk assessments taking into consideration the needs of all people (women, children, older people, people with disabilities, etc.)	5	-	-	-	-	-	-	2	2
A.4 Is risk information consolidated?		**4.5**	**1.0**	**4.0**	**4.0**	**2.5**	**4.0**	**3.0**	**2.3**	**2.3**
A.4.1	Central standardized repository (including but not limited to a Geographic Information System) established to store all event/disaster and risk information	5	-	-	-	-	-	-	2	2
A.4.2	National standards (where possible, following international standards) established for the systematic collection, sharing and assessment of risk information and data related to hazards, exposures, vulnerabilities, and capacities	5	-	-	-	1	4	2.5	2	2
A.4.3	Standardized vulnerability data and information disaggregated by sex, age, and disability	3	1	4	4	4	4	3.4	3	3
A.4.4	Process established to maintain, regularly review, and update risk data, including information on any new or emerging vulnerabilities and hazards, with roles and responsibilities of stakeholders identified along with appropriate funding	5	-	-	-	-	-	-	2	2
A.5 Is risk information properly incorporated into the early warning system?		**5.0**	**-**	**-**	**-**	**1.0**	**4.0**	**2.5**	**1.0**	**1.0**
A.5.1	Information on the geographical extent of hazards used to define safe areas and evacuation zones	5	-	-	-	-	-	-	1	1
A.5.2	Risk information on vulnerable groups (hazard, exposure, differential vulnerability) used to identify and define evacuation routes and location of temporary shelters	5	-	-	-	-	-	-	-	-
A.5.3	Risk information on different types of assets reviewed to outline procedures to minimize damage or loss of such assets once a warning is issued	5	-	-	-	1	4	2.5	-	-
A.5.4	Process established for continuous update on new or emerging risks (e.g., due to urban expansion or establishment of new settlements) and potential changes to some hazards (due to changes in land use) to update safe areas, evacuation zones and shelters	-	-	-	-	-	-	-	1	1

(Appendix C: Raw Data Score Sheets Continued…)

Brunei

Hazard Detection, Monitoring, Analysis, and Forecasting

No.	Sub-Element	Desk Study Score	Stakeholder Inputs					SH Score Average	Post-FGD Adjusted Score	Final Score
			BR1	BR2	BR3	BR4	BR5			
B.1 Are there monitoring systems in place?		**5.0**	**-**	**-**	**-**	**1.3**	**3.8**	**2.5**	**4.7**	**2.7**
B.1.1	Monitoring network established that monitors hazards that impact the country	5	-	-	-	1	4	2.5	3	3
B.1.2	Measurement parameters and specifications documented for each relevant hazard	5	-	-	-	-	-	-	5	-
B.1.3	Technical equipment, suited to local conditions and circumstances, in place and personnel trained in its use and maintenance	5	-	-	-	1	4	2.5	5	3
B.1.4	Monitoring data received, processed and available in an interoperable format in real time or near real time	5	-	-	-	2	4	3.0	5	2
B.1.5	Monitoring data and metadata routinely curated with quality controls, archived and accessible for verification, research purposes and other applications	5	-	-	-	-	-	-	5	-
B.1.6	Monitoring hardware and software maintenance conducted routinely, and costs and resources considered from the beginning to ensure optimal operation of the system over time	5	-	-	-	1	3	2.0	5	-
B.1.7	The system is able to combine and benefit from new and older technology allowing for exchange of data among countries with different technical capabilities	5	-	-	-	-	-	-	5	-
B.2 Are there forecasting and warning services in place?		**5.0**	**3.0**	**4.0**	**4.0**	**1.8**	**3.5**	**2.9**	**4.9**	**3.5**
B.2.1	Data analysis and processing, modelling, prediction, and warning products generated based on accepted scientific and technical methodologies and disseminated within international standards and protocols	5	3	4	4	1	3	3.0	4	3
B.2.2	New data analysis and processing, modelling, prediction, and warning products can be integrated easily in the system as science and technology evolve	5	-	-	-	-	-	-	5	-
B.2.3	Warning centers are operational at all times (24 hours/day, seven days/week) and staffed by trained personnel following appropriate national and international standards	5	-	-	-	2	3	2.5	5	4
B.2.4	Warning messages are clear, consistent and include risk and impact information and are designed with consideration for linking threat levels to emergency preparedness and response actions	5	-	-	-	-	-	-	5	3
B.2.5	Software and data analysis for the received data updated periodically and to high security standards	5	-	-	-	-	-	-	5	-
B.2.6	The state of the monitoring and data analysis systems continuously monitored for any data gaps, connection issues or processing issues	-	-	-	-	-	-	-	-	-
B.2.7	Warnings generated and disseminated in an efficient and timely manner for each type of hazard	5	-	-	-	3	4	3.5	5	4
B.2.8	Warning system(s) subjected to regular system-wide tests and exercises	5	-	-	-	1	4	2.5	5	-
B.3 Are there institutional mechanisms in place?		**5.0**	**-**	**-**	**-**	**2.3**	**4.0**	**3.2**	**5.0**	**2.8**
B.3.1	Plans and documents for monitoring networks available and agreed upon with experts and relevant authorities	5	-	-	-	2	4	3.0	5	3
B.3.2	Agreements and interagency protocols established within country for exchange of monitoring systems data and baseline data needed for certain data products (e.g., bathymetric, and topographic data for tsunami modelling)	5	-	-	-	-	-	-	5	2
B.3.3	Agreements and interagency protocols established to ensure consistency of warning language and communication responsibilities where different hazards are handled by different agencies	5	-	-	-	-	-	-	5	2
B.3.4	A multi-hazard coordination strategy established to obtain mutual efficiencies and effectiveness among different warning systems	5	-	-	-	-	-	-	5	2
B.3.5	Warning system partners, including local authorities and the media, are aware of and respect which organizations are responsible for generation and issuance of warnings	5	-	-	-	4	4	4.0	5	-
B.3.6	Cross-border exchange of warnings and observation data realized through bilateral/ multilateral agreements, especially for concerns such as tropical cyclones, floods, diseases, shared basins, data exchange, and technical capacity-building	5	-	-	-	1	4	2.5	5	5

(Appendix C: Raw Data Score Sheets Continued…)

Brunei

Warning Dissemination and Communication

No.	Sub-Element	Desk Study Score	Stakeholder Inputs					SH Score Average	Post-FGD Adjusted Score	Final Score
			BR1	BR2	BR3	BR4	BR5			
B.1 Are there monitoring systems in place?		**5.0**	**-**	**-**	**-**	**1.3**	**3.8**	**2.5**	**4.7**	**2.7**
B.1.1	Monitoring network established that monitors hazards that impact the country	5	-	-	-	1	4	2.5	3	3
B.1.2	Measurement parameters and specifications documented for each relevant hazard	5	-	-	-	-	-	-	5	-
B.1.3	Technical equipment, suited to local conditions and circumstances, in place and personnel trained in its use and maintenance	5	-	-	-	1	4	2.5	5	3
B.1.4	Monitoring data received, processed and available in an interoperable format in real time or near real time	5	-	-	-	2	4	3.0	5	2
B.1.5	Monitoring data and metadata routinely curated with quality controls, archived and accessible for verification, research purposes and other applications	5	-	-	-	-	-	-	5	-
B.1.6	Monitoring hardware and software maintenance conducted routinely, and costs and resources considered from the beginning to ensure optimal operation of the system over time	5	-	-	-	1	3	2.0	5	-
B.1.7	The system is able to combine and benefit from new and older technology allowing for exchange of data among countries with different technical capabilities	5	-	-	-	-	-	-	5	-
B.2 Are there forecasting and warning services in place?		**5.0**	**3.0**	**4.0**	**4.0**	**1.8**	**3.5**	**2.9**	**4.9**	**3.5**
B.2.1	Data analysis and processing, modelling, prediction, and warning products generated based on accepted scientific and technical methodologies and disseminated within international standards and protocols	5	3	4	4	1	3	3.0	4	3
B.2.2	New data analysis and processing, modelling, prediction, and warning products can be integrated easily in the system as science and technology evolve	5	-	-	-	-	-	-	5	-
B.2.3	Warning centers are operational at all times (24 hours/day, seven days/week) and staffed by trained personnel following appropriate national and international standards	5	-	-	-	2	3	2.5	5	4
B.2.4	Warning messages are clear, consistent and include risk and impact information and are designed with consideration for linking threat levels to emergency preparedness and response actions	5	-	-	-	-	-	-	5	3
B.2.5	Software and data analysis for the received data updated periodically and to high security standards	5	-	-	-	-	-	-	5	-
B.2.6	The state of the monitoring and data analysis systems continuously monitored for any data gaps, connection issues or processing issues	-	-	-	-	-	-	-	-	-
B.2.7	Warnings generated and disseminated in an efficient and timely manner for each type of hazard	5	-	-	-	3	4	3.5	5	4
B.2.8	Warning system(s) subjected to regular system-wide tests and exercises	5	-	-	-	1	4	2.5	5	-
B.3 Are there institutional mechanisms in place?		**5.0**	**-**	**-**	**-**	**2.3**	**4.0**	**3.2**	**5.0**	**2.8**
B.3.1	Plans and documents for monitoring networks available and agreed upon with experts and relevant authorities	5	-	-	-	2	4	3.0	5	3
B.3.2	Agreements and interagency protocols established within country for exchange of monitoring systems data and baseline data needed for certain data products (e.g., bathymetric, and topographic data for tsunami modelling)	5	-	-	-	-	-	-	5	2
B.3.3	Agreements and interagency protocols established to ensure consistency of warning language and communication responsibilities where different hazards are handled by different agencies	5	-	-	-	-	-	-	5	2
B.3.4	A multi-hazard coordination strategy established to obtain mutual efficiencies and effectiveness among different warning systems	5	-	-	-	-	-	-	5	2
B.3.5	Warning system partners, including local authorities and the media, are aware of and respect which organizations are responsible for generation and issuance of warnings	5	-	-	-	4	4	4.0	5	-
B.3.6	Cross-border exchange of warnings and observation data realized through bilateral/ multilateral agreements, especially for concerns such as tropical cyclones, floods, diseases, shared basins, data exchange, and technical capacity-building	5	-	-	-	1	4	2.5	5	5

(Appendix C: Raw Data Score Sheets Continued...)

Brunei

Preparedness and Response Capabilities

No.	Sub-Element	Desk Study Score	Stakeholder Inputs					SH Score Average	Post-FGD Adjusted Score	Final Score
			BR1	BR2	BR3	BR4	BR5			
D.1 Are disaster preparedness measures, including response plans, developed and operational?		**5.0**	**2.0**	**3.0**	**4.0**	**2.8**	**4.0**	**2.6**	**5.0**	**2.0**
D.1.1	Disaster preparedness, including plans or standard operating procedures, developed in a participatory manner, disseminated to the community, practiced, and underpinned by legislation where appropriate	5	-	-	-	3	4	3.5	5	3
D.1.2	Disaster preparedness measures, including plans and standard operating procedures, account for the needs of people with different degrees of vulnerability	5	-	-	-	-	-	-	5	1
D.1.3	Multi-hazard risk assessments utilized to develop and design evacuation strategies (evacuation routes, demarcation of safe areas and location of temporary shelters, use of vertical evacuation if needed)	5	-	-	-	3	-	3.0	5	1
D.1.4	Community's ability to communicate in response to early warnings assessed	5	2	3	4	4	-	3.3	5	-
D.1.5	Contingency planning developed in a scenario-based manner following forecasts or likely scenarios across different timescales and informed by climate projections and scientific research	-	2	3	-	-	-	2.5	-	-
D.1.6	Early action and response options across time and geographical scales are linked to the provision of funding to support them	-	2	3	-	-	-	2.5	-	-
D.1.7	Strategies implemented to maintain preparedness for longer return-periods and cascading hazard events	5	-	-	-	-	-	-	5	-
D.1.8	Protocols incorporated in the plans or standard operating procedures to reach emergency and health services that need to be ready to respond to events promptly	5	-	-	-	-	-	-	5	-
D.1.9	Protocols established to activate and mobilize last-mile operators (e.g., local police, firefighters, volunteers, health services) who disseminate warnings to the public and decide public measures, including issuing orders for evacuation or sheltering in place	5	-	-	-	1	-	1.0	5	3
D.1.10	Regular exercises undertaken to test and optimize the effectiveness of early warning dissemination processes, preparedness, and response to warning	5	-	-	-	-	-	-	5	-
D.2 Are public awareness and education campaigns conducted?		**5.0**	**1.0**	**5.0**	**4.0**	**1.3**	**3.7**	**2.7**	**5.0**	**2.0**
D.2.1	Ongoing public awareness and education programmes on hazards that could impact the population, vulnerabilities, exposure and how to reduce disaster impacts built into school curricula from primary through university	-	1	5	4	1	4	3.0	-	2
D.2.2	Public education provided to recognize hydro-meteorological and geophysical hazard signals and disease signs and symptoms in order to contribute to community surveillance and to allow and promote robust no-regret response measures	5	-	-	-	1	4	2.5	5	2
D.2.3	People educated on how warnings will be disseminated, which sources are reliable and how to respond	5	-	-	-	-	-	-	5	2
D.2.4	Utilization of the most effective media (e.g., established broadcasting media, social networks, alternative media) to improve public awareness	5	-	-	-	2	3	2.5	5	3
D.2.5	Public awareness and education campaigns tailored to the specific needs of vulnerable groups (e.g., women, children, older people, and people with disabilities)	5	-	-	-			-	5	1
D.3 Is public awareness and response tested and evaluated?		**5.0**	**1.0**	**4.0**	**4.0**	**4.0**	**4.0**	**3.4**	**5.0**	**2.0**
D.3.1	Previous emergency and disaster events and responses analyzed, and lessons learned incorporated into preparedness and response plans and into capacity-building strategies	5	1	4	4	4	4	3.4	5	2
D.3.2	Public awareness strategies and programmes evaluated regularly and updated as required	5	-	-	-	-	-	-	5	-

(Appendix C: Raw Data Score Sheets Continued...)
Cambodia

Summary

Thematic Area	Desk Study Score	Revised Score Based on FGD	Final Score
A. Disaster Risk Knowledge			
A.1 Are key hazards and related threats identified?	2.5	3.0	3.0
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?	3.0	3.1	3.1
A.3 Are roles and responsibilities of stakeholders identified?	4.0	3.8	3.8
A.4 Is risk information consolidated?	2.0	3.3	3.3
A.5 Is risk information properly incorporated into the early warning system?	-	3.0	3.0
Thematic Area Score	**2.9**	**3.2**	**3.2**
B. Detection, Monitoring, Analysis			
B.1 Are there monitoring systems in place?	4.3	3.8	3.8
B.2 Are there forecasting and warning services in place?	4.2	3.5	3.5
B.3 Are there institutional mechanisms in place?	4.3	3.5	3.5
Thematic Area Score	**4.3**	**3.6**	**3.6**
C. Warning Dissemination and Communications			
C.1 Are organizational and decision-making processes in place and operational?	4.0	2.8	2.8
C.2 Are communication systems and equipment in place and operational?	4.3	3.1	3.1
C.3 Are impact-based early warning communicated effectively to prompt action by target groups?	4.0	3.7	3.7
Thematic Area Score	**4.1**	**3.2**	**3.2**
D. Preparedness and Response			
D.1 Are disaster preparedness measures, including response plans, developed and operational?	3.3	3.3	3.3
D.2 Are public awareness and education campaigns conducted?	3.8	3.6	3.6
D.3 Is public awareness and response tested and evaluated?	3.0	3.0	3.0
Thematic Area Score	**3.4**	**3.3**	**3.3**

(Appendix C: Raw Data Score Sheets Continued…)
Cambodia

Disaster Risk Knowledge

No.	Sub-Element	Desk Study Score	Stakeholder Inputs		SH Score Average	Post-FGD Adjusted Score	Final Score
			CA1	CA2			
A.1 Are key hazards and related threats identified?		**2.5**	**5.0**	**FALSE**	**5.0**	**3.0**	**3.0**
A.1.A	Characteristics of key hazards (e.g., geographical extent, magnitude, intensity, disease transmissibility, frequency, probability), including possible cascading hazardous events, are analyzed, historical data evaluated, and potential future risks assessed	3			-	3.0	3
A.1.2	Hazard maps (dynamic and multi-hazard, when possible) are developed that identify the geographical areas/people that could be affected by hazards	2	5		5.0	3.0	3
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?		**3.0**	**4.3**	**2.5**	**3.7**	**3.1**	**3.1**
A.2.1	Assessment and quantification of exposed people, services (e.g., hospitals) and critical infrastructure (e.g., electricity and water works, quality of building stock) conducted and mapped for all relevant hazards, as well as of any compounding risks, at local level in both rural and urban areas and coastlines	3			-	3.0	3
A.2.2	Impacts to critical infrastructure and secondary risks associated with these impacts are evaluated, and risk management solutions considered to increase resilience	-	-		-	3.0	3
A.2.3	Vulnerability factors such as gender, disability, access to infrastructure, economic diversity, societal inequalities, and environmental sensitivities considered	3	5	3	4.0	3.0	3
A.2.4	Vulnerabilities of key economic sectors at national to local levels assessed	3	-		-	3.0	3
A.2.5	Historical and indigenous knowledge integrated into risk assessments	-	4		4.0	4.0	4
A.2.6	Activities that increase or compound risks (e.g., urbanization and land use) identified and evaluated	-	-		-	3.0	3
A.2.7	Risk assessment results integrated into local risk management plans and warning messages in a clear and easy-to-understand language with attention to how different people assess information	-	4	2	3.0	3.0	3
A.2.8	Legislation and cultural norms assessed to identify gaps that may increase vulnerability	-	-		-	-	-
A.3 Are roles and responsibilities of stakeholders identified?		**4.0**	**FALSE**	**FALSE**	**FALSE**	**3.8**	**3.8**
A.3.1	Key national government agencies involved in risk assessments (including hazard, vulnerability, and capacity assessments) are identified and roles defined	5			-	5.0	5
A.3.2	Legislation or government policy mandating the preparation of hazard, vulnerability and capacity assessments for all areas are in place	4			-	4.0	4
A.3.3	Responsibility for coordinating hazard identification and risk information (exposure, social and physical vulnerability, and capacity) assigned to one national organization with a view to consolidating approaches and monitoring linkages and cascading impacts	5			-	4.0	4
A.3.4	Process developed for scientific and technical experts to assess and review the accuracy of risk data and information	3			-	3.0	3
A.3.5	Process developed to actively engage rural and urban communities in local hazard and risk assessments taking into consideration the needs of all people (women, children, older people, people with disabilities, etc.)	3			-	3.0	3
A.4 Is risk information consolidated?		**2.0**	**4.7**	**2.0**	**4.3**	**3.3**	**3.3**
A.4.1	Central standardized repository (including but not limited to a Geographic Information System) established to store all event/disaster and risk information	-	-		-	3.0	3
A.4.2	National standards (where possible, following international standards) established for the systematic collection, sharing and assessment of risk information and data related to hazards, exposures, vulnerabilities, and capacities	-	5		5.0	3.0	3
A.4.3	Standardized vulnerability data and information disaggregated by sex, age, and disability	-	4	2	3.0	3.0	3
A.4.4	Process established to maintain, regularly review, and update risk data, including information on any new or emerging vulnerabilities and hazards, with roles and responsibilities of stakeholders identified along with appropriate funding	2	5		5.0	4.0	4
A.5 Is risk information properly incorporated into the early warning system?		**FALSE**	**3.0**	**FALSE**	**3.0**	**3.0**	**3.0**
A.5.1	Information on the geographical extent of hazards used to define safe areas and evacuation zones	-	-		-	3.0	3
A.5.2	Risk information on vulnerable groups (hazard, exposure, differential vulnerability) used to identify and define evacuation routes and location of temporary shelters	-	-		-	3.0	3
A.5.3	Risk information on different types of assets reviewed to outline procedures to minimize damage or loss of such assets once a warning is issued	-	3		3.0	3.0	3
A.5.4	Process established for continuous update on new or emerging risks (e.g., due to urban expansion or establishment of new settlements) and potential changes to some hazards (due to changes in land use) to update safe areas, evacuation zones and shelters	-	-		-	3.0	3

(Appendix C: Raw Data Score Sheets Continued…)
Cambodia

Hazard Detection, Monitoring, Analysis, and Forecasting

No.	Sub-Element	Desk Study Score	Stakeholder Inputs		SH Score Average	Post-FGD Adjusted Score	Final Score
			CA1	CA2			
B.1 Are there monitoring systems in place?		**4.3**	**3.7**	**-**	**3.7**	**3.8**	**3.8**
B.1.1	Monitoring network established that monitors hazards that impact the country	5			-	4.0	4
B.1.2	Measurement parameters and specifications documented for each relevant hazard	-	-		-	-	-
B.1.3	Technical equipment, suited to local conditions and circumstances, in place and personnel trained in its use and maintenance	4	3		3.0	4.0	4
B.1.4	Monitoring data received, processed and available in an interoperable format in real time or near real time	4			-	4.0	4
B.1.5	Monitoring data and metadata routinely curated with quality controls, archived and accessible for verification, research purposes and other applications	-	4		4.0	3.0	3
B.1.6	Monitoring hardware and software maintenance conducted routinely, and costs and resources considered from the beginning to ensure optimal operation of the system over time	-	4		4.0	4.0	4
B.1.7	The system is able to combine and benefit from new and older technology allowing for exchange of data among countries with different technical capabilities	4			-	-	-
B.2 Are there forecasting and warning services in place?		**4.2**	**4.5**	**-**	**4.5**	**3.5**	**3.5**
B.2.1	Data analysis and processing, modelling, prediction, and warning products generated based on accepted scientific and technical methodologies and disseminated within international standards and protocols	5			-	4.0	4
B.2.2	New data analysis and processing, modelling, prediction, and warning products can be integrated easily in the system as science and technology evolve	3			-	3.0	3
B.2.3	Warning centers are operational at all times (24 hours/day, seven days/week) and staffed by trained personnel following appropriate national and international standards	4			-	4.0	4
B.2.4	Warning messages are clear, consistent and include risk and impact information and are designed with consideration for linking threat levels to emergency preparedness and response actions	5			-	4.0	4
B.2.5	Software and data analysis for the received data updated periodically and to high security standards	-	-		-	3.0	3
B.2.6	The state of the monitoring and data analysis systems continuously monitored for any data gaps, connection issues or processing issues	-	4		4.0	3.0	3
B.2.7	Warnings generated and disseminated in an efficient and timely manner for each type of hazard	4			-	4.0	4
B.2.8	Warning system(s) subjected to regular system-wide tests and exercises	-	5		5.0	3.0	3
B.3 Are there institutional mechanisms in place?		**4.3**	**-**	**-**	**-**	**3.5**	**3.5**
B.3.1	Plans and documents for monitoring networks available and agreed upon with experts and relevant authorities	4			-	4.0	4
B.3.2	Agreements and interagency protocols established within country for exchange of monitoring systems data and baseline data needed for certain data products (e.g., bathymetric, and topographic data for tsunami modelling)	-	-		-	3.0	3
B.3.3	Agreements and interagency protocols established to ensure consistency of warning language and communication responsibilities where different hazards are handled by different agencies	4			-	2.0	2
B.3.4	A multi-hazard coordination strategy established to obtain mutual efficiencies and effectiveness among different warning systems	-	-		-	3.0	3
B.3.5	Warning system partners, including local authorities and the media, are aware of and respect which organizations are responsible for generation and issuance of warnings	5			-	5.0	5
B.3.6	Cross-border exchange of warnings and observation data realized through bilateral/ multilateral agreements, especially for concerns such as tropical cyclones, floods, diseases, shared basins, data exchange, and technical capacity-building		-		-	4.0	4

(Appendix C: Raw Data Score Sheets Continued…)

Cambodia

Warning Dissemination and Communication

No.	Sub-Element	Desk Study Score	Stakeholder Inputs		SH Score Average	Post-FGD Adjusted Score	Final Score
			CA1	CA2			
C.1 Are organizational and decision-making processes in place and operational?		**4.0**	**3.5**	**1.8**	**2.1**	**2.8**	**2.8**
C.1.1	Functions, roles, and responsibilities of each actor in the warning dissemination process enforced through government policy or legislation at all levels and included in the standard operating procedures	5			-	3.0	3
C.1.2	Warning communication strategies at the national, subnational, and local levels in place that ensure coordination across warning issuers and dissemination channels	4			-	2.0	2
C.1.3	Regular coordination, planning and review meetings between the warning issuers, the media, and other stakeholders	-	4	2	3.0	3.0	3
C.1.4	Professional and volunteer networks established to receive and disseminate warnings widely	3	3	2	2.5	3.0	3
C.1.5	Feedback mechanisms in place to verify that warnings have been received and to correct potential failures in dissemination and communication	4		1	1.0	3.0	3
C.1.6	Mechanisms to update the information are in place and are resilient to the event	4		2	2.0	3.0	3
C.2 Are communication systems and equipment in place and operational?		**4.3**	**2.6**	**2.3**	**2.5**	**3.1**	**3.1**
C.2.1	Communication and dissemination systems tailored to the different needs of specific groups (urban and rural populations, women and men, older people and youth, people with disabilities, etc.)	4	2	2	2.0	3.0	3
C.2.2	Understanding of last-mile connectivity to know which population groups can be reached by different services, including mobile-cellular, satellite and radio services	4			-	3.0	3
C.2.3	Warning communication and dissemination systems reach the entire population, including seasonal populations and those in remote locations, through multiple communication channels (e.g., satellite and mobile-cellular networks, social media, flags, sirens, bells, public address systems, door-to-door visits, community meetings)	4			-	3.0	3
C.2.4	Communication strategies evaluated to ensure messages are reaching the population	-	2	2	2.0	3.0	3
C.2.5	Agreements developed to utilize private sector resources where appropriate (e.g., mobile-cellular, satellite, television, radio broadcasting, amateur radio, social media) to disseminate warnings	5			-	4.0	4
C.2.6	Equipment maintained and upgraded to utilize new technologies (when appropriate) to ensure interoperability	4	3		3.0	3.0	3
C.2.7	Backup systems and processes in place in the event of failure	-	-		-	-	-
C.2.8	Resilience of communication channels and early warning system hardware evaluated in advance to reduce the impact of events on the infrastructure	-	4	3	3.5	3.0	3
C.2.9	Coverage of communication channels and multiple-channel systems assessed to identify gaps and possible points of failure that may increase vulnerability	5	2	2	2.0	3.0	3
C.3 Are impact-based early warnngs communicated effectively to prompt action by target groups?		**4.0**	**5.0**	**2.0**	**3.5**	**3.7**	**3.7**
C.3.1	Warning messages provide clear guidance to trigger reactions (e.g., evacuation)	4			-	4.0	4
C.3.2	In the case of events with a short timeframe for reaction (e.g., earthquake early warning), automated systems should be in place to mitigate impacts (e.g., automatic stop of transport, activation of red lights in tunnels, stopping elevators on the closest floor, opening of fire-truck gates, etc.)	-	5	2	3.5	-	-
C.3.3	Early warnings should take into account the different risks and needs of subpopulations, including differential vulnerabilities (urban and rural, women and men, older people and youth, people with disabilities, etc.)	4			-	3.0	3
C.3.4	Public and other stakeholders are aware of which authorities issue the warnings and trust their message	4			-	4.0	4

(Appendix C: Raw Data Score Sheets Continued…)

Cambodia

Preparedness and Response Capabilities

No.	Sub-Element	Desk Study Score	Stakeholder Inputs		SH Score Average	Post-FGD Adjusted Score	Final Score
			CA1	CA2			
D.1 Are disaster preparedness measures, including response plans, developed and operational?		**3.3**	**3.3**	**2.1**	**2.7**	**3.3**	**3.3**
D.1.1	Disaster preparedness, including plans or standard operating procedures, developed in a participatory manner, disseminated to the community, practiced, and underpinned by legislation where appropriate	3	3	3	3.0	3.0	3
D.1.2	Disaster preparedness measures, including plans and standard operating procedures, account for the needs of people with different degrees of vulnerability	3			-	3.0	3
D.1.3	Multi-hazard risk assessments utilized to develop and design evacuation strategies (evacuation routes, demarcation of safe areas and location of temporary shelters, use of vertical evacuation if needed)	-	4	1	2.5	3.0	3
D.1.4	Community's ability to communicate in response to early warnings assessed	3	2	2	2.0	3.0	3
D.1.5	Contingency planning developed in a scenario-based manner following forecasts or likely scenarios across different timescales and informed by climate projections and scientific research	3	3	3	3.0	3.0	3
D.1.6	Early action and response options across time and geographical scales are linked to the provision of funding to support them	-	-		-	4.0	4
D.1.7	Strategies implemented to maintain preparedness for longer return-periods and cascading hazard events	4	5	2	3.5	4.0	4
D.1.8	Protocols incorporated in the plans or standard operating procedures to reach emergency and health services that need to be ready to respond to events promptly	4	4	2	3.0	4.0	4
D.1.9	Protocols established to activate and mobilize last-mile operators (e.g., local police, firefighters, volunteers, health services) who disseminate warnings to the public and decide public measures, including issuing orders for evacuation or sheltering in place	-	-		-	3.0	3
D.1.10	Regular exercises undertaken to test and optimize the effectiveness of early warning dissemination processes, preparedness, and response to warning	3	2	2	2.0	3.0	3
D.2 Are public awareness and education campaigns conducted?		**3.8**	**3.5**	**1.0**	**2.3**	**3.6**	**3.6**
D.2.1	Ongoing public awareness and education pro-grammes on hazards that could impact the population, vulnerabilities, exposure and how to reduce disaster impacts built into school curricula from primary through university	3	3	1	2.0	3.0	3
D.2.2	Public education provided to recognize hydro-meteorological and geophysical hazard signals and disease signs and symptoms in order to contribute to community surveillance and to allow and promote robust no-regret response measures	4			-	4.0	4
D.2.3	People educated on how warnings will be disseminated, which sources are reliable and how to respond	5			-	4.0	4
D.2.4	Utilization of the most effective media (e.g., established broadcasting media, social networks, alter-native media) to improve public awareness	4			-	4.0	4
D.2.5	Public awareness and education campaigns tailored to the specific needs of vulnerable groups (e.g., women, children, older people, and people with disabilities)	3	4	1	2.5	3.0	3
D.3 Is public awareness and response tested and evaluated?		**3.0**	**2.5**	**2.0**	**2.3**	**3.0**	**3.0**
D.3.1	Previous emergency and disaster events and responses analyzed, and lessons learned incorporated into preparedness and response plans and into capacity-building strategies	3	2	3	2.5	3.0	3
D.3.2	Public awareness strategies and programmes evaluated regularly and updated as required	-	3	1	2.0	3.0	3

(Appendix C: Raw Data Score Sheets Continued…)

Indonesia

Summary

Thematic Area	Desk Study Score	Revised Score Based on FGD	Final Score
A. Disaster Risk Knowledge			
A.1 Are key hazards and related threats identified?	5.0	5.0	4.0
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?	2.0	2.0	2.0
A.3 Are roles and responsibilities of stakeholders identified?	3.4	3.6	3.6
A.4 Is risk information consolidated?	4.3	4.3	3.8
A.5 Is risk information properly incorporated into the early warning system?	1.3	1.3	2.3
Thematic Area Score	**3.2**	**3.2**	**3.1**
B. Detection, Monitoring, Analysis			
B.1 Are there monitoring systems in place?	4.1	4.0	3.7
B.2 Are there forecasting and warning services in place?	4.1	4.1	3.1
B.3 Are there institutional mechanisms in place?	4.5	4.5	3.7
Thematic Area Score	**4.3**	**4.2**	**3.5**
C. Warning Dissemination and Communications			
C.1 Are organizational and decision-making processes in place and operational?	3.5	4.0	3.7
C.2 Are communication systems and equipment in place and operational?	2.1	2.6	2.7
C.3 Are impact-based early warning communicated effectively to prompt action by target groups?	2.0	2.0	1.5
Thematic Area Score	**2.5**	**2.9**	**2.6**
D. Preparedness and Response			
D.1 Are disaster preparedness measures, including response plans, developed and operational?	1.9	2.5	2.8
D.2 Are public awareness and education campaigns conducted?	2.8	2.8	3.2
D.3 Is public awareness and response tested and evaluated?	1.0	1.0	1.5
Thematic Area Score	**1.9**	**2.1**	**2.5**

(Appendix C: Raw Data Score Sheets Continued…)

Indonesia

Disaster Risk Knowledge

No.	Sub-Element	Desk Study Score	Stakeholder Inputs						SH Score Average	Post-FGD Adjusted Score	Final Score
			IN1	IN2	IN3	IN4	IN5	IN6			
A.1 Are key hazards and related threats identified?		**5.0**	**3.0**	**3.0**	**5.0**	**4.0**	**4.0**	**3.0**	**3.7**	**5.0**	**4.0**
A.1.A	Characteristics of key hazards (e.g., geographical extent, magnitude, intensity, disease transmissibility, frequency, probability), including possible cascading hazardous events, are analyzed, historical data evaluated, and potential future risks assessed	5	3	3	5	4	4	3	3.7	5	5
A.1.2	Hazard maps (dynamic and multi-hazard, when possible) are developed that identify the geographical areas/people that could be affected by hazards	5							-	5	3
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?		**2.0**	**3.0**	**4.0**	**5.0**	**3.0**	**3.0**	**3.0**	**3.5**	**2.0**	**2.0**
A.2.1	Assessment and quantification of exposed people, services (e.g., hospitals) and critical infrastructure (e.g., electricity and water works, quality of building stock) conducted and mapped for all relevant hazards, as well as of any compounding risks, at local level in both rural and urban areas and coastlines	3							-	3	3
A.2.2	Impacts to critical infrastructure and secondary risks associated with these impacts are evaluated, and risk management solutions considered to increase resilience	2							-	2	2
A.2.3	Vulnerability factors such as gender, disability, access to infrastructure, economic diversity, societal inequalities, and environmental sensitivities considered	2	3	4	5	3	3	3	3.5	2	2
A.2.4	Vulnerabilities of key economic sectors at national to local levels assessed	1							-	1	1
A.2.5	Historical and indigenous knowledge integrated into risk assessments	2							-	2	2
A.2.6	Activities that increase or compound risks (e.g., urbanization and land use) identified and evaluated	2							-	2	2
A.2.7	Risk assessment results integrated into local risk management plans and warning messages in a clear and easy-to-understand language with attention to how different people assess information	2							-	2	2
A.2.8	Legislation and cultural norms assessed to identify gaps that may increase vulnerability	2							-	2	2
A.3 Are roles and responsibilities of stakeholders identified?		**3.4**	**3.0**	**3.5**	**5.0**	**4.0**	**4.0**	**3.0**	**3.8**	**3.6**	**3.6**
A.3.1	Key national government agencies involved in risk assessments (including hazard, vulnerability, and capacity assessments) are identified and roles defined	5							-	5	5
A.3.2	Legislation or government policy mandating the preparation of hazard, vulnerability and capacity assessments for all areas are in place	2							-	2	2
A.3.3	Responsibility for coordinating hazard identification and risk information (exposure, social and physical vulnerability, and capacity) assigned to one national organization with a view to consolidating approaches and monitoring linkages and cascading impacts	5							-	5	5
A.3.4	Process developed for scientific and technical experts to assess and review the accuracy of risk data and information	3	3	4	5	4	5	3	4.0	3	3
A.3.5	Process developed to actively engage rural and urban communities in local hazard and risk assessments taking into consideration the needs of all people (women, children, older people, people with disabilities, etc.)	2	-	3	5	4	3	3	3.6	3	3
A.4 Is risk information consolidated?		**4.3**	**-**	**3.7**	**5.0**	**3.0**	**4.3**	**3.7**	**3.9**	**4.3**	**3.8**
A.4.1	Central standardized repository (including but not limited to a Geographic Information System) established to store all event/disaster and risk information	4							-	4	4
A.4.2	National standards (where possible, following international standards) established for the systematic collection, sharing and assessment of risk information and data related to hazards, exposures, vulnerabilities, and capacities	5	-	3	5	3	4	4	3.8	5	4
A.4.3	Standardized vulnerability data and information disaggregated by sex, age, and disability	3	-	4	5	3	4	3	3.8	3	3
A.4.4	Process established to maintain, regularly review, and update risk data, including information on any new or emerging vulnerabilities and hazards, with roles and responsibilities of stakeholders identified along with appropriate funding	5	-	4	5	3	5	4	4.2	5	4
A.5 Is risk information properly incorporated into the early warning system?		**1.3**	**-**	**2.5**	**5.0**	**3.0**	**3.5**	**3.5**	**3.5**	**1.3**	**2.3**
A.5.1	Information on the geographical extent of hazards used to define safe areas and evacuation zones	2	-	2	5	3	5	3	3.6	2	4
A.5.2	Risk information on vulnerable groups (hazard, exposure, differential vulnerability) used to identify and define evacuation routes and location of temporary shelters	1	-	3	5	3	2	4	3.4	1	3
A.5.3	Risk information on different types of assets reviewed to outline procedures to minimize damage or loss of such assets once a warning is issued	1							-	1	1
A.5.4	Process established for continuous update on new or emerging risks (e.g., due to urban expansion or establishment of new settlements) and potential changes to some hazards (due to changes in land use) to update safe areas, evacuation zones and shelters	1							-	1	1

(Appendix C: Raw Data Score Sheets Continued…)

Indonesia

Hazard Detection, Monitoring, Analysis, and Forecasting

No.	Sub-Element	Desk Study Score	Stakeholder Inputs						SH Score Average	Post-FGD Adjusted Score	Final Score
			IN1	IN2	IN3	IN4	IN5	IN6			
B.1 Are there monitoring systems in place?		**4.1**	**-**	**3.7**	**4.7**	**3.7**	**5.0**	**4.0**	**4.2**	**4.0**	**3.7**
B.1.1	Monitoring network established that monitors hazards that impact the country	4	-	4	5	4	5	4	4.4	4	4
B.1.2	Measurement parameters and specifications documented for each relevant hazard	4							-	4	4
B.1.3	Technical equipment, suited to local conditions and circumstances, in place and personnel trained in its use and maintenance	4	-	3	5	4	5	4	4.2	4	4
B.1.4	Monitoring data received, processed and available in an interoperable format in real time or near real time	4	-	4	4	3	5	4	4.0	4	4
B.1.5	Monitoring data and metadata routinely curated with quality controls, archived and accessible for verification, research purposes and other applications	4							-	4	4
B.1.6	Monitoring hardware and software maintenance conducted routinely, and costs and resources considered from the beginning to ensure optimal operation of the system over time	5							-	5	2
B.1.7	The system is able to combine and benefit from new and older technology allowing for exchange of data among countries with different technical capabilities	4							-	4	4
B.2 Are there forecasting and warning services in place?		**4.1**	**-**	**4.0**	**5.0**	**3.5**	**5.0**	**3.5**	**4.2**	**4.1**	**3.1**
B.2.1	Data analysis and processing, modelling, prediction, and warning products generated based on accepted scientific and technical methodologies and disseminated within international standards and protocols	4							-	4	4
B.2.2	New data analysis and processing, modelling, prediction, and warning products can be integrated easily in the system as science and technology evolve	4							-	4	4
B.2.3	Warning centers are operational at all times (24 hours/day, seven days/week) and staffed by trained personnel following appropriate national and international standards	5	-	4	5	3	5	3	4.0	5	4
B.2.4	Warning messages are clear, consistent and include risk and impact information and are designed with consideration for linking threat levels to emergency preparedness and response actions	5							-	5	2
B.2.5	Software and data analysis for the received data updated periodically and to high security standards	4							-	4	4
B.2.6	The state of the monitoring and data analysis systems continuously monitored for any data gaps, connection issues or processing issues	1							-	1	1
B.2.7	Warnings generated and disseminated in an efficient and timely manner for each type of hazard	5							-	5	2
B.2.8	Warning system(s) subjected to regular system-wide tests and exercises	5	-	4	5	4	5	4	4.4	5	4
B.3 Are there institutional mechanisms in place?		**4.5**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**4.5**	**3.7**
B.3.1	Plans and documents for monitoring networks available and agreed upon with experts and relevant authorities	5							-	5	2
B.3.2	Agreements and interagency protocols established within country for exchange of monitoring systems data and baseline data needed for certain data products (e.g., bathymetric, and topographic data for tsunami modelling)	5							-	5	5
B.3.3	Agreements and interagency protocols established to ensure consistency of warning language and communication responsibilities where different hazards are handled by different agencies	4							-	4	4
B.3.4	A multi-hazard coordination strategy established to obtain mutual efficiencies and effectiveness among different warning systems	4							-	4	4
B.3.5	Warning system partners, including local authorities and the media, are aware of and respect which organizations are responsible for generation and issuance of warnings	5							-	5	5
B.3.6	Cross-border exchange of warnings and observation data realized through bilateral/ multilateral agreements, especially for concerns such as tropical cyclones, floods, diseases, shared basins, data exchange, and technical capacity-building	4							-	4	2

(Appendix C: Raw Data Score Sheets Continued…)

Indonesia

Warning Dissemination and Communication

No.	Sub-Element	Desk Study Score	Stakeholder Inputs						SH Score Average	Post-FGD Adjusted Score	Final Score
			IN1	IN2	IN3	IN4	IN5	IN6			
C.1 Are organizational and decision-making processes in place and operational?		**3.5**	**-**	**3.3**	**5.0**	**3.3**	**3.0**	**3.3**	**3.6**	**4.0**	**3.7**
C.1.1	Functions, roles, and responsibilities of each actor in the warning dissemination process enforced through government policy or legislation at all levels and included in the standard operating procedures	4							-	4	4
C.1.2	Warning communication strategies at the national, subnational, and local levels in place that ensure coordination across warning issuers and dissemination channels	4	-	3	5	3	3	4	3.6	4	4
C.1.3	Regular coordination, planning and review meetings between the warning issuers, the media, and other stakeholders	4							-	4	4
C.1.4	Professional and volunteer networks established to receive and disseminate warnings widely	4	-	4	5	4	4	3	4.0	4	4
C.1.5	Feedback mechanisms in place to verify that warnings have been received and to correct potential failures in dissemination and communication	1	-	3	5	3	2	3	3.2	1	2
C.1.6	Mechanisms to update the information are in place and are resilient to the event	4							-	4	4
C.2 Are communication systems and equipment in place and operational?		**2.1**	**-**	**3.4**	**4.7**	**3.3**	**3.9**	**3.0**	**3.7**	**2.6**	**2.7**
C.2.1	Communication and dissemination systems tailored to the different needs of specific groups (urban and rural populations, women and men, older people and youth, people with disabilities, etc.)	1	-	3	5	3	3	2	3.2	1	1
C.2.2	Understanding of last-mile connectivity to know which population groups can be reached by different services, including mobile-cellular, satellite and radio services	5							-	5	5
C.2.3	Warning communication and dissemination systems reach the entire population, including seasonal populations and those in remote locations, through multiple communication channels (e.g., satellite and mobile-cellular networks, social media, flags, sirens, bells, public address systems, door-to-door visits, community meetings)	1	-	3	5	4	5	4	4.2	1	2
C.2.4	Communication strategies evaluated to ensure messages are reaching the population	1	-	4	5	3	4	2	3.6	1	2
C.2.5	Agreements developed to utilize private sector resources where appropriate (e.g., mobile-cellular, satellite, television, radio broadcasting, amateur radio, social media) to disseminate warnings	4							-	4	4
C.2.6	Equipment maintained and upgraded to utilize new technologies (when appropriate) to ensure interoperability	4	-	4	4	4	5	4	4.2	4	4
C.2.7	Backup systems and processes in place in the event of failure	1	-	3	5	4	3	3	3.6	5	2
C.2.8	Resilience of communication channels and early warning system hardware evaluated in advance to reduce the impact of events on the infrastructure	1	-	4	4	3	4	3	3.6	1	2
C.2.9	Coverage of communication channels and multiple-channel systems assessed to identify gaps and possible points of failure that may increase vulnerability	1	-	3	5	2	3	3	3.2	1	2
C.3 Are impact-based early warnngs communicated effectively to prompt action by target groups?		**2.0**	**-**	**3.3**	**5.0**	**4.3**	**4.0**	**2.8**	**3.9**	**2.0**	**1.5**
C.3.1	Warning messages provide clear guidance to trigger reactions (e.g., evacuation)	3	-	3	5	4	4	2	3.6	3	1
C.3.2	In the case of events with a short timeframe for reaction (e.g., earthquake early warning), automated systems should be in place to mitigate impacts (e.g., automatic stop of transport, activation of red lights in tunnels, stopping elevators on the closest floor, opening of fire-truck gates, etc.)	1	-	3	5	4	4	2	3.6	1	1
C.3.3	Early warnings should take into account the different risks and needs of subpopulations, including differential vulnerabilities (urban and rural, women and men, older people and youth, people with disabilities, etc.)	2	-	3	5	5	3	4	4.0	2	2
C.3.4	Public and other stakeholders are aware of which authorities issue the warnings and trust their message	2	-	4	5	4	5	3	4.2	2	2

(Appendix C: Raw Data Score Sheets Continued...)

Indonesia

Preparedness and Response Capabilities

No.	Sub-Element	Desk Study Score	Stakeholder Inputs				SH Score Average	Post-FGD Adjusted Score	Final Score
			IN1	IN2	IN3	IN4			
D.1 Are disaster preparedness measures, including response plans, developed and operational?		**1.9**	**-**	**3.4**	**5.0**	**3.9**	**4.1**	**2.5**	**2.8**
D.1.1	Disaster preparedness, including plans or standard operating procedures, developed in a participatory manner, disseminated to the community, practiced, and underpinned by legislation where appropriate	1	-	3	5	4	4.0	4	4
D.1.2	Disaster preparedness measures, including plans and standard operating procedures, account for the needs of people with different degrees of vulnerability	1	-	3	5	4	4.0	1	1
D.1.3	Multi-hazard risk assessments utilized to develop and design evacuation strategies (evacuation routes, demarcation of safe areas and location of temporary shelters, use of vertical evacuation if needed)	2	-	3	5	4	4.0	2	2
D.1.4	Community's ability to communicate in response to early warnings assessed	1	-	3	5	4	4.0	1	-
D.1.5	Contingency planning developed in a scenario-based manner following forecasts or likely scenarios across different timescales and informed by climate projections and scientific research	2	-	4	5	4	4.3	2	2
D.1.6	Early action and response options across time and geographical scales are linked to the provision of funding to support them	1	-	4	5	3	4.0	1	-
D.1.7	Strategies implemented to maintain preparedness for longer return-periods and cascading hazard events	5					-	5	5
D.1.8	Protocols incorporated in the plans or standard operating procedures to reach emergency and health services that need to be ready to respond to events promptly	1					-	1	2
D.1.9	Protocols established to activate and mobilize last-mile operators (e.g., local police, firefighters, volunteers, health services) who disseminate warnings to the public and decide public measures, including issuing orders for evacuation or sheltering in place	4					-	4	4
D.1.10	Regular exercises undertaken to test and optimize the effectiveness of early warning dissemination processes, preparedness, and response to warning	1	-	4	5	4	4.3	1	2
D.2 Are public awareness and education campaigns conducted?		**2.8**	**-**	**4.0**	**5.0**	**4.4**	**4.5**	**2.8**	**3.2**
D.2.1	Ongoing public awareness and education programmes on hazards that could impact the population, vulnerabilities, exposure and how to reduce disaster impacts built into school curricula from primary through university	2	-	4	5	5	4.7	2	4
D.2.2	Public education provided to recognize hydro-meteorological and geophysical hazard signals and disease signs and symptoms in order to contribute to community surveillance and to allow and promote robust no-regret response measures	3	-	4	5	4	4.3	3	3
D.2.3	People educated on how warnings will be disseminated, which sources are reliable and how to respond	3	-	4	5	4	4.3	3	3
D.2.4	Utilization of the most effective media (e.g., established broadcasting media, social networks, alter-native media) to improve public awareness	3	-	4	5	5	4.7	3	3
D.2.5	Public awareness and education campaigns tailored to the specific needs of vulnerable groups (e.g., women, children, older people, and people with disabilities)	3	-	4	5	4	4.3	3	3
D.3 Is public awareness and response tested and evaluated?		**1.0**	**-**	**4.0**	**5.0**	**4.0**	**4.4**	**1.0**	**1.5**
D.3.1	Previous emergency and disaster events and responses analyzed, and lessons learned incorporated into preparedness and response plans and into capacity-building strategies	1	-	4	5	4	4.3	1	2
D.3.2	Public awareness strategies and programmes evaluated regularly and updated as required	1	-	4	5	-	4.5	1	1

(Appendix C: Raw Data Score Sheets Continued…)
Lao PDR

Summary

Thematic Area	Desk Study Score	Revised Score Based on FGD	Final Score
A. Disaster Risk Knowledge			
A.1 Are key hazards and related threats identified?	3.0	3.0	3.0
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?	2.4	2.0	2.0
A.3 Are roles and responsibilities of stakeholders identified?	2.0	2.0	2.0
A.4 Is risk information consolidated?	1.5	1.5	1.5
A.5 Is risk information properly incorporated into the early warning system?	1.7	1.7	1.7
Thematic Area Score	**2.1**	**2.0**	**2.0**
B. Detection, Monitoring, Analysis			
B.1 Are there monitoring systems in place?	1.7	2.5	1.7
B.2 Are there forecasting and warning services in place?	1.3	1.3	1.3
B.3 Are there institutional mechanisms in place?	2.2	2.2	2.2
Thematic Area Score	**1.7**	**2.0**	**1.7**
C. Warning Dissemination and Communications			
C.1 Are organizational and decision-making processes in place and operational?	2.0	2.5	2.0
C.2 Are communication systems and equipment in place and operational?	1.6	1.8	1.8
C.3 Are impact-based early warning communicated effectively to prompt action by target groups?	1.5	1.5	1.5
Thematic Area Score	**1.7**	**1.9**	**1.8**
D. Preparedness and Response			
D.1 Are disaster preparedness measures, including response plans, developed and operational?	1.9	3.5	1.9
D.2 Are public awareness and education campaigns conducted?	2.0	2.0	2.0
D.3 Is public awareness and response tested and evaluated?	1.5	1.5	1.5
Thematic Area Score	**1.8**	**2.3**	**1.8**

(Appendix C: Raw Data Score Sheets Continued…)

Lao PDR

Disaster Risk Knowledge

No.	Sub-Element	Desk Study Score	Stakeholder Inputs					SH Score Average	Post-FGD Adjusted Score	Final Score
			LA1	LA2	LA3	LA4	LA5			
A.1 Are key hazards and related threats identified?		**3.0**	**4.0**	**3.0**	**3.0**	**3.0**	**2.0**	**3.0**	**3.0**	**3.0**
A.1.A	Characteristics of key hazards (e.g., geographical extent, magnitude, intensity, disease transmissibility, frequency, probability), including possible cascading hazardous events, are analyzed, historical data evaluated, and potential future risks assessed	3	4	3	3	3	2	3.0	3.0	3
A.1.2	Hazard maps (dynamic and multi-hazard, when possible) are developed that identify the geographical areas/people that could be affected by hazards	3	4	3	-	3	2	3.0	3.0	3
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?		**2.4**	**3.3**	**2.3**	**3.0**	**3.0**	**1.7**	**2.7**	**2.0**	**2.0**
A.2.1	Assessment and quantification of exposed people, services (e.g., hospitals) and critical infrastructure (e.g., electricity and water works, quality of building stock) conducted and mapped for all relevant hazards, as well as of any compounding risks, at local level in both rural and urban areas and coastlines	2	4	3	3	3	1	2.8	2.0	2.0
A.2.2	Impacts to critical infrastructure and secondary risks associated with these impacts are evaluated, and risk management solutions considered to increase resilience	1						-	1.0	1.0
A.2.3	Vulnerability factors such as gender, disability, access to infrastructure, economic diversity, societal inequalities, and environmental sensitivities considered	4	3	2	4	3	2	2.8	3.0	3.0
A.2.4	Vulnerabilities of key economic sectors at national to local levels assessed	3						-	3.0	3.0
A.2.5	Historical and indigenous knowledge integrated into risk assessments	4	3	2	2	3	2	2.4	2.0	2.0
A.2.6	Activities that increase or compound risks (e.g., urbanization and land use) identified and evaluated	1						-	1.0	1.0
A.2.7	Risk assessment results integrated into local risk management plans and warning messages in a clear and easy-to-understand language with attention to how different people assess information	2						-	2.0	2.0
A.2.8	Legislation and cultural norms assessed to identify gaps that may increase vulnerability	2						-	2.0	2.0
A.3 Are roles and responsibilities of stakeholders identified?		**2.0**	**3.0**	**3.0**	**2.0**	**3.0**	**2.0**	**2.6**	**2.0**	**2.0**
A.3.1	Key national government agencies involved in risk assessments (including hazard, vulnerability, and capacity assessments) are identified and roles defined	4						-	4	4
A.3.2	Legislation or government policy mandating the preparation of hazard, vulnerability and capacity assessments for all areas are in place	3						-	3	3
A.3.3	Responsibility for coordinating hazard identification and risk information (exposure, social and physical vulnerability, and capacity) assigned to one national organization with a view to consolidating approaches and monitoring linkages and cascading impacts	1						-	1	1
A.3.4	Process developed for scientific and technical experts to assess and review the accuracy of risk data and information	1	3	3	2	3	2	2.6	1	1
A.3.5	Process developed to actively engage rural and urban communities in local hazard and risk assessments taking into consideration the needs of all people (women, children, older people, people with disabilities, etc.)	1						-	1	1
A.4 Is risk information consolidated?		**1.5**	**3.0**	**3.0**	**3.5**	**3.0**	**2.0**	**2.9**	**1.5**	**1.5**
A.4.1	Central standardized repository (including but not limited to a Geographic Information System) established to store all event/disaster and risk information	1						-	1	1
A.4.2	National standards (where possible, following international standards) established for the systematic collection, sharing and assessment of risk information and data related to hazards, exposures, vulnerabilities, and capacities	-	3	3	3	3	3	3.0	-	-
A.4.3	Standardized vulnerability data and information disaggregated by sex, age, and disability	-	3	3	4	3	1	2.8	-	-
A.4.4	Process established to maintain, regularly review, and update risk data, including information on any new or emerging vulnerabilities and hazards, with roles and responsibilities of stakeholders identified along with appropriate funding	2						-	2	2
A.5 Is risk information properly incorporated into the early warning system?		**1.7**	**3.0**	**2.0**	**4.0**	**3.0**	**1.0**	**2.6**	**1.7**	**1.7**
A.5.1	Information on the geographical extent of hazards used to define safe areas and evacuation zones	3						-	3	3
A.5.2	Risk information on vulnerable groups (hazard, exposure, differential vulnerability) used to identify and define evacuation routes and location of temporary shelters	-						-	-	-
A.5.3	Risk information on different types of assets reviewed to outline procedures to minimize damage or loss of such assets once a warning is issued	1	3	2	4	3	1	2.6	1	1
A.5.4	Process established for continuous update on new or emerging risks (e.g., due to urban expansion or establishment of new settlements) and potential changes to some hazards (due to changes in land use) to update safe areas, evacuation zones and shelters	1						-	1	1

(Appendix C: Raw Data Score Sheets Continued…)

Lao PDR

Hazard Detection, Monitoring, Analysis, and Forecasting

No.	Sub-Element	Desk Study Score	Stakeholder Inputs					SH Score Average	Post-FGD Adjusted Score	Final Score
			LA1	LA2	LA3	LA4	LA5			
B.1 Are there monitoring systems in place?		**1.7**	**3.0**	**3.3**	**2.5**	**3.0**	**2.5**	**2.9**	**2.5**	**1.7**
B.1.1	Monitoring network established that monitors hazards that impact the country	2	3	3	3	3	2	2.8	2	2
B.1.2	Measurement parameters and specifications documented for each relevant hazard	3						-	3	3
B.1.3	Technical equipment, suited to local conditions and circumstances, in place and personnel trained in its use and maintenance	1	3	4	2	3	3	3.0	1	1
B.1.4	Monitoring data received, processed and available in an interoperable format in real time or near real time	1	3	3	2	3	2	2.6	1	1
B.1.5	Monitoring data and metadata routinely curated with quality controls, archived and accessible for verification, research purposes and other applications	2						-	2	2
B.1.6	Monitoring hardware and software maintenance conducted routinely, and costs and resources considered from the beginning to ensure optimal operation of the system over time	1	3	3	3	3	3	3.0	1	1
B.1.7	The system is able to combine and benefit from new and older technology allowing for exchange of data among countries with different technical capabilities	2						-	2	2
B.2 Are there forecasting and warning services in place?		**1.3**	**3.0**	**3.0**	**2.5**	**3.0**	**2.3**	**2.9**	**1.3**	**1.3**
B.2.1	Data analysis and processing, modelling, prediction, and warning products generated based on accepted scientific and technical methodologies and disseminated within international standards and protocols	1	3	3	-	3	-	3.0	1	1
B.2.2	New data analysis and processing, modelling, prediction, and warning products can be integrated easily in the system as science and technology evolve	1						-	1	1
B.2.3	Warning centers are operational at all times (24 hours/day, seven days/week) and staffed by trained personnel following appropriate national and international standards	2	3	4	3	3	1	2.8	2	2
B.2.4	Warning messages are clear, consistent and include risk and impact information and are designed with consideration for linking threat levels to emergency preparedness and response actions	1						-	1	1
B.2.5	Software and data analysis for the received data updated periodically and to high security standards	2						-	2	2
B.2.6	The state of the monitoring and data analysis systems continuously monitored for any data gaps, connection issues or processing issues	1						-	1	1
B.2.7	Warnings generated and disseminated in an efficient and timely manner for each type of hazard	1	3	2	2	3	3	2.6	1	1
B.2.8	Warning system(s) subjected to regular system-wide tests and exercises	1	3	3	-	3	3	3.0	1	1
B.3 Are there institutional mechanisms in place?		**2.2**	**3.0**	**2.5**	**3.5**	**3.0**	**-**	**3.0**	**2.2**	**2.2**
B.3.1	Plans and documents for monitoring networks available and agreed upon with experts and relevant authorities	2	3	3	-	3	-	3.0	2	2
B.3.2	Agreements and interagency protocols established within country for exchange of monitoring systems data and baseline data needed for certain data products (e.g., bathymetric, and topographic data for tsunami modelling)	2						-	2	2
B.3.3	Agreements and interagency protocols established to ensure consistency of warning language and communication responsibilities where different hazards are handled by different agencies	2						-	2	2
B.3.4	A multi-hazard coordination strategy established to obtain mutual efficiencies and effectiveness among different warning systems	3						-	3	3
B.3.5	Warning system partners, including local authorities and the media, are aware of and respect which organizations are responsible for generation and issuance of warnings	1	3	2	4	3	-	3.0	1	1
B.3.6	Cross-border exchange of warnings and observation data realized through bilateral/ multilateral agreements, especially for concerns such as tropical cyclones, floods, diseases, shared basins, data exchange, and technical capacity-building	3	3	-	3	-	-	3.0	3	3

(Appendix C: Raw Data Score Sheets Continued…)

Lao PDR

Warning Dissemination and Communication

No.	Sub-Element	Desk Study Score	Stakeholder Inputs					SH Score Average	Post-FGD Adjusted Score	Final Score
			LA1	LA2	LA3	LA4	LA5			
C.1 Are organizational and decision-making processes in place and operational?		**2.0**	**3.0**	**3.0**	**3.0**	**3.0**	**2.0**	**2.9**	**2.5**	**2.0**
C.1.1	Functions, roles, and responsibilities of each actor in the warning dissemination process enforced through government policy or legislation at all levels and included in the standard operating procedures	3	3	2	3	3	-	2.8	3	3
C.1.2	Warning communication strategies at the national, subnational, and local levels in place that ensure coordination across warning issuers and dissemination channels	2	3	3	4	3	-	3.3	2	2
C.1.3	Regular coordination, planning and review meetings between the warning issuers, the media, and other stakeholders	2						-	2	2
C.1.4	Professional and volunteer networks established to receive and disseminate warnings widely	2	3	4	2	3	-	3.0	2	2
C.1.5	Feedback mechanisms in place to verify that warnings have been received and to correct potential failures in dissemination and communication	1						-	1	1
C.1.6	Mechanisms to update the information are in place and are resilient to the event	2	3	3	-	3	2	2.8	2	2
C.2 Are communication systems and equipment in place and operational?		**1.6**	**3.0**	**3.4**	**2.5**	**3.0**	**2.0**	**2.8**	**1.8**	**1.8**
C.2.1	Communication and dissemination systems tailored to the different needs of specific groups (urban and rural populations, women and men, older people and youth, people with disabilities, etc.)	2	3	3	-	3	2	2.8	2.0	2
C.2.2	Understanding of last-mile connectivity to know which population groups can be reached by different services, including mobile-cellular, satellite and radio services	2	3	3	2	3	2	2.6	2.0	2
C.2.3	Warning communication and dissemination systems reach the entire population, including seasonal populations and those in remote locations, through multiple communication channels (e.g., satellite and mobile-cellular networks, social media, flags, sirens, bells, public address systems, door-to-door visits, community meetings)	1	3	4	3	3	1	2.8	2.0	2
C.2.4	Communication strategies evaluated to ensure messages are reaching the population	3						-	3	3
C.2.5	Agreements developed to utilize private sector resources where appropriate (e.g., mobile-cellular, satellite, television, radio broadcasting, amateur radio, social media) to disseminate warnings	2						-	2	2
C.2.6	Equipment maintained and upgraded to utilize new technologies (when appropriate) to ensure interoperability	1	3	4	-	3	2	3.0	1.0	1
C.2.7	Backup systems and processes in place in the event of failure	1						-	1	1
C.2.8	Resilience of communication channels and early warning system hardware evaluated in advance to reduce the impact of events on the infrastructure	1						-	1	1
C.2.9	Coverage of communication channels and multiple-channel systems assessed to identify gaps and possible points of failure that may increase vulnerability	-	3	3	-	3	3	3.0	-	-
C.3 Are impact-based early warnngs communicated effectively to prompt action by target groups?		**1.5**	**-**	**-**	**-**	**-**	**-**	**-**	**1.5**	**1.5**
C.3.1	Warning messages provide clear guidance to trigger reactions (e.g., evacuation)	2						-	2	2
C.3.2	In the case of events with a short timeframe for reaction (e.g., earthquake early warning), automated systems should be in place to mitigate impacts (e.g., automatic stop of transport, activation of red lights in tunnels, stopping elevators on the closest floor, opening of fire-truck gates, etc.)	1						-	1	1
C.3.3	Early warnings should take into account the different risks and needs of subpopulations, including differential vulnerabilities (urban and rural, women and men, older people and youth, people with disabilities, etc.)	1						-	1	1
C.3.4	Public and other stakeholders are aware of which authorities issue the warnings and trust their message	2						-	2	2

(Appendix C: Raw Data Score Sheets Continued…)

Lao PDR

Preparedness and Response Capabilities

No.	Sub-Element	Desk Study Score	Stakeholder Inputs					SH Score Average	Post-FGD Adjusted Score	Final Score
			LA1	LA2	LA3	LA4	LA5			
D.1 Are disaster preparedness measures, including response plans, developed and operational?		**1.9**	**3.0**	**3.3**	**3.3**	**3.0**	**3.0**	**3.1**	**3.5**	**1.9**
D.1.1	Disaster preparedness, including plans or standard operating procedures, developed in a participatory manner, disseminated to the community, practiced, and underpinned by legislation where appropriate	4	3	3	4	3	4	3.4	4	4
D.1.2	Disaster preparedness measures, including plans and standard operating procedures, account for the needs of people with different degrees of vulnerability	3						-	3	3
D.1.3	Multi-hazard risk assessments utilized to develop and design evacuation strategies (evacuation routes, demarcation of safe areas and location of temporary shelters, use of vertical evacuation if needed)	3	3	3	3	3	2	2.8	3	3
D.1.4	Community's ability to communicate in response to early warnings assessed	1	3	3	3	3	3	3.0	1	1
D.1.5	Contingency planning developed in a scenario-based manner following forecasts or likely scenarios across different timescales and informed by climate projections and scientific research	1						-	1	1
D.1.6	Early action and response options across time and geographical scales are linked to the provision of funding to support them	1						-	1	1
D.1.7	Strategies implemented to maintain preparedness for longer return-periods and cascading hazard events	1						-	1	1
D.1.8	Protocols incorporated in the plans or standard operating procedures to reach emergency and health services that need to be ready to respond to events promptly	2						-	2	2
D.1.9	Protocols established to activate and mobilize last-mile operators (e.g., local police, firefighters, volunteers, health services) who disseminate warnings to the public and decide public measures, including issuing orders for evacuation or sheltering in place	1	3	4	-	3	-	3.3	1	1
D.1.10	Regular exercises undertaken to test and optimize the effectiveness of early warning dissemination processes, preparedness, and response to warning	2						-	2	1
D.2 Are public awareness and education campaigns conducted?		**2.0**	**3.0**	**3.0**	**3.0**	**3.0**	**2.0**	**2.9**	**2.0**	**2.0**
D.2.1	Ongoing public awareness and education pro-grammes on hazards that could impact the population, vulnerabilities, exposure and how to reduce disaster impacts built into school curricula from primary through university	2	3	3	3	3	-	3.0	2	2
D.2.2	Public education provided to recognize hydro-meteorological and geophysical hazard signals and disease signs and symptoms in order to contribute to community surveillance and to allow and promote robust no-regret response measures	2	3	3	-	3	-	3.0	2	2
D.2.3	People educated on how warnings will be disseminated, which sources are reliable and how to respond	2						-	2	2
D.2.4	Utilization of the most effective media (e.g., established broadcasting media, social networks, alter-native media) to improve public awareness	2	3	3	3	3	2	2.8	2	2
D.2.5	Public awareness and education campaigns tailored to the specific needs of vulnerable groups (e.g., women, children, older people, and people with disabilities)	2						-	2	2
D.3 Is public awareness and response tested and evaluated?		**1.5**	**3.0**	**3.0**	**4.0**	**3.0**	**4.0**	**3.4**	**1.5**	**1.5**
D.3.1	Previous emergency and disaster events and responses analyzed, and lessons learned incorporated into preparedness and response plans and into capacity-building strategies	2	3	3	4	3	4	3.4	2	2
D.3.2	Public awareness strategies and programmes evaluated regularly and updated as required	1						-	1	1

(Appendix C: Raw Data Score Sheets Continued…)

Malaysia

Summary

Thematic Area	Desk Study Score	Revised Score Based on FGD	Final Score
A. Disaster Risk Knowledge			
A.1 Are key hazards and related threats identified?	5.0	5.0	4.5
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?	4.3	4.3	3.3
A.3 Are roles and responsibilities of stakeholders identified?	5.0	5.0	4.6
A.4 Is risk information consolidated?	4.5	4.5	4.3
A.5 Is risk information properly incorporated into the early warning system?	4.5	4.5	2.3
Thematic Area Score	**4.7**	**4.7**	**3.8**
B. Detection, Monitoring, Analysis			
B.1 Are there monitoring systems in place?	5.0	5.0	4.8
B.2 Are there forecasting and warning services in place?	5.0	5.0	4.2
B.3 Are there institutional mechanisms in place?	4.8	4.8	3.4
Thematic Area Score	**4.9**	**4.9**	**4.1**
C. Warning Dissemination and Communications			
C.1 Are organizational and decision-making processes in place and operational?	5.0	5.0	3.2
C.2 Are communication systems and equipment in place and operational?	3.7	4.4	3.2
C.3 Are impact-based early warning communicated effectively to prompt action by target groups?	5.0	5.0	2.0
Thematic Area Score	**4.6**	**4.8**	**2.8**
D. Preparedness and Response			
D.1 Are disaster preparedness measures, including response plans, developed and operational?	4.9	5.0	3.2
D.2 Are public awareness and education campaigns conducted?	3.4	4.2	2.8
D.3 Is public awareness and response tested and evaluated?	5.0	5.0	4.5
Thematic Area Score	**4.4**	**4.7**	**3.5**

(Appendix C: Raw Data Score Sheets Continued…)
Malaysia

Disaster Risk Knowledge

No.	Sub-Element	Desk Study Score	Stakeholder Inputs			SH Score Average	Post-FGD Adjusted Score	Final Score
			MA1	MA2	MA3			
A.1 Are key hazards and related threats identified?		**5.0**	**-**	**-**	**-**	**-**	**5.0**	**4.5**
A.1.A	Characteristics of key hazards (e.g., geographical extent, magnitude, intensity, disease transmissibility, frequency, probability), including possible cascading hazardous events, are analyzed, historical data evaluated, and potential future risks assessed	5	-	-	-	-	5	5
A.1.2	Hazard maps (dynamic and multi-hazard, when possible) are developed that identify the geographical areas/people that could be affected by hazards	5	-	-	-	-	5	4
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?		**4.3**	**4.0**	**5.0**	**-**	**4.5**	**4.3**	**3.1**
A.2.1	Assessment and quantification of exposed people, services (e.g., hospitals) and critical infrastructure (e.g., electricity and water works, quality of building stock) conducted and mapped for all relevant hazards, as well as of any compounding risks, at local level in both rural and urban areas and coastlines	5	-	-	-	-	5	3
A.2.2	Impacts to critical infrastructure and secondary risks associated with these impacts are evaluated, and risk management solutions considered to increase resilience	5	-	-	-	-	5	3
A.2.3	Vulnerability factors such as gender, disability, access to infrastructure, economic diversity, societal inequalities, and environmental sensitivities considered	4	4	5	-	4.5	4	4
A.2.4	Vulnerabilities of key economic sectors at national to local levels assessed	4	-	-	-	-	4	4
A.2.5	Historical and indigenous knowledge integrated into risk assessments	5	-	-	-	-	5	3
A.2.6	Activities that increase or compound risks (e.g., urbanization and land use) identified and evaluated	5	-	-	-	-	5	3
A.2.7	Risk assessment results integrated into local risk management plans and warning messages in a clear and easy-to-understand language with attention to how different people assess information	3	-	-	-	-	3	2
A.2.8	Legislation and cultural norms assessed to identify gaps that may increase vulnerability	3	-	-	-	-	3	-
A.3 Are roles and responsibilities of stakeholders identified?		**5.0**	**4.0**	**5.0**	**4.0**	**4.3**	**5.0**	**4.6**
A.3.1	Key national government agencies involved in risk assessments (including hazard, vulnerability, and capacity assessments) are identified and roles defined	5	4	5	4	4.3	5	5
A.3.2	Legislation or government policy mandating the preparation of hazard, vulnerability and capacity assessments for all areas are in place	5	-	-	-	-	5	5
A.3.3	Responsibility for coordinating hazard identification and risk information (exposure, social and physical vulnerability, and capacity) assigned to one national organization with a view to consolidating approaches and monitoring linkages and cascading impacts	5	-	-	-	-	5	5
A.3.4	Process developed for scientific and technical experts to assess and review the accuracy of risk data and information	5	-	-	-	-	5	5
A.3.5	Process developed to actively engage rural and urban communities in local hazard and risk assessments taking into consideration the needs of all people (women, children, older people, people with disabilities, etc.)	5	-	-	-	-	5	3
A.4 Is risk information consolidated?		**4.5**	**4.5**	**5.0**	**4.0**	**4.7**	**4.5**	**4.3**
A.4.1	Central standardized repository (including but not limited to a Geographic Information System) established to store all event/disaster and risk information	5	-	-	-	-	5	3
A.4.2	National standards (where possible, following international standards) established for the systematic collection, sharing and assessment of risk information and data related to hazards, exposures, vulnerabilities, and capacities	5	4	5	4	4.3	5	4
A.4.3	Standardized vulnerability data and information disaggregated by sex, age, and disability	3	5	5	-	5.0	3	5
A.4.4	Process established to maintain, regularly review, and update risk data, including information on any new or emerging vulnerabilities and hazards, with roles and responsibilities of stakeholders identified along with appropriate funding	5	-	-	-	-	5	5
A.5 Is risk information properly incorporated into the early warning system?		**4.5**	**4.0**	**4.0**	**-**	**4.0**	**4.5**	**2.3**
A.5.1	Information on the geographical extent of hazards used to define safe areas and evacuation zones	5	4	4	-	4.0	5	2
A.5.2	Risk information on vulnerable groups (hazard, exposure, differential vulnerability) used to identify and define evacuation routes and location of temporary shelters	5	-	-	-	-	5	2
A.5.3	Risk information on different types of assets reviewed to outline procedures to minimize damage or loss of such assets once a warning is issued	4	-	-	-	-	4	-
A.5.4	Process established for continuous update on new or emerging risks (e.g., due to urban expansion or establishment of new settlements) and potential changes to some hazards (due to changes in land use) to update safe areas, evacuation zones and shelters	4	-	-	-	-	4	3

(Appendix C: Raw Data Score Sheets Continued…)

Malaysia

Hazard Detection, Monitoring, Analysis, and Forecasting

No.	Sub-Element	Desk Study Score	Stakeholder Inputs			SH Score Average	Post-FGD Adjusted Score	Final Score
			MA1	MA2	MA3			
B.1 Are there monitoring systems in place?		**5.0**	**-**	**-**	**-**	**-**	**5.0**	**4.8**
B.1.1	Monitoring network established that monitors hazards that impact the country	5	-	-	-	-	5	5
B.1.2	Measurement parameters and specifications documented for each relevant hazard	5	-	-	-	-	5	5
B.1.3	Technical equipment, suited to local conditions and circumstances, in place and personnel trained in its use and maintenance	5	-	-	-	-	4	4
B.1.4	Monitoring data received, processed and available in an interoperable format in real time or near real time	5	-	-	-	-	5	5
B.1.5	Monitoring data and metadata routinely curated with quality controls, archived and accessible for verification, research purposes and other applications	5	-	-	-	-	5	-
B.1.6	Monitoring hardware and software maintenance conducted routinely, and costs and resources considered from the beginning to ensure optimal operation of the system over time	5	-	-	-	-	5	-
B.1.7	The system is able to combine and benefit from new and older technology allowing for exchange of data among countries with different technical capabilities	5	-	-	-	-	5	-
B.2 Are there forecasting and warning services in place?		**5.0**	**-**	**-**	**-**	**-**	**5.0**	**4.2**
B.2.1	Data analysis and processing, modelling, prediction, and warning products generated based on accepted scientific and technical methodologies and disseminated within international standards and protocols	5	-	-	-	-	5	5
B.2.2	New data analysis and processing, modelling, prediction, and warning products can be integrated easily in the system as science and technology evolve	5	-	-	-	-	5	-
B.2.3	Warning centers are operational at all times (24 hours/day, seven days/week) and staffed by trained personnel following appropriate national and international standards	5	-	-	-	-	5	4
B.2.4	Warning messages are clear, consistent and include risk and impact information and are designed with consideration for linking threat levels to emergency preparedness and response actions	5	-	-	-	-	5	3
B.2.5	Software and data analysis for the received data updated periodically and to high security standards	5	-	-	-	-	5	-
B.2.6	The state of the monitoring and data analysis systems continuously monitored for any data gaps, connection issues or processing issues	5	-	-	-	-	5	5
B.2.7	Warnings generated and disseminated in an efficient and timely manner for each type of hazard	5	-	-	-	-	5	4
B.2.8	Warning system(s) subjected to regular system-wide tests and exercises	5	-	-	-	-	5	-
B.3 Are there institutional mechanisms in place?		**4.8**	**-**	**-**	**-**	**-**	**4.8**	**3.4**
B.3.1	Plans and documents for monitoring networks available and agreed upon with experts and relevant authorities	5	-	-	-	-	5	4
B.3.2	Agreements and interagency protocols established within country for exchange of monitoring systems data and baseline data needed for certain data products (e.g., bathymetric, and topographic data for tsunami modelling)	5	-	-	-	-	5	4
B.3.3	Agreements and interagency protocols established to ensure consistency of warning language and communication responsibilities where different hazards are handled by different agencies	4	-	-	-	-	4	-
B.3.4	A multi-hazard coordination strategy established to obtain mutual efficiencies and effectiveness among different warning systems	-	-	-	-	-	-	1
B.3.5	Warning system partners, including local authorities and the media, are aware of and respect which organizations are responsible for generation and issuance of warnings	5	-	-	-	-	5	5
B.3.6	Cross-border exchange of warnings and observation data realized through bilateral/ multilateral agreements, especially for concerns such as tropical cyclones, floods, diseases, shared basins, data exchange, and technical capacity-building	5	-	-	-	-	5	3

(Appendix C: Raw Data Score Sheets Continued…)

Malaysia

Warning Dissemination and Communication

No.	Sub-Element	Desk Study Score	Stakeholder Inputs			SH Score Average	Post-FGD Adjusted Score	Final Score
			MA1	MA2	MA3			
C.1 Are organizational and decision-making processes in place and operational?		**5.0**	**-**	**-**	**-**	**-**	**5.0**	**3.2**
C.1.1	Functions, roles, and responsibilities of each actor in the warning dissemination process enforced through government policy or legislation at all levels and included in the standard operating procedures	5		-	-	-	5	5
C.1.2	Warning communication strategies at the national, subnational, and local levels in place that ensure coordination across warning issuers and dissemination channels	5	-	-	-	-	5	4
C.1.3	Regular coordination, planning and review meetings between the warning issuers, the media, and other stakeholders	5	-	-	-	-	5	2
C.1.4	Professional and volunteer networks established to receive and disseminate warnings widely	5	-	-	-	-	5	2
C.1.5	Feedback mechanisms in place to verify that warnings have been received and to correct potential failures in dissemination and communication	5	-	-	-	-	5	1
C.1.6	Mechanisms to update the information are in place and are resilient to the event	5	-	-	-	-	5	5
C.2 Are communication systems and equipment in place and operational?		**3.6**	**3.3**	**4.3**	**4.5**	**4.0**	**4.4**	**3.2**
C.2.1	Communication and dissemination systems tailored to the different needs of specific groups (urban and rural populations, women and men, older people and youth, people with disabilities, etc.)	3	-	2	5	3.5	4	1
C.2.2	Understanding of last-mile connectivity to know which population groups can be reached by different services, including mobile-cellular, satellite and radio services	5	4	-	-	4.0	5	2
C.2.3	Warning communication and dissemination systems reach the entire population, including seasonal populations and those in remote locations, through multiple communication channels (e.g., satellite and mobile-cellular networks, social media, flags, sirens, bells, public address systems, door-to-door visits, community meetings)	5	-	-	-	-	5	3
C.2.4	Communication strategies evaluated to ensure messages are reaching the population	4	-	-	-	-	4	-
C.2.5	Agreements developed to utilize private sector resources where appropriate (e.g., mobile-cellular, satellite, television, radio broadcasting, amateur radio, social media) to disseminate warnings	4	-	-	-	-	4	5
C.2.6	Equipment maintained and upgraded to utilize new technologies (when appropriate) to ensure interoperability	4	-	5	5	5.0	4	4
C.2.7	Backup systems and processes in place in the event of failure	1	3	5	5	4.3	5.0	4
C.2.8	Resilience of communication channels and early warning system hardware evaluated in advance to reduce the impact of events on the infrastructure	5	3	-	-	3.0	5.0	-
C.2.9	Coverage of communication channels and multiple-channel systems assessed to identify gaps and possible points of failure that may increase vulnerability	1	-	5	3	4.0	4.0	-
C.3 Are impact-based early warnngs communicated effectively to prompt action by target groups?		**5.0**	**-**	**5.0**	**-**	**4.4**	**5.0**	**2.0**
C.3.1	Warning messages provide clear guidance to trigger reactions (e.g., evacuation)	5	**4.0**			4.0	5	2
C.3.2	In the case of events with a short timeframe for reaction (e.g., earthquake early warning), automated systems should be in place to mitigate impacts (e.g., automatic stop of transport, activation of red lights in tunnels, stopping elevators on the closest floor, opening of fire-truck gates, etc.)	-		5	-	5.0	-	2
C.3.3	Early warnings should take into account the different risks and needs of subpopulations, including differential vulnerabilities (urban and rural, women and men, older people and youth, people with disabilities, etc.)	-	4	5	-	4.5	-	1
C.3.4	Public and other stakeholders are aware of which authorities issue the warnings and trust their message	5	4	-	-	4.0	5	3

(Appendix C: Raw Data Score Sheets Continued…)

Malaysia

Preparedness and Response Capabilities

No.	Sub-Element	Desk Study Score	Stakeholder Inputs			SH Score Average	Post-FGD Adjusted Score	Final Score
			MA1	MA2	MA3			
D.1 Are disaster preparedness measures, including response plans, developed and operational?		**4.9**	**4.5**	**5.0**	**4.0**	**4.7**	**5.0**	**3.2**
D.1.1	Disaster preparedness, including plans or standard operating procedures, developed in a participatory manner, disseminated to the community, practiced, and underpinned by legislation where appropriate	5	-	-	-	-	5	3
D.1.2	Disaster preparedness measures, including plans and standard operating procedures, account for the needs of people with different degrees of vulnerability	5	-	-	-	-	5	3
D.1.3	Multi-hazard risk assessments utilized to develop and design evacuation strategies (evacuation routes, demarcation of safe areas and location of temporary shelters, use of vertical evacuation if needed)	5	-	-	-	-	5	1
D.1.4	Community's ability to communicate in response to early warnings assessed	5	4	5	4	4.3	5	-
D.1.5	Contingency planning developed in a scenario-based manner following forecasts or likely scenarios across different timescales and informed by climate projections and scientific research	5	-	-	-	-	5	-
D.1.6	Early action and response options across time and geographical scales are linked to the provision of funding to support them	4	5	5	-	5.0	4	4
D.1.7	Strategies implemented to maintain preparedness for longer return-periods and cascading hazard events	5	-	-	-	-	5	-
D.1.8	Protocols incorporated in the plans or standard operating procedures to reach emergency and health services that need to be ready to respond to events promptly	5	-	-	-	-	5	5
D.1.9	Protocols established to activate and mobilize last-mile operators (e.g., local police, firefighters, volunteers, health services) who disseminate warnings to the public and decide public measures, including issuing orders for evacuation or sheltering in place	5	-	-	-	-	5	-
D.1.10	Regular exercises undertaken to test and optimize the effectiveness of early warning dissemination processes, preparedness, and response to warning	5	-	-	-	-	5	3
D.2 Are public awareness and education campaigns conducted?		**3.4**	**4.3**	**4.2**	**4.0**	**4.0**	**4.2**	**2.8**
D.2.1	Ongoing public awareness and education programmes on hazards that could impact the population, vulnerabilities, exposure and how to reduce disaster impacts built into school curricula from primary through university	4	-	3	-	3.0	4	3
D.2.2	Public education provided to recognize hydro-meteorological and geophysical hazard signals and disease signs and symptoms in order to contribute to community surveillance and to allow and promote robust no-regret response measures	4	4	4	4	4.0	4	4
D.2.3	People educated on how warnings will be disseminated, which sources are reliable and how to respond	3	4	5	4	4.3	4	3
D.2.4	Utilization of the most effective media (e.g., established broadcasting media, social networks, alternative media) to improve public awareness	3	5	5	4	4.7	5	3
D.2.5	Public awareness and education campaigns tailored to the specific needs of vulnerable groups (e.g., women, children, older people, and people with disabilities)	3	4	4	-	4.0	4	1
D.3 Is public awareness and response tested and evaluated?		**5.0**	**5.0**	**5.0**	**-**	**5.0**	**5.0**	**4.5**
D.3.1	Previous emergency and disaster events and responses analyzed, and lessons learned incorporated into preparedness and response plans and into capacity-building strategies	5	5	5	-	5.0	5	5
D.3.2	Public awareness strategies and programmes evaluated regularly and updated as required	5	-	-	-	-	5	4

(Appendix C: Raw Data Score Sheets Continued…)

Myanmar

Summary

Thematic Area	Desk Study Score	Revised Score Based on FGD	Final Score
A. Disaster Risk Knowledge			
A.1 Are key hazards and related threats identified?	5.0	2.0	2.0
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?	3.8	1.7	1.6
A.3 Are roles and responsibilities of stakeholders identified?	3.8	3.4	3.6
A.4 Is risk information consolidated?	4.5	2.5	2.5
A.5 Is risk information properly incorporated into the early warning system?	-	2.5	2.5
Thematic Area Score	**4.3**	**2.4**	**2.4**
B. Detection, Monitoring, Analysis			
B.1 Are there monitoring systems in place?	5.0	2.0	2.0
B.2 Are there forecasting and warning services in place?	5.0	2.0	2.1
B.3 Are there institutional mechanisms in place?	4.5	3.0	3.0
Thematic Area Score	**4.8**	**2.3**	**2.4**
C. Warning Dissemination and Communications			
C.1 Are organizational and decision-making processes in place and operational?	2.0	2.0	2.2
C.2 Are communication systems and equipment in place and operational?	3.0	3.0	2.1
C.3 Are impact-based early warning communicated effectively to prompt action by target groups?	5.0	1.0	1.3
Thematic Area Score	**3.3**	**2.0**	**1.9**
D. Preparedness and Response			
D.1 Are disaster preparedness measures, including response plans, developed and operational?	2.8	2.0	2.5
D.2 Are public awareness and education campaigns conducted?	1.8	1.7	2.4
D.3 Is public awareness and response tested and evaluated?	4.0	3.5	3.5
Thematic Area Score	**2.9**	**2.4**	**2.8**

(Appendix C: Raw Data Score Sheets Continued…)

Myanmar

Disaster Risk Knowledge

No.	Sub-Element	Desk Study Score	Stakeholder Inputs				SH Score Average	Post-FGD Adjusted Score	Final Score
			MY1	MY2	MY3	MY4			
A.1 Are key hazards and related threats identified?		**5.0**	-	-	-	-	-	**2.0**	**2.0**
A.1.A	Characteristics of key hazards (e.g., geographical extent, magnitude, intensity, disease transmissibility, frequency, probability), including possible cascading hazardous events, are analyzed, historical data evaluated, and potential future risks assessed	5					-	2	2
A.1.2	Hazard maps (dynamic and multi-hazard, when possible) are developed that identify the geographical areas/people that could be affected by hazards	5					-	2	2
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?		**3.8**	**4.0**	**3.0**	**3.0**	**5.0**	**3.8**	**1.7**	**1.6**
A.2.1	Assessment and quantification of exposed people, services (e.g., hospitals) and critical infrastructure (e.g., electricity and water works, quality of building stock) conducted and mapped for all relevant hazards, as well as of any compounding risks, at local level in both rural and urban areas and coastlines	5					-	2	2
A.2.2	Impacts to critical infrastructure and secondary risks associated with these impacts are evaluated, and risk management solutions considered to increase resilience	5					-	2	2
A.2.3	Vulnerability factors such as gender, disability, access to infrastructure, economic diversity, societal inequalities, and environmental sensitivities considered	2	4	3	3	5	3.8	2	2
A.2.4	Vulnerabilities of key economic sectors at national to local levels assessed	1					-	1	1
A.2.5	Historical and indigenous knowledge integrated into risk assessments	5					-	2	2
A.2.6	Activities that increase or compound risks (e.g., urbanization and land use) identified and evaluated	-	-	-	-		-	-	1
A.2.7	Risk assessment results integrated into local risk management plans and warning messages in a clear and easy-to-understand language with attention to how different people assess information	5					-	1	1
A.2.8	Legislation and cultural norms assessed to identify gaps that may increase vulnerability	-	-	-	-		-	-	-
A.3 Are roles and responsibilities of stakeholders identified?		**3.8**	**2.5**	**3.5**	**-**	**3.0**	**3.0**	**3.4**	**3.6**
A.3.1	Key national government agencies involved in risk assessments (including hazard, vulnerability, and capacity assessments) are identified and roles defined	2	2	4	-	3	3.0	2	3
A.3.2	Legislation or government policy mandating the preparation of hazard, vulnerability and capacity assessments for all areas are in place	3					-	3	3
A.3.3	Responsibility for coordinating hazard identification and risk information (exposure, social and physical vulnerability, and capacity) assigned to one national organization with a view to consolidating approaches and monitoring linkages and cascading impacts	5					-	5	5
A.3.4	Process developed for scientific and technical experts to assess and review the accuracy of risk data and information	5					-	4	4
A.3.5	Process developed to actively engage rural and urban communities in local hazard and risk assessments taking into consideration the needs of all people (women, children, older people, people with disabilities, etc.)	-	3	3	-	3	3.0	3	3
A.4 Is risk information consolidated?		**4.5**	**3.0**	**3.0**	**3.0**	**3.5**	**3.2**	**2.5**	**2.5**
A.4.1	Central standardized repository (including but not limited to a Geographic Information System) established to store all event/disaster and risk information	5					-	2	2
A.4.2	National standards (where possible, following international standards) established for the systematic collection, sharing and assessment of risk information and data related to hazards, exposures, vulnerabilities, and capacities	5	3	3	-	4	3.3	3	3
A.4.3	Standardized vulnerability data and information disaggregated by sex, age, and disability	3	3	3	3	3	3.0	3	3
A.4.4	Process established to maintain, regularly review, and update risk data, including information on any new or emerging vulnerabilities and hazards, with roles and responsibilities of stakeholders identified along with appropriate funding	5					-	2	2
A.5 Is risk information properly incorporated into the early warning system?		**-**	**4.0**	**3.0**	**4.0**	**4.0**	**3.8**	**2.5**	**2.5**
A.5.1	Information on the geographical extent of hazards used to define safe areas and evacuation zones	-	-	-	-		-	2	2
A.5.2	Risk information on vulnerable groups (hazard, exposure, differential vulnerability) used to identify and define evacuation routes and location of temporary shelters	-	4	3	4	4	3.8	4	4
A.5.3	Risk information on different types of assets reviewed to outline procedures to minimize damage or loss of such assets once a warning is issued	-	-	-	-		-	2	2
A.5.4	Process established for continuous update on new or emerging risks (e.g., due to urban expansion or establishment of new settlements) and potential changes to some hazards (due to changes in land use) to update safe areas, evacuation zones and shelters	-	-	-	-		-	2	2

(Appendix C: Raw Data Score Sheets Continued…)

Myanmar

Hazard Detection, Monitoring, Analysis, and Forecasting

No.	Sub-Element	Desk Study Score	Stakeholder Inputs				SH Score Average	Post-FGD Adjusted Score	Final Score
			MY1	MY2	MY3	MY4			
B.1 Are there monitoring systems in place?		**5.0**	-	-	-	-	-	**2.0**	**2.0**
B.1.1	Monitoring network established that monitors hazards that impact the country	5					-	2	2
B.1.2	Measurement parameters and specifications documented for each relevant hazard	5					-	2	2
B.1.3	Technical equipment, suited to local conditions and circumstances, in place and personnel trained in its use and maintenance	5					-	2	2
B.1.4	Monitoring data received, processed and available in an interoperable format in real time or near real time	5					-	2	2
B.1.5	Monitoring data and metadata routinely curated with quality controls, archived and accessible for verification, research purposes and other applications	5					-	2	2
B.1.6	Monitoring hardware and software maintenance conducted routinely, and costs and resources considered from the beginning to ensure optimal operation of the system over time	5					-	2	2
B.1.7	The system is able to combine and benefit from new and older technology allowing for exchange of data among countries with different technical capabilities	5					-	2	2
B.2 Are there forecasting and warning services in place?		**5.0**	-	-	-	-	-	**2.0**	**2.1**
B.2.1	Data analysis and processing, modelling, prediction, and warning products generated based on accepted scientific and technical methodologies and disseminated within international standards and protocols	5					-	2	2
B.2.2	New data analysis and processing, modelling, prediction, and warning products can be integrated easily in the system as science and technology evolve	5					-	2	2
B.2.3	Warning centers are operational at all times (24 hours/day, seven days/week) and staffed by trained personnel following appropriate national and international standards	5					-	2	3
B.2.4	Warning messages are clear, consistent and include risk and impact information and are designed with consideration for linking threat levels to emergency preparedness and response actions	5					-	2	2
B.2.5	Software and data analysis for the received data updated periodically and to high security standards	5					-	2	2
B.2.6	The state of the monitoring and data analysis systems continuously monitored for any data gaps, connection issues or processing issues	5					-	2	2
B.2.7	Warnings generated and disseminated in an efficient and timely manner for each type of hazard	5					-	2	2
B.2.8	Warning system(s) subjected to regular system-wide tests and exercises	5					-	2	2
B.3 Are there institutional mechanisms in place?		**4.5**	**2.7**	**3.0**	**3.0**	**5.0**	**3.4**	**3.0**	**3.0**
B.3.1	Plans and documents for monitoring networks available and agreed upon with experts and relevant authorities	-	2	3	3	5	3	3	3
B.3.2	Agreements and interagency protocols established within country for exchange of monitoring systems data and baseline data needed for certain data products (e.g., bathymetric, and topographic data for tsunami modelling)	5	2	3	3	5	3	3	3
B.3.3	Agreements and interagency protocols established to ensure consistency of warning language and communication responsibilities where different hazards are handled by different agencies	3	4	3	3	5	4	3	3
B.3.4	A multi-hazard coordination strategy established to obtain mutual efficiencies and effectiveness among different warning systems	-					-	-	-
B.3.5	Warning system partners, including local authorities and the media, are aware of and respect which organizations are responsible for generation and issuance of warnings	5					-	3	3
B.3.6	Cross-border exchange of warnings and observation data realized through bilateral/multilateral agreements, especially for concerns such as tropical cyclones, floods, diseases, shared basins, data exchange, and technical capacity-building	5					-	3	3

(Appendix C: Raw Data Score Sheets Continued…)

Myanmar

Warning Dissemination and Communication

No.	Sub-Element	Desk Study Score	Stakeholder Inputs				SH Score Average	Post-FGD Adjusted Score	Final Score
			MY1	MY2	MY3	MY4			
C.1 Are organizational and decision-making processes in place and operational?		**2.0**	**2.2**	**3.0**	**3.0**	**4.7**	**3.2**	**2.0**	**2.2**
C.1.1	Functions, roles, and responsibilities of each actor in the warning dissemination process enforced through government policy or legislation at all levels and included in the standard operating procedures	-	4	3	3	5	4	-	3
C.1.2	Warning communication strategies at the national, subnational, and local levels in place that ensure coordination across warning issuers and dissemination channels	-	2	3	3	5	3	-	3
C.1.3	Regular coordination, planning and review meetings between the warning issuers, the media, and other stakeholders	-	3	3	3	5	4	-	2
C.1.4	Professional and volunteer networks established to receive and disseminate warnings widely	2	2	3	3	5	3	2	2
C.1.5	Feedback mechanisms in place to verify that warnings have been received and to correct potential failures in dissemination and communication	-	1	3	3	4	3	-	1
C.1.6	Mechanisms to update the information are in place and are resilient to the event	-	1	3	3	4	3	-	-
C.2 Are communication systems and equipment in place and operational?		**3.0**	**1.1**	**3.0**	**3.0**	**4.3**	**2.8**	**3.0**	**2.1**
C.2.1	Communication and dissemination systems tailored to the different needs of specific groups (urban and rural populations, women and men, older people and youth, people with disabilities, etc.)	2	1	3	3	5	3	2	2
C.2.2	Understanding of last-mile connectivity to know which population groups can be reached by different services, including mobile-cellular, satellite and radio services	4	1	3	3	4	3	4	4
C.2.3	Warning communication and dissemination systems reach the entire population, including seasonal populations and those in remote locations, through multiple communication channels (e.g., satellite and mobile-cellular networks, social media, flags, sirens, bells, public address systems, door-to-door visits, community meetings)	-	1	3	3	4	3	-	2
C.2.4	Communication strategies evaluated to ensure messages are reaching the population	-	1	3	3	4	3	-	1
C.2.5	Agreements developed to utilize private sector resources where appropriate (e.g., mobile-cellular, satellite, television, radio broadcasting, amateur radio, social media) to disseminate warnings	-	1	3	3	-	2	-	4
C.2.6	Equipment maintained and upgraded to utilize new technologies (when appropriate) to ensure interoperability	-	1	3	3	5	3	-	1
C.2.7	Backup systems and processes in place in the event of failure	-	1	3	3	4	3	-	-
C.2.8	Resilience of communication channels and early warning system hardware evaluated in advance to reduce the impact of events on the infrastructure	-					-	-	-
C.2.9	Coverage of communication channels and multiple-channel systems assessed to identify gaps and possible points of failure that may increase vulnerability	-	2	3	3	-	3	-	1
C.3 Are impact-based early warnngs communicated effectively to prompt action by target groups?		**1.0**	**1.7**	**3.0**	**3.0**	**-**	**2.6**	**1.0**	**1.3**
C.3.1	Warning messages provide clear guidance to trigger reactions (e.g., evacuation)	-	3	3	3	-	3	-	1
C.3.2	In the case of events with a short timeframe for reaction (e.g., earthquake early warning), automated systems should be in place to mitigate impacts (e.g., automatic stop of transport, activation of red lights in tunnels, stopping elevators on the closest floor, opening of fire-truck gates, etc.)	-	1	3	3	-	2	-	1
C.3.3	Early warnings should take into account the different risks and needs of subpopulations, including differential vulnerabilities (urban and rural, women and men, older people and youth, people with disabilities, etc.)	-	1	3	3	-	2	-	2
C.3.4	Public and other stakeholders are aware of which authorities issue the warnings and trust their message	1					-	1	1

(Appendix C: Raw Data Score Sheets Continued...)

Myanmar

Preparedness and Response Capabilities

No.	Sub-Element	Desk Study Score	Stakeholder Inputs				SH Score Average	Post-FGD Adjusted Score	Final Score
			MY1	MY2	MY3	MY4			
D.1 Are disaster preparedness measures, including response plans, developed and operational?		**2.4**	**3.2**	**3.0**	**3.0**	**4.3**	**3.2**	**2.0**	**2.5**
D.1.1	Disaster preparedness, including plans or standard operating procedures, developed in a partici-patory manner, disseminated to the community, practiced, and underpinned by legislation where appropriate	2	5	3	3		4	2	4
D.1.2	Disaster preparedness measures, including plans and standard operating procedures, account for the needs of people with different degrees of vulnerability	2	4	3	3		3	2	2
D.1.3	Multi-hazard risk assessments utilized to develop and design evacuation strategies (evacuation routes, demarcation of safe areas and location of temporary shelters, use of vertical evacuation if needed)	2	2	3	3		3	2	2
D.1.4	Community's ability to communicate in response to early warnings assessed	2	2	3	3	5	3	2	1
D.1.5	Contingency planning developed in a scenario-based manner following forecasts or likely scenarios across different timescales and informed by climate projections and scientific research	2	4	3	3		3	2	2
D.1.6	Early action and response options across time and geographical scales are linked to the provision of funding to support them	-	4	3	3	4	4	-	1
D.1.7	Strategies implemented to maintain preparedness for longer return-periods and cascading hazard events	5	3	3	3	4	3	5	5
D.1.8	Protocols incorporated in the plans or standard operating procedures to reach emergency and health services that need to be ready to respond to events promptly	-	3	3	3		3	-	2
D.1.9	Protocols established to activate and mobilize last-mile operators (e.g., local police, firefighters, volunteers, health services) who disseminate warnings to the public and decide public measures, including issuing orders for evacuation or sheltering in place	-	2	3	3	4	3	-	4
D.1.10	Regular exercises undertaken to test and optimize the effectiveness of early warning dissemination processes, preparedness, and response to warning	2					-	2	2
D.2 Are public awareness and education campaigns conducted?		**1.7**	**2.8**	**3.0**	**3.0**	**5.0**	**3.1**	**1.7**	**2.4**
D.2.1	Ongoing public awareness and education programmes on hazards that could impact the population, vulnerabilities, exposure and how to reduce disaster impacts built into school curricula from primary through university	3	4	3	3		3	3	3
D.2.2	Public education provided to recognize hydro-meteorological and geophysical hazard signals and dis-ease signs and symptoms in order to contribute to community surveillance and to allow and promote robust no-regret response measures	-	4	3	3		3	-	3
D.2.3	People educated on how warnings will be disseminated, which sources are reliable and how to respond	-	2	3	3	5	3	-	2
D.2.4	Utilization of the most effective media (e.g., established broadcasting media, social networks, alter-native media) to improve public awareness	1	2	3	3		3	1	1
D.2.5	Public awareness and education campaigns tailored to the specific needs of vulnerable groups (e.g., women, children, older people, and people with disabilities)	1	2	3	3		3	1	3
D.3 Is public awareness and response tested and evaluated?		**4.0**	**4.0**	**3.0**	**3.0**	**5.0**	**3.5**	**3.5**	**3.5**
D.3.1	Previous emergency and disaster events and responses analyzed, and lessons learned incorporated into preparedness and response plans and into capacity-building strategies	5	4	3	3	5	4	4	4
D.3.2	Public awareness strategies and programmes evaluated regularly and updated as required	3	4	3	3		3	3	3

(Appendix C: Raw Data Score Sheets Continued…)

Philippines

Summary

Thematic Area	Desk Study Score	Revised Score Based on FGD	Final Score
A. Disaster Risk Knowledge			
A.1 Are key hazards and related threats identified?	4.0	4.0	4.0
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?	2.8	3.9	3.6
A.3 Are roles and responsibilities of stakeholders identified?	4.6	4.6	4.6
A.4 Is risk information consolidated?	4.0	4.3	4.0
A.5 Is risk information properly incorporated into the early warning system?	4.0	4.0	3.8
Thematic Area Score	**3.9**	**4.1**	**4.0**
B. Detection, Monitoring, Analysis			
B.1 Are there monitoring systems in place?	4.5	4.7	4.3
B.2 Are there forecasting and warning services in place?	3.5	4.4	4.3
B.3 Are there institutional mechanisms in place?	4.3	4.2	4.2
Thematic Area Score	**4.1**	**4.4**	**4.2**
C. Warning Dissemination and Communications			
C.1 Are organizational and decision-making processes in place and operational?	4.2	4.2	4.0
C.2 Are communication systems and equipment in place and operational?	3.0	3.8	3.4
C.3 Are impact-based early warning communicated effectively to prompt action by target groups?	4.3	4.3	4.3
Thematic Area Score	**3.8**	**4.1**	**3.9**
D. Preparedness and Response			
D.1 Are disaster preparedness measures, including response plans, developed and operational?	3.9	3.9	3.9
D.2 Are public awareness and education campaigns conducted?	4.8	4.2	4.2
D.3 Is public awareness and response tested and evaluated?	3.5	4.0	4.0
Thematic Area Score	**4.1**	**4.0**	**4.0**

(Appendix C: Raw Data Score Sheets Continued…)

Philippines

Disaster Risk Knowledge

No.	Sub-Element	Desk Study Score	Stakeholder Inputs									SH Score Average	Post-FGD Adjusted Score	Final Score
			PH1	PH2	PH3	PH4	PH5	PH6	PH7	PH8	PH9			
A.1 Are key hazards and related threats identified?		**4.0**	-	-	-	-	-	-	-	-	-	-	**4.0**	**4.0**
A.1.A	Characteristics of key hazards (e.g., geographical extent, magnitude, intensity, disease transmissibility, frequency, probability), including possible cascading hazardous events, are analyzed, historical data evaluated, and potential future risks assessed	4										-	4.0	4
A.1.2	Hazard maps (dynamic and multi-hazard, when possible) are developed that identify the geographical areas/people that could be affected by hazards	4										-	4.0	4
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?		**2.8**	**4.0**	**5.0**	**-**	**-**	**-**	**-**	**3.5**	**4.0**	**4.0**	**4.1**	**3.9**	**4.0**
A.2.1	Assessment and quantification of exposed people, services (e.g., hospitals) and critical infrastructure (e.g., electricity and water works, quality of building stock) conducted and mapped for all relevant hazards, as well as of any compounding risks, at local level in both rural and urban areas and coastlines	2										-	4.0	4
A.2.2	Impacts to critical infrastructure and secondary risks associated with these impacts are evaluated, and risk management solutions considered to increase resilience	3										-	3.0	3
A.2.3	Vulnerability factors such as gender, disability, access to infrastructure, economic diversity, societal inequalities, and environmental sensitivities considered	3	4	5					3	4	4	4.0	4.0	4
A.2.4	Vulnerabilities of key economic sectors at national to local levels assessed	3										-	4.0	3
A.2.5	Historical and indigenous knowledge integrated into risk assessments	3										-	4.0	3
A.2.6	Activities that increase or compound risks (e.g., urbanization and land use) identified and evaluated	-	-									-	4.0	4
A.2.7	Risk assessment results integrated into local risk management plans and warning messages in a clear and easy-to-understand language with attention to how different people assess information	3	4	5					4	4	4	4.2	4.0	4
A.2.8	Legislation and cultural norms assessed to identify gaps that may increase vulnerability	-	-									-	-	-
A.3 Are roles and responsibilities of stakeholders identified?		**4.6**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**4.6**	**4.6**
A.3.1	Key national government agencies involved in risk assessments (including hazard, vulnerability, and capacity assessments) are identified and roles defined	5										-	5.0	5
A.3.2	Legislation or government policy mandating the preparation of hazard, vulnerability and capacity assessments for all areas are in place	5										-	5.0	5
A.3.3	Responsibility for coordinating hazard identification and risk information (exposure, social and physical vulnerability, and capacity) assigned to one national organization with a view to consolidating approaches and monitoring linkages and cascading impacts	5										-	5.0	5
A.3.4	Process developed for scientific and technical experts to assess and review the accuracy of risk data and information	4										-	4.0	4
A.3.5	Process developed to actively engage rural and urban communities in local hazard and risk assessments taking into consideration the needs of all people (women, children, older people, people with disabilities, etc.)	4										-	4.0	4
A.4 Is risk information consolidated?		**4.0**	**3.0**	**-**	**-**	**-**	**-**	**-**	**3.0**	**3.0**	**3.0**	**3.0**	**4.3**	**4.0**
A.4.1	Central standardized repository (including but not limited to a Geographic Information System) established to store all event/disaster and risk information	3										-	4.0	4
A.4.2	National standards (where possible, following international standards) established for the systematic collection, sharing and assessment of risk information and data related to hazards, exposures, vulnerabilities, and capacities	-	-									-	4.0	4
A.4.3	Standardized vulnerability data and information disaggregated by sex, age, and disability	5	3	-					3	3	3	3.0	5.0	4
A.4.4	Process established to maintain, regularly review, and update risk data, including information on any new or emerging vulnerabilities and hazards, with roles and responsibilities of stakeholders identified along with appropriate funding	4										-	4.0	4
A.5 Is risk information properly incorporated into the early warning system?		**4.0**	**2.0**	**-**	**-**	**-**	**-**	**-**	**4.0**	**3.0**	**3.0**	**3.0**	**4.0**	**3.8**
A.5.1	Information on the geographical extent of hazards used to define safe areas and evacuation zones	4										-	4.0	4
A.5.2	Risk information on vulnerable groups (hazard, exposure, differential vulnerability) used to identify and define evacuation routes and location of temporary shelters	4										-	4.0	4
A.5.3	Risk information on different types of assets reviewed to outline procedures to minimize damage or loss of such assets once a warning is issued	-	2	-					4	3	3	3.0		3
A.5.4	Process established for continuous update on new or emerging risks (e.g., due to urban expansion or establishment of new settlements) and potential changes to some hazards (due to changes in land use) to update safe areas, evacuation zones and shelters	-	-									-		4

(Appendix C: Raw Data Score Sheets Continued…)

Philippines

Hazard Detection, Monitoring, Analysis, and Forecasting

No.	Sub-Element	Desk Study Score	Stakeholder Inputs									SH Score Average	Post-FGD Adjusted Score	Final Score
			PH1	PH2	PH3	PH4	PH5	PH6	PH7	PH8	PH9			
B.1 Are there monitoring systems in place?		**4.5**	**4.0**	**-**	**3.5**	**3.0**	**5.0**	**2.5**	**-**	**3.5**	**-**	**3.6**	**4.7**	**4.3**
B.1.1	Monitoring network established that monitors hazards that impact the country	5										-	5.0	5
B.1.2	Measurement parameters and specifications documented for each relevant hazard	5										-	5.0	5
B.1.3	Technical equipment, suited to local conditions and circumstances, in place and personnel trained in its use and maintenance	4										-	5.0	5
B.1.4	Monitoring data received, processed and available in an interoperable format in real time or near real time	4										-	5.0	4
B.1.5	Monitoring data and metadata routinely curated with quality controls, archived and accessible for verification, research purposes and other applications	-	4	-	3	2	5	1		4		3.2	4.0	3
B.1.6	Monitoring hardware and software maintenance conducted routinely, and costs and resources considered from the beginning to ensure optimal operation of the system over time	-	4	-	4	4	5	4		3		4.0	4.0	4
B.1.7	The system is able to combine and benefit from new and older technology allowing for exchange of data among countries with different technical capabilities	-	-									-	5.0	4
B.2 Are there forecasting and warning services in place?		**3.5**	**3.3**	**4.7**	**3.3**	**3.0**	**4.3**	**3.3**	**-**	**3.3**	**-**	**3.6**	**4.4**	**4.3**
B.2.1	Data analysis and processing, modelling, prediction, and warning products generated based on accepted scientific and technical methodologies and disseminated within international standards and protocols	5										-	5.0	5
B.2.2	New data analysis and processing, modelling, prediction, and warning products can be integrated easily in the system as science and technology evolve	2										-	4.0	4
B.2.3	Warning centers are operational at all times (24 hours/day, seven days/week) and staffed by trained personnel following appropriate national and international standards	5										-	5.0	5
B.2.4	Warning messages are clear, consistent and include risk and impact information and are designed with consideration for linking threat levels to emergency preparedness and response actions	3										-	5.0	5
B.2.5	Software and data analysis for the received data updated periodically and to high security standards	4										-	4.0	4
B.2.6	The state of the monitoring and data analysis systems continuously monitored for any data gaps, connection issues or processing issues	4	3	5	3	4	5	3		3		3.7	4.0	4
B.2.7	Warnings generated and disseminated in an efficient and timely manner for each type of hazard	3	4	5	4	4	4	4		4		4.1	4.0	4
B.2.8	Warning system(s) subjected to regular system-wide tests and exercises	2	3	4	3	1	4	3	-	3		3.0	4.0	3
B.3 Are there institutional mechanisms in place?		**4.3**	**4.3**	**4.5**	**3.7**	**2.0**	**4.7**	**3.7**	**4.0**	**4.0**	**-**	**3.8**	**4.2**	**4.2**
B.3.1	Plans and documents for monitoring networks available and agreed upon with experts and relevant authorities	-	4	-	4	1	5	1	-	4		3.2	4.0	-
B.3.2	Agreements and interagency protocols established within country for exchange of monitoring systems data and baseline data needed for certain data products (e.g., bathymetric, and topographic data for tsunami modelling)	-	4	4	4	3	4	5	4	4		4.0	4.0	4
B.3.3	Agreements and interagency protocols established to ensure consistency of warning language and communication responsibilities where different hazards are handled by different agencies	4	5	5	3	2	5	5	4	4		4.1	4.0	4
B.3.4	A multi-hazard coordination strategy established to obtain mutual efficiencies and effectiveness among different warning systems	4										-	4.0	4
B.3.5	Warning system partners, including local authorities and the media, are aware of and respect which organizations are responsible for generation and issuance of warnings	5										-	5.0	5
B.3.6	Cross-border exchange of warnings and observation data realized through bilateral/ multilateral agreements, especially for concerns such as tropical cyclones, floods, diseases, shared basins, data exchange, and technical capacity-building	4										-	4.0	4

(Appendix C: Raw Data Score Sheets Continued…)

Philippines

Warning Dissemination and Communication

No.	Sub-Element	Desk Study Score	Stakeholder Inputs									SH Score Average	Post-FGD Adjusted Score	Final Score
			PH1	PH2	PH3	PH4	PH5	PH6	PH7	PH8	PH9			
C.1 Are organizational and decision-making processes in place and operational?		**4.2**	**3.0**	**3.0**	**3.0**	**3.5**	**4.0**	**2.0**	**3.0**	**3.5**	**-**	**3.1**	**4.2**	**4.0**
C.1.1	Functions, roles, and responsibilities of each actor in the warning dissemination process enforced through government policy or legislation at all levels and included in the standard operating procedures	4										-	4.0	4
C.1.2	Warning communication strategies at the national, subnational, and local levels in place that ensure coordination across warning issuers and dissemination channels	5										-	5.0	5
C.1.3	Regular coordination, planning and review meetings between the warning issuers, the media, and other stakeholders	4										-	4.0	4
C.1.4	Professional and volunteer networks established to receive and disseminate warnings widely	4										-	4.0	4
C.1.5	Feedback mechanisms in place to verify that warnings have been received and to correct potential failures in dissemination and communication	4	3	3	3	4	4	2		3		3.1	4.0	4
C.1.6	Mechanisms to update the information are in place and are resilient to the event	-	3	3	3	3	4	2	3	4		3.1	4.0	3
C.2 Are communication systems and equipment in place and operational?		**3.0**	**3.3**	**4.1**	**3.3**	**2.0**	**3.6**	**2.4**	**3.0**	**2.6**	**3.0**	**3.0**	**3.8**	**3.4**
C.2.1	Communication and dissemination systems tailored to the different needs of specific groups (urban and rural populations, women and men, older people and youth, people with disabilities, etc.)	3	3	3	3	4	4	4	3	4	3	3.4	3.0	3
C.2.2	Understanding of last-mile connectivity to know which population groups can be reached by different services, including mobile-cellular, satellite and radio services	-	3	4	4	2	3	2		2		2.9	4.0	3
C.2.3	Warning communication and dissemination systems reach the entire population, including seasonal populations and those in remote locations, through multiple communication channels (e.g., satellite and mobile-cellular networks, social media, flags, sirens, bells, public address systems, door-to-door visits, community meetings)	4										-	4.0	4
C.2.4	Communication strategies evaluated to ensure messages are reaching the population	-	4	5			2			3		3.5	4.0	4
C.2.5	Agreements developed to utilize private sector resources where appropriate (e.g., mobile-cellular, satellite, television, radio broadcasting, amateur radio, social media) to disseminate warnings	4	4	5	3	1	5	4	3	2	3	3.3	4.0	4
C.2.6	Equipment maintained and upgraded to utilize new technologies (when appropriate) to ensure interoperability	3	3	-				2	-	3		2.7	4.0	4
C.2.7	Backup systems and processes in place in the event of failure	2	3	4	3	2	4	2		3		3.0	4.0	3
C.2.8	Resilience of communication channels and early warning system hardware evaluated in advance to reduce the impact of events on the infrastructure	2	3	4	4	2	4	2		2		3.0	4.0	3
C.2.9	Coverage of communication channels and multiple-channel systems assessed to identify gaps and possible points of failure that may increase vulnerability	-	3	4	3	1	3	1		2		2.4	3.0	3
C.3 Are impact-based early warnngs communicated effectively to prompt action by target groups?		**4.3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**4.3**	**4.3**
C.3.1	Warning messages provide clear guidance to trigger reactions (e.g., evacuation)	4										-	4.0	4
C.3.2	In the case of events with a short timeframe for reaction (e.g., earthquake early warning), automated systems should be in place to mitigate impacts (e.g., automatic stop of transport, activation of red lights in tunnels, stopping elevators on the closest floor, opening of fire-truck gates, etc.)	5										-	5.0	5
C.3.3	Early warnings should take into account the different risks and needs of subpopulations, including differential vulnerabilities (urban and rural, women and men, older people and youth, people with disabilities, etc.)	4										-	4.0	4
C.3.4	Public and other stakeholders are aware of which authorities issue the warnings and trust their message	4										-	4.0	4

(Appendix C: Raw Data Score Sheets Continued…)

Philippines

Preparedness and Response Capabilities

No.	Sub-Element	Desk Study Score	Stakeholder Inputs									SH Score Average	Post-FGD Adjusted Score	Final Score
			PH1	PH2	PH3	PH4	PH5	PH6	PH7	PH8	PH9			
D.1 Are disaster preparedness measures, including response plans, developed and operational?		**3.9**	**2.8**	**3.7**	**3.8**	**2.3**	**4.0**	**-**	**-**	**5.0**	**-**	**3.5**	**3.9**	**3.9**
D.1.1	Disaster preparedness, including plans or standard operating procedures, developed in a participatory manner, disseminated to the community, practiced, and underpinned by legislation where appropriate	4										-	4.0	4
D.1.2	Disaster preparedness measures, including plans and standard operating procedures, account for the needs of people with different degrees of vulnerability	4										-	4.0	4
D.1.3	Multi-hazard risk assessments utilized to develop and design evacuation strategies (evacuation routes, demarcation of safe areas and location of temporary shelters, use of vertical evacuation if needed)	3	3	4	4	2	5			5		3.8	4.0	4
D.1.4	Community's ability to communicate in response to early warnings assessed	4	3	3	4	3	3			5		3.5	4.0	4
D.1.5	Contingency planning developed in a scenario-based manner following forecasts or likely scenarios across different timescales and informed by climate projections and scientific research	4										-	4.0	4
D.1.6	Early action and response options across time and geographical scales are linked to the provision of funding to support them	-	2	-	3	1	4			5		3.0	3.0	3
D.1.7	Strategies implemented to maintain preparedness for longer return-periods and cascading hazard events	4										-	4.0	4
D.1.8	Protocols incorporated in the plans or standard operating procedures to reach emergency and health services that need to be ready to respond to events promptly	4										-	4.0	4
D.1.9	Protocols established to activate and mobilize last-mile operators (e.g., local police, firefighters, volunteers, health services) who disseminate warnings to the public and decide public measures, including issuing orders for evacuation or sheltering in place	4	3	4	4	3	4			5		3.8	4.0	4
D.1.10	Regular exercises undertaken to test and optimize the effectiveness of early warning dissemination processes, preparedness, and response to warning	4										-	4.0	4
D.2 Are public awareness and education campaigns conducted?		**4.8**	**2.5**	**5.0**	**4.0**	**3.0**	**4.0**	**-**	**-**	**-**	**-**	**3.7**	**4.2**	**4.2**
D.2.1	Ongoing public awareness and education pro-grammes on hazards that could impact the population, vulnerabilities, exposure and how to reduce disaster impacts built into school curricula from primary through university	5										-	3.0	3
D.2.2	Public education provided to recognize hydro-meteorological and geophysical hazard signals and disease signs and symptoms in order to contribute to community surveillance and to allow and promote robust no-regret response measures	5	2	5	4	3	4					3.6	4.0	4
D.2.3	People educated on how warnings will be disseminated, which sources are reliable and how to respond	5										-	5.0	5
D.2.4	Utilization of the most effective media (e.g., established broadcasting media, social networks, alter-native media) to improve public awareness	5										-	5.0	5
D.2.5	Public awareness and education campaigns tailored to the specific needs of vulnerable groups (e.g., women, children, older people, and people with disabilities)	4	3	5	4	3	4					3.8	4.0	4
D.3 Is public awareness and response tested and evaluated?		**3.5**	**2.5**	**5.0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3.8**	**4.0**	**4.0**
D.3.1	Previous emergency and disaster events and responses analyzed, and lessons learned incorporated into preparedness and response plans and into capacity-building strategies	4	3	5								4.0	4.0	4
D.3.2	Public awareness strategies and programmes evaluated regularly and updated as required	3	2	5								3.5	4.0	4

(Appendix C: Raw Data Score Sheets Continued…)

Singapore

Summary

Thematic Area	Desk Study Score	Revised Score Based on FGD	Final Score
A. Disaster Risk Knowledge			
A.1 Are key hazards and related threats identified?	4.0	4.0	4.0
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?	4.0	4.0	4.0
A.3 Are roles and responsibilities of stakeholders identified?	3.8	3.5	4.2
A.4 Is risk information consolidated?	2.8	3.5	4.3
A.5 Is risk information properly incorporated into the early warning system?	4.0	4.0	4.0
Thematic Area Score	**3.7**	**3.8**	**4.1**
B. Detection, Monitoring, Analysis			
B.1 Are there monitoring systems in place?	3.7	3.5	4.0
B.2 Are there forecasting and warning services in place?	3.6	3.5	4.1
B.3 Are there institutional mechanisms in place?	3.3	3.3	4.0
Thematic Area Score	**3.5**	**3.4**	**4.0**
C. Warning Dissemination and Communications			
C.1 Are organizational and decision-making processes in place and operational?	3.5	3.8	4.2
C.2 Are communication systems and equipment in place and operational?	3.8	4.0	4.0
C.3 Are impact-based early warning communicated effectively to prompt action by target groups?	4.3	4.3	4.3
Thematic Area Score	**3.9**	**4.0**	**4.2**
D. Preparedness and Response			
D.1 Are disaster preparedness measures, including response plans, developed and operational?	3.9	3.9	3.9
D.2 Are public awareness and education campaigns conducted?	4.0	4.0	4.0
D.3 Is public awareness and response tested and evaluated?	3.0	3.0	3.5
Thematic Area Score	**3.6**	**3.6**	**3.8**

(Appendix C: Raw Data Score Sheets Continued…)
Singapore

Disaster Risk Knowledge

No.	Sub-Element	Desk Study Score	Stakeholder Inputs		SH Score Average	Post-FGD Adjusted Score	Final Score
			SG1	SG2			
A.1 Are key hazards and related threats identified?		**4.0**	**-**	**-**	**-**	**4.0**	**4.0**
A.1.A	Characteristics of key hazards (e.g., geographical extent, magnitude, intensity, disease transmissibility, frequency, probability), including possible cascading hazardous events, are analyzed, historical data evaluated, and potential future risks assessed	4			-	4	4
A.1.2	Hazard maps (dynamic and multi-hazard, when possible) are developed that identify the geographical areas/people that could be affected by hazards	4			-	4	4
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?		**4.0**	**-**	**-**	**-**	**4.0**	**4.0**
A.2.1	Assessment and quantification of exposed people, services (e.g., hospitals) and critical infrastructure (e.g., electricity and water works, quality of building stock) conducted and mapped for all relevant hazards, as well as of any compounding risks, at local level in both rural and urban areas and coastlines	5			-	5	5
A.2.2	Impacts to critical infrastructure and secondary risks associated with these impacts are evaluated, and risk management solutions considered to increase resilience	5			-	5	5
A.2.3	Vulnerability factors such as gender, disability, access to infrastructure, economic diversity, societal inequalities, and environmental sensitivities considered	4	-		-	4	4
A.2.4	Vulnerabilities of key economic sectors at national to local levels assessed	4			-	4	4
A.2.5	Historical and indigenous knowledge integrated into risk assessments	2	-	-	-	2	2
A.2.6	Activities that increase or compound risks (e.g., urbanization and land use) identified and evaluated	3		-	-	3	3
A.2.7	Risk assessment results integrated into local risk management plans and warning messages in a clear and easy-to-understand language with attention to how different people assess information	4	-		-	4	4
A.2.8	Legislation and cultural norms assessed to identify gaps that may increase vulnerability	5			-	5	5
A.3 Are roles and responsibilities of stakeholders identified?		**3.5**	**3.7**	**4.0**	**3.7**	**3.5**	**4.2**
A.3.1	Key national government agencies involved in risk assessments (including hazard, vulnerability, and capacity assessments) are identified and roles defined	4	4	4	4.0	4	4
A.3.2	Legislation or government policy mandating the preparation of hazard, vulnerability and capacity assessments for all areas are in place	2			-	2	4
A.3.3	Responsibility for coordinating hazard identification and risk information (exposure, social and physical vulnerability, and capacity) assigned to one national organization with a view to consolidating approaches and monitoring linkages and cascading impacts	4			-	4	4
A.3.4	Process developed for scientific and technical experts to assess and review the accuracy of risk data and information	-	3	-	3.0	-	5
A.3.5	Process developed to actively engage rural and urban communities in local hazard and risk assessments taking into consideration the needs of all people (women, children, older people, people with disabilities, etc.)	4	4	-	4.0	4	4
A.4 Is risk information consolidated?		**3.7**	**4.0**	**4.0**	**4.0**	**3.5**	**4.3**
A.4.1	Central standardized repository (including but not limited to a Geographic Information System) established to store all event/disaster and risk information	4			-	4	4
A.4.2	National standards (where possible, following international standards) established for the systematic collection, sharing and assessment of risk information and data related to hazards, exposures, vulnerabilities, and capacities	4	4	4	4.0	-	4
A.4.3	Standardized vulnerability data and information disaggregated by sex, age, and disability	3		-	-	3	5
A.4.4	Process established to maintain, regularly review, and update risk data, including information on any new or emerging vulnerabilities and hazards, with roles and responsibilities of stakeholders identified along with appropriate funding	-	4	4	4.0	-	4
A.5 Is risk information properly incorporated into the early warning system?		**4.0**	**-**	**5.0**	**5.0**	**4.0**	**4.0**
A.5.1	Information on the geographical extent of hazards used to define safe areas and evacuation zones	4	-	-	-	4	4
A.5.2	Risk information on vulnerable groups (hazard, exposure, differential vulnerability) used to identify and define evacuation routes and location of temporary shelters	4	-	5	5.0	4	4
A.5.3	Risk information on different types of assets reviewed to outline procedures to minimize damage or loss of such assets once a warning is issued	4	-	5	5.0	4	4
A.5.4	Process established for continuous update on new or emerging risks (e.g., due to urban expansion or establishment of new settlements) and potential changes to some hazards (due to changes in land use) to update safe areas, evacuation zones and shelters	4			-	4	4

(Appendix C: Raw Data Score Sheets Continued…)

Singapore

Hazard Detection, Monitoring, Analysis, and Forecasting

No.	Sub-Element	Desk Study Score	Stakeholder Inputs		SH Score Average	Post-FGD Adjusted Score	Final Score
			SG1	SG2			
B.1 Are there monitoring systems in place?		**3.5**	**4.0**	**-**	**4.0**	**3.5**	**4.0**
B.1.1	Monitoring network established that monitors hazards that impact the country	3			-	3	4
B.1.2	Measurement parameters and specifications documented for each relevant hazard	3			-	3	4
B.1.3	Technical equipment, suited to local conditions and circumstances, in place and personnel trained in its use and maintenance	-	4		4.0	-	4
B.1.4	Monitoring data received, processed and available in an interoperable format in real time or near real time	4			-	4	4
B.1.5	Monitoring data and metadata routinely curated with quality controls, archived and accessible for verification, research purposes and other applications	4	-		-	4	4
B.1.6	Monitoring hardware and software maintenance conducted routinely, and costs and resources considered from the beginning to ensure optimal operation of the system over time	4	4		4.0	4	4
B.1.7	The system is able to combine and benefit from new and older technology allowing for exchange of data among countries with different technical capabilities	3			-	3	4
B.2 Are there forecasting and warning services in place?		**3.5**	**4.3**	**-**	**4.3**	**3.5**	**4.1**
B.2.1	Data analysis and processing, modelling, prediction, and warning products generated based on accepted scientific and technical methodologies and disseminated within international standards and protocols	3	-		-	3	5
B.2.2	New data analysis and processing, modelling, prediction, and warning products can be integrated easily in the system as science and technology evolve	3			-	3	4
B.2.3	Warning centers are operational at all times (24 hours/day, seven days/week) and staffed by trained personnel following appropriate national and international standards	-	5		5.0	-	5
B.2.4	Warning messages are clear, consistent and include risk and impact information and are designed with consideration for linking threat levels to emergency preparedness and response actions	4			-	4	4
B.2.5	Software and data analysis for the received data updated periodically and to high security standards	3			-	3	3
B.2.6	The state of the monitoring and data analysis systems continuously monitored for any data gaps, connection issues or processing issues	-	4		4.0	-	4
B.2.7	Warnings generated and disseminated in an efficient and timely manner for each type of hazard	4	4		4.0	4	4
B.2.8	Warning system(s) subjected to regular system-wide tests and exercises	4			-	4	4
B.3 Are there institutional mechanisms in place?		**3.3**	**-**	**-**	**-**	**3.3**	**4.0**
B.3.1	Plans and documents for monitoring networks available and agreed upon with experts and relevant authorities	3	-		-	3	4
B.3.2	Agreements and interagency protocols established within country for exchange of monitoring systems data and baseline data needed for certain data products (e.g., bathymetric, and topographic data for tsunami modelling)	3			-	3	4
B.3.3	Agreements and interagency protocols established to ensure consistency of warning language and communication responsibilities where different hazards are handled by different agencies	3			-	3	4
B.3.4	A multi-hazard coordination strategy established to obtain mutual efficiencies and effectiveness among different warning systems	3			-	3	4
B.3.5	Warning system partners, including local authorities and the media, are aware of and respect which organizations are responsible for generation and issuance of warnings	4			-	4	4
B.3.6	Cross-border exchange of warnings and observation data realized through bilateral/ multilateral agreements, especially for concerns such as tropical cyclones, floods, diseases, shared basins, data exchange, and technical capacity-building	4			-	4	4

(Appendix C: Raw Data Score Sheets Continued…)

Singapore

Warning Dissemination and Communication

No.	Sub-Element	Desk Study Score	Stakeholder Inputs		SH Score Average	Post-FGD Adjusted Score	Final Score
			SG1	SG2			
C.1 Are organizational and decision-making processes in place and operational?		**3.8**	**4.3**	**-**	**4.3**	**3.8**	**4.2**
C.1.1	Functions, roles, and responsibilities of each actor in the warning dissemination process enforced through government policy or legislation at all levels and included in the standard operating procedures	4			-	4	4
C.1.2	Warning communication strategies at the national, subnational, and local levels in place that ensure coordination across warning issuers and dissemination channels	4			-	4	4
C.1.3	Regular coordination, planning and review meetings between the warning issuers, the media, and other stakeholders	4	4		4.0	4	4
C.1.4	Professional and volunteer networks established to receive and disseminate warnings widely	3			-	3	-
C.1.5	Feedback mechanisms in place to verify that warnings have been received and to correct potential failures in dissemination and communication	-	5		5.0	-	5
C.1.6	Mechanisms to update the information are in place and are resilient to the event	-	4		4.0	-	4
C.2 Are communication systems and equipment in place and operational?		**4.0**	**4.0**	**-**	**4.0**	**4.0**	**4.0**
C.2.1	Communication and dissemination systems tailored to the different needs of specific groups (urban and rural populations, women and men, older people and youth, people with disabilities, etc.)	-	4		4.0	-	4
C.2.2	Understanding of last-mile connectivity to know which population groups can be reached by different services, including mobile-cellular, satellite and radio services	4	4		4.0	4	4
C.2.3	Warning communication and dissemination systems reach the entire population, including seasonal populations and those in remote locations, through multiple communication channels (e.g., satellite and mobile-cellular networks, social media, flags, sirens, bells, public address systems, door-to-door visits, community meetings)	4			-	4	4
C.2.4	Communication strategies evaluated to ensure messages are reaching the population	4			-	4	4
C.2.5	Agreements developed to utilize private sector resources where appropriate (e.g., mobile-cellular, satellite, television, radio broadcasting, amateur radio, social media) to disseminate warnings	4			-	4	4
C.2.6	Equipment maintained and upgraded to utilize new technologies (when appropriate) to ensure interoperability	4	4		4.0	4	4
C.2.7	Backup systems and processes in place in the event of failure	4			-	4	4
C.2.8	Resilience of communication channels and early warning system hardware evaluated in advance to reduce the impact of events on the infrastructure	4			-	4	4
C.2.9	Coverage of communication channels and multiple-channel systems assessed to identify gaps and possible points of failure that may increase vulnerability	4	4		4.0	4	4
C.3 Are impact-based early warnngs communicated effectively to prompt action by target groups?		**4.3**	**-**	**-**	**-**	**4.3**	**4.3**
C.3.1	Warning messages provide clear guidance to trigger reactions (e.g., evacuation)	4			-	4	4
C.3.2	In the case of events with a short timeframe for reaction (e.g., earthquake early warning), automated systems should be in place to mitigate impacts (e.g., automatic stop of transport, activation of red lights in tunnels, stopping elevators on the closest floor, opening of fire-truck gates, etc.)	4			-	4	4
C.3.3	Early warnings should take into account the different risks and needs of subpopulations, including differential vulnerabilities (urban and rural, women and men, older people and youth, people with disabilities, etc.)	4			-	4	4
C.3.4	Public and other stakeholders are aware of which authorities issue the warnings and trust their message	5			-	5	5

(Appendix C: Raw Data Score Sheets Continued...)

Singapore

Preparedness and Response Capabilities

No.	Sub-Element	Desk Study Score	Stakeholder Inputs		SH Score Average	Post-FGD Adjusted Score	Final Score
			SG1	SG2			
D.1 Are disaster preparedness measures, including response plans, developed and operational?		**3.9**	**-**	**-**	**-**	**3.9**	**3.9**
D.1.1	Disaster preparedness, including plans or standard operating procedures, developed in a participatory manner, disseminated to the community, practiced, and underpinned by legislation where appropriate	4			-	4	4
D.1.2	Disaster preparedness measures, including plans and standard operating procedures, account for the needs of people with different degrees of vulnerability	3			-	3	3
D.1.3	Multi-hazard risk assessments utilized to develop and design evacuation strategies (evacuation routes, demarcation of safe areas and location of temporary shelters, use of vertical evacuation if needed)	4			-	4	4
D.1.4	Community's ability to communicate in response to early warnings assessed	4	-		-	4	4
D.1.5	Contingency planning developed in a scenario-based manner following forecasts or likely scenarios across different timescales and informed by climate projections and scientific research	4			-	4	4
D.1.6	Early action and response options across time and geographical scales are linked to the provision of funding to support them	3			-	3	3
D.1.7	Strategies implemented to maintain preparedness for longer return-periods and cascading hazard events	4			-	4	4
D.1.8	Protocols incorporated in the plans or standard operating procedures to reach emergency and health services that need to be ready to respond to events promptly	4			-	4	4
D.1.9	Protocols established to activate and mobilize last-mile operators (e.g., local police, firefighters, volunteers, health services) who disseminate warnings to the public and decide public measures, including issuing orders for evacuation or sheltering in place	4			-	4	4
D.1.10	Regular exercises undertaken to test and optimize the effectiveness of early warning dissemination processes, preparedness, and response to warning	5			-	5	5
D.2 Are public awareness and education campaigns conducted?		**4.0**	**-**	**-**	**-**	**4.0**	**4.0**
D.2.1	Ongoing public awareness and education pro-grammes on hazards that could impact the population, vulnerabilities, exposure and how to reduce disaster impacts built into school curricula from primary through university	4			-	4	4
D.2.2	Public education provided to recognize hydro-meteorological and geophysical hazard signals and disease signs and symptoms in order to contribute to community surveillance and to allow and promote robust no-regret response measures	4			-	4	4
D.2.3	People educated on how warnings will be disseminated, which sources are reliable and how to respond	4			-	4	4
D.2.4	Utilization of the most effective media (e.g., established broadcasting media, social networks, alternative media) to improve public awareness	4			-	4	4
D.2.5	Public awareness and education campaigns tailored to the specific needs of vulnerable groups (e.g., women, children, older people, and people with disabilities)	4			-	4	4
D.3 Is public awareness and response tested and evaluated?		**3.0**	**4.0**	**-**	**4.0**	**3.0**	**3.5**
D.3.1	Previous emergency and disaster events and responses analyzed, and lessons learned incorporated into preparedness and response plans and into capacity-building strategies	3	-		-	3	3
D.3.2	Public awareness strategies and programmes evaluated regularly and updated as required	-	4		4.0	-	4

(Appendix C: Raw Data Score Sheets Continued…)

Thailand

Summary

Thematic Area	Desk Study Score	Revised Score Based on FGD	Final Score
A. Disaster Risk Knowledge			
A.1 Are key hazards and related threats identified?	3.5	3.5	3.5
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?	2.9	3.0	3.0
A.3 Are roles and responsibilities of stakeholders identified?	4.0	4.2	4.2
A.4 Is risk information consolidated?	3.3	3.5	3.5
A.5 Is risk information properly incorporated into the early warning system?	3.0	3.0	3.0
Thematic Area Score	**3.3**	**3.4**	**3.4**
B. Detection, Monitoring, Analysis			
B.1 Are there monitoring systems in place?	3.4	4.0	3.4
B.2 Are there forecasting and warning services in place?	3.8	3.8	3.8
B.3 Are there institutional mechanisms in place?	3.0	3.2	3.2
Thematic Area Score	**3.4**	**3.6**	**3.4**
C. Warning Dissemination and Communications			
C.1 Are organizational and decision-making processes in place and operational?	3.2	4.0	3.5
C.2 Are communication systems and equipment in place and operational?	2.4	2.6	2.6
C.3 Are impact-based early warning communicated effectively to prompt action by target groups?	2.3	2.3	2.3
Thematic Area Score	**2.6**	**3.0**	**2.8**
D. Preparedness and Response			
D.1 Are disaster preparedness measures, including response plans, developed and operational?	3.8	4.0	3.8
D.2 Are public awareness and education campaigns conducted?	2.6	2.6	2.6
D.3 Is public awareness and response tested and evaluated?	3.5	3.5	3.5
Thematic Area Score	**3.3**	**3.4**	**3.3**

(Appendix C: Raw Data Score Sheets Continued…)
Thailand

Disaster Risk Knowledge

No.	Sub-Element	Desk Study Score	Stakeholder Inputs							SH Score Average	Post-FGD Adjusted Score	Final Score
			TH1	TH2	TH3	TH4	TH5	TH6	TH7			
A.1 Are key hazards and related threats identified?		**3.5**	-	-	-	-	-	-	-	-	**3.5**	**3.5**
A.1.A	Characteristics of key hazards (e.g., geographical extent, magnitude, intensity, disease transmissibility, frequency, probability), including possible cascading hazardous events, are analyzed, historical data evaluated, and potential future risks assessed	3								-	3	3
A.1.2	Hazard maps (dynamic and multi-hazard, when possible) are developed that identify the geographical areas/people that could be affected by hazards	4								-	4	4
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?		**2.9**	**4.0**	**5.0**	**4.0**	**2.5**	**4.5**	**3.0**	**5.0**	**3.9**	**3.0**	**3.0**
A.2.1	Assessment and quantification of exposed people, services (e.g., hospitals) and critical infrastructure (e.g., electricity and water works, quality of building stock) conducted and mapped for all relevant hazards, as well as of any compounding risks, at local level in both rural and urban areas and coastlines	3	4	5	4	3	5	3	5	4.1	4	4
A.2.2	Impacts to critical infrastructure and secondary risks associated with these impacts are evaluated, and risk management solutions considered to increase resilience	2								-	2	2
A.2.3	Vulnerability factors such as gender, disability, access to infrastructure, economic diversity, societal inequalities, and environmental sensitivities considered	2								-	2	2
A.2.4	Vulnerabilities of key economic sectors at national to local levels assessed	2								-	2	2
A.2.5	Historical and indigenous knowledge integrated into risk assessments	3		5	4	2	4	3		3.6	3	3
A.2.6	Activities that increase or compound risks (e.g., urbanization and land use) identified and evaluated	4								-	4	4
A.2.7	Risk assessment results integrated into local risk management plans and warning messages in a clear and easy-to-understand language with attention to how different people assess information	4								-	4	4
A.2.8	Legislation and cultural norms assessed to identify gaps that may increase vulnerability	3								-	3	3
A.3 Are roles and responsibilities of stakeholders identified?		**4.0**	-	**4.0**	**4.0**	**1.0**	**4.0**	**3.0**	-	**3.2**	**4.2**	**4.2**
A.3.1	Key national government agencies involved in risk assessments (including hazard, vulnerability, and capacity assessments) are identified and roles defined	5								-	5	5
A.3.2	Legislation or government policy mandating the preparation of hazard, vulnerability and capacity assessments for all areas are in place	5								-	5	5
A.3.3	Responsibility for coordinating hazard identification and risk information (exposure, social and physical vulnerability, and capacity) assigned to one national organization with a view to consolidating approaches and monitoring linkages and cascading impacts	4								-	4	4
A.3.4	Process developed for scientific and technical experts to assess and review the accuracy of risk data and information	3								-	3	3
A.3.5	Process developed to actively engage rural and urban communities in local hazard and risk assessments taking into consideration the needs of all people (women, children, older people, people with disabilities, etc.)	3		4	4	1	4	3		3.2	4	4
A.4 Is risk information consolidated?		**3.3**	-	**3.0**	**3.0**	**2.5**	**3.0**	**4.0**	-	**3.1**	**3.5**	**3.5**
A.4.1	Central standardized repository (including but not limited to a Geographic Information System) established to store all event/disaster and risk information	3								-	3	3
A.4.2	National standards (where possible, following international standards) established for the systematic collection, sharing and assessment of risk information and data related to hazards, exposures, vulnerabilities, and capacities	3								-	3	3
A.4.3	Standardized vulnerability data and information disaggregated by sex, age, and disability	2		3	3	2	2	4		2.8	3	3
A.4.4	Process established to maintain, regularly review, and update risk data, including information on any new or emerging vulnerabilities and hazards, with roles and responsibilities of stakeholders identified along with appropriate funding	5		3	3	3	4	4		3.4	5	5
A.5 Is risk information properly incorporated into the early warning system?		**3.0**	-	**3.0**	**3.0**	**2.0**	**2.0**	**2.0**	-	**2.4**	**3.0**	**3.0**
A.5.1	Information on the geographical extent of hazards used to define safe areas and evacuation zones	4								-	4	4
A.5.2	Risk information on vulnerable groups (hazard, exposure, differential vulnerability) used to identify and define evacuation routes and location of temporary shelters	2								-	2	2
A.5.3	Risk information on different types of assets reviewed to outline procedures to minimize damage or loss of such assets once a warning is issued	1		3	3	2	2	2		2.4	1.0	1.0
A.5.4	Process established for continuous update on new or emerging risks (e.g., due to urban expansion or establishment of new settlements) and potential changes to some hazards (due to changes in land use) to update safe areas, evacuation zones and shelters	5								-	5	5

(Appendix C: Raw Data Score Sheets Continued…)

Thailand

Hazard Detection, Monitoring, Analysis, and Forecasting

No.	Sub-Element	Desk Study Score	Stakeholder Inputs							SH Score Average	Post-FGD Adjusted Score	Final Score
			TH1	TH2	TH3	TH4	TH5	TH6	TH7			
B.1 Are there monitoring systems in place?		**3.4**	**4.5**	**3.0**	**3.5**	**3.5**	**4.0**	**3.5**	**4.0**	**3.8**	**4.0**	**3.4**
B.1.1	Monitoring network established that monitors hazards that impact the country	5								-	5	5
B.1.2	Measurement parameters and specifications documented for each relevant hazard	3								-	3	3
B.1.3	Technical equipment, suited to local conditions and circumstances, in place and personnel trained in its use and maintenance	4								-	4	4
B.1.4	Monitoring data received, processed and available in an interoperable format in real time or near real time	5	4	-	4	3	4	4		3.8	5	5
B.1.5	Monitoring data and metadata routinely curated with quality controls, archived and accessible for verification, research purposes and other applications	3	5	3	3	4	4	3	4	3.7	3	3
B.1.6	Monitoring hardware and software maintenance conducted routinely, and costs and resources considered from the beginning to ensure optimal operation of the system over time	2								-	2	2
B.1.7	The system is able to combine and benefit from new and older technology allowing for exchange of data among countries with different technical capabilities	2								-	2	2
B.2 Are there forecasting and warning services in place?		**3.8**	**4.5**	**3.5**	**4.5**	**4.0**	**4.5**	**4.5**	**4.0**	**4.3**	**3.8**	**3.8**
B.2.1	Data analysis and processing, modelling, prediction, and warning products generated based on accepted scientific and technical methodologies and disseminated within international standards and protocols	4	4	2	4	3	4	4	4	3.6	4	4
B.2.2	New data analysis and processing, modelling, prediction, and warning products can be integrated easily in the system as science and technology evolve	2								-	2	2
B.2.3	Warning centers are operational at all times (24 hours/day, seven days/week) and staffed by trained personnel following appropriate national and international standards	5	5	5	5	5	5	5		5.0	5	5
B.2.4	Warning messages are clear, consistent and include risk and impact information and are designed with consideration for linking threat levels to emergency preparedness and response actions	3								-	3	3
B.2.5	Software and data analysis for the received data updated periodically and to high security standards	3								-	3	3
B.2.6	The state of the monitoring and data analysis systems continuously monitored for any data gaps, connection issues or processing issues	4								-	4	4
B.2.7	Warnings generated and disseminated in an efficient and timely manner for each type of hazard	4								-	4	4
B.2.8	Warning system(s) subjected to regular system-wide tests and exercises	5								-	5	5
B.3 Are there institutional mechanisms in place?		**3.0**	**-**	**5.0**	**4.0**	**5.0**	**5.0**	**5.0**	**-**	**4.8**	**3.2**	**3.2**
B.3.1	Plans and documents for monitoring networks available and agreed upon with experts and relevant authorities	3								-	3	3
B.3.2	Agreements and interagency protocols established within country for exchange of monitoring systems data and baseline data needed for certain data products (e.g., bathymetric, and topographic data for tsunami modelling)	4								-	4	4
B.3.3	Agreements and interagency protocols established to ensure consistency of warning language and communication responsibilities where different hazards are handled by different agencies	2								-	2	2
B.3.4	A multi-hazard coordination strategy established to obtain mutual efficiencies and effectiveness among different warning systems	2								-	2	2
B.3.5	Warning system partners, including local authorities and the media, are aware of and respect which organizations are responsible for generation and issuance of warnings	3		5	4	5	5	5		4.8	4	4
B.3.6	Cross-border exchange of warnings and observation data realized through bilateral/multilateral agreements, especially for concerns such as tropical cyclones, floods, diseases, shared basins, data exchange, and technical capacity-building	4								-	4	4

(Appendix C: Raw Data Score Sheets Continued…)

Thailand

Warning Dissemination and Communication

No.	Sub-Element	Desk Study Score	Stakeholder Inputs							SH Score Average	Post-FGD Adjusted Score	Final Score
			TH1	TH2	TH3	TH4	TH5	TH6	TH7			
C.1 Are organizational and decision-making processes in place and operational?		**3.2**	**-**	**5.0**	**4.5**	**5.0**	**4.5**	**4.0**	**-**	**4.6**	**4.0**	**3.5**
C.1.1	Functions, roles, and responsibilities of each actor in the warning dissemination process enforced through government policy or legislation at all levels and included in the standard operating procedures	3		5	5	5	5	4		4.8	5	5
C.1.2	Warning communication strategies at the national, subnational, and local levels in place that ensure coordination across warning issuers and dissemination channels	3								-	3	3
C.1.3	Regular coordination, planning and review meetings between the warning issuers, the media, and other stakeholders	3								-	3	3
C.1.4	Professional and volunteer networks established to receive and disseminate warnings widely	4		5	4	5	4	4		4.4	4	4
C.1.5	Feedback mechanisms in place to verify that warnings have been received and to correct potential failures in dissemination and communication	2								-	2	2
C.1.6	Mechanisms to update the information are in place and are resilient to the event	4								-	4	4
C.2 Are communication systems and equipment in place and operational?		**2.3**	**-**	**3.5**	**4.0**	**3.5**	**3.8**	**3.0**	**-**	**3.6**	**2.6**	**2.6**
C.2.1	Communication and dissemination systems tailored to the different needs of specific groups (urban and rural populations, women and men, older people and youth, people with disabilities, etc.)	2		4	4	3	3	2		3.2	3	3
C.2.2	Understanding of last-mile connectivity to know which population groups can be reached by different services, including mobile-cellular, satellite and radio services	2								-		-
C.2.3	Warning communication and dissemination systems reach the entire population, including seasonal populations and those in remote locations, through multiple communication channels (e.g., satellite and mobile-cellular networks, social media, flags, sirens, bells, public address systems, door-to-door visits, community meetings)	2		4	4	3	4	3		3.6	3	3
C.2.4	Communication strategies evaluated to ensure messages are reaching the population	2								-	2	2
C.2.5	Agreements developed to utilize private sector resources where appropriate (e.g., mobile-cellular, satellite, television, radio broadcasting, amateur radio, social media) to disseminate warnings	3								-	3	3
C.2.6	Equipment maintained and upgraded to utilize new technologies (when appropriate) to ensure interoperability	3		3	4	4	4	4		3.8	3	3
C.2.7	Backup systems and processes in place in the event of failure	3								-	3	3
C.2.8	Resilience of communication channels and early warning system hardware evaluated in advance to reduce the impact of events on the infrastructure	2								-	2	2
C.2.9	Coverage of communication channels and multiple-channel systems assessed to identify gaps and possible points of failure that may increase vulnerability	2		3	4	4	4	3		3.6	2	2
C.3 Are impact-based early warnngs communicated effectively to prompt action by target groups?		**2.3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.3**	**2.3**
C.3.1	Warning messages provide clear guidance to trigger reactions (e.g., evacuation)	3								-	3	3
C.3.2	In the case of events with a short timeframe for reaction (e.g., earthquake early warning), automated systems should be in place to mitigate impacts (e.g., automatic stop of transport, activation of red lights in tunnels, stopping elevators on the closest floor, opening of fire-truck gates, etc.)	1								-	1	1
C.3.3	Early warnings should take into account the different risks and needs of subpopulations, including differential vulnerabilities (urban and rural, women and men, older people and youth, people with disabilities, etc.)	2								-	2	2
C.3.4	Public and other stakeholders are aware of which authorities issue the warnings and trust their message	3								-	3	3

(Appendix C: Raw Data Score Sheets Continued…)

Thailand

Preparedness and Response Capabilities

No.	Sub-Element	Desk Study Score	Stakeholder Inputs							SH Score Average	Post-FGD Adjusted Score	Final Score
			TH1	TH2	TH3	TH4	TH5	TH6	TH7			
D.1 Are disaster preparedness measures, including response plans, developed and operational?		**3.8**	**4.0**	**3.5**	**4.0**	**3.0**	**4.0**	**3.0**	**4.0**	**3.6**	**4.0**	**3.8**
D.1.1	Disaster preparedness, including plans or standard operating procedures, developed in a participatory manner, disseminated to the community, practiced, and underpinned by legislation where appropriate	5								-	5	5
D.1.2	Disaster preparedness measures, including plans and standard operating procedures, account for the needs of people with different degrees of vulnerability	3								-	3	3
D.1.3	Multi-hazard risk assessments utilized to develop and design evacuation strategies (evacuation routes, demarcation of safe areas and location of temporary shelters, use of vertical evacuation if needed)	2								-	2	2
D.1.4	Community's ability to communicate in response to early warnings assessed	3	4	5	4	4	4	3	4	4.0	3	3
D.1.5	Contingency planning developed in a scenario-based manner following forecasts or likely scenarios across different timescales and informed by climate projections and scientific research	2								-	2	2
D.1.6	Early action and response options across time and geographical scales are linked to the provision of funding to support them	5								-	5	5
D.1.7	Strategies implemented to maintain preparedness for longer return-periods and cascading hazard events	5								-	5	5
D.1.8	Protocols incorporated in the plans or standard operating procedures to reach emergency and health services that need to be ready to respond to events promptly	5								-	5	5
D.1.9	Protocols established to activate and mobilize last-mile operators (e.g., local police, fire-fighters, volunteers, health services) who disseminate warnings to the public and decide public measures, including issuing orders for evacuation or sheltering in place	4	4	2	4	2	4	3	4	3.3	4	4
D.1.10	Regular exercises undertaken to test and optimize the effectiveness of early warning dissemination processes, preparedness, and response to warning	4								-	4	4
D.2 Are public awareness and education campaigns conducted?		**2.6**	**-**	**2.5**	**3.5**	**3.0**	**3.5**	**2.5**	**-**	**3.0**	**2.6**	**2.6**
D.2.1	Ongoing public awareness and education pro-grammes on hazards that could impact the population, vulnerabilities, exposure and how to reduce disaster impacts built into school curricula from primary through university	3		2	3	3	3	2		2.6	3	3
D.2.2	Public education provided to recognize hydro-meteorological and geophysical hazard signals and disease signs and symptoms in order to contribute to community surveillance and to allow and promote robust no-regret response measures	1								-	1	1
D.2.3	People educated on how warnings will be disseminated, which sources are reliable and how to respond	3								-	3	3
D.2.4	Utilization of the most effective media (e.g., established broadcasting media, social networks, alternative media) to improve public awareness	3		3	4	3	4	3		3.4	3	3
D.2.5	Public awareness and education campaigns tailored to the specific needs of vulnerable groups (e.g., women, children, older people, and people with disabilities)	3								-	3	3
D.3 Is public awareness and response tested and evaluated?		**3.5**	**-**	**5.0**	**4.0**	**3.0**	**4.0**	**4.0**	**-**	**4.0**	**3.5**	**3.5**
D.3.1	Previous emergency and disaster events and responses analyzed, and lessons learned incorporated into preparedness and response plans and into capacity-building strategies	4		5	4	3	4	4		4.0	4	4
D.3.2	Public awareness strategies and programmes evaluated regularly and updated as required	3								-	3	3

(Appendix C: Raw Data Score Sheets Continued…)

Viet Nam

Summary

Thematic Area	Desk Study Score	Revised Score Based on FGD	Final Score
A. Disaster Risk Knowledge			
A.1 Are key hazards and related threats identified?	3.5	2.5	3.0
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?	2.5	2.5	2.7
A.3 Are roles and responsibilities of stakeholders identified?	4.0	4.0	4.0
A.4 Is risk information consolidated?	3.5	3.5	3.3
A.5 Is risk information properly incorporated into the early warning system?	2.8	2.8	2.8
Thematic Area Score	**3.3**	**3.1**	**3.1**
B. Detection, Monitoring, Analysis			
B.1 Are there monitoring systems in place?	4.0	3.4	3.5
B.2 Are there forecasting and warning services in place?	3.0	3.5	3.5
B.3 Are there institutional mechanisms in place?	3.8	3.3	3.3
Thematic Area Score	**3.6**	**3.4**	**3.4**
C. Warning Dissemination and Communications			
C.1 Are organizational and decision-making processes in place and operational?	3.2	3.2	3.2
C.2 Are communication systems and equipment in place and operational?	2.0	2.1	2.1
C.3 Are impact-based early warning communicated effectively to prompt action by target groups?	3.0	5.0	2.3
Thematic Area Score	**2.7**	**3.4**	**2.5**
D. Preparedness and Response			
D.1 Are disaster preparedness measures, including response plans, developed and operational?	1.9	2.2	2.6
D.2 Are public awareness and education campaigns conducted?	3.2	3.4	3.4
D.3 Is public awareness and response tested and evaluated?	2.0	2.0	2.0
Thematic Area Score	**2.4**	**2.5**	**2.7**

(Appendix C: Raw Data Score Sheets Continued…)
Viet Nam

Disaster Risk Knowledge

No.	Sub-Element	Desk Study Score	Stakeholder Inputs	SH Score Average	Post-FGD Adjusted Score	Final Score
			VN1			
A.1 Are key hazards and related threats identified?		**3.5**	**-**	**-**	**2.5**	**2.5**
A.1.A	Characteristics of key hazards (e.g., geographical extent, magnitude, intensity, disease transmissibility, frequency, probability), including possible cascading hazardous events, are analyzed, historical data evaluated, and potential future risks assessed	3		-	3	3
A.1.2	Hazard maps (dynamic and multi-hazard, when possible) are developed that identify the geographical areas/people that could be affected by hazards	4		-	2	2
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?		**2.5**	**5.0**	**5.0**	**2.5**	**2.7**
A.2.1	Assessment and quantification of exposed people, services (e.g., hospitals) and critical infrastructure (e.g., electricity and water works, quality of building stock) conducted and mapped for all relevant hazards, as well as of any compounding risks, at local level in both rural and urban areas and coastlines	-		-	-	3
A.2.2	Impacts to critical infrastructure and secondary risks associated with these impacts are evaluated, and risk management solutions considered to increase resilience	-		-	-	-
A.2.3	Vulnerability factors such as gender, disability, access to infrastructure, economic diversity, societal inequalities, and environmental sensitivities considered	3	5	5.0	3	3
A.2.4	Vulnerabilities of key economic sectors at national to local levels assessed	3		-	3	3
A.2.5	Historical and indigenous knowledge integrated into risk assessments	-		-	-	3
A.2.6	Activities that increase or compound risks (e.g., urbanization and land use) identified and evaluated	2		-	2	2
A.2.7	Risk assessment results integrated into local risk management plans and warning messages in a clear and easy-to-understand language with attention to how different people assess information	2		-	2	2
A.2.8	Legislation and cultural norms assessed to identify gaps that may increase vulnerability	-		-	-	-
A.3 Are roles and responsibilities of stakeholders identified?		**4.0**	**5.0**	**5.0**	**4.0**	**4.0**
A.3.1	Key national government agencies involved in risk assessments (including hazard, vulnerability, and capacity assessments) are identified and roles defined	5		-	5	5
A.3.2	Legislation or government policy mandating the preparation of hazard, vulnerability and capacity assessments for all areas are in place	5		-	5	5
A.3.3	Responsibility for coordinating hazard identification and risk information (exposure, social and physical vulnerability, and capacity) assigned to one national organization with a view to consolidating approaches and monitoring linkages and cascading impacts	5		-	5	5
A.3.4	Process developed for scientific and technical experts to assess and review the accuracy of risk data and information	3		-	3	3
A.3.5	Process developed to actively engage rural and urban communities in local hazard and risk assessments taking into consideration the needs of all people (women, children, older people, people with disabilities, etc.)	2	5	5.0	2	2
A.4 Is risk information consolidated?		**3.5**	**5.0**	**5.0**	**3.5**	**3.3**
A.4.1	Central standardized repository (including but not limited to a Geographic Information System) established to store all event/disaster and risk information	5		-	5	4
A.4.2	National standards (where possible, following international standards) established for the systematic collection, sharing and assessment of risk information and data related to hazards, exposures, vulnerabilities, and capacities	2	5	5.0	2	2
A.4.3	Standardized vulnerability data and information disaggregated by sex, age, and disability	5	5	5.0	5	5
A.4.4	Process established to maintain, regularly review, and update risk data, including information on any new or emerging vulnerabilities and hazards, with roles and responsibilities of stakeholders identified along with appropriate funding	2	5	5.0	2	2
A.5 Is risk information properly incorporated into the early warning system?		**2.8**	**5.0**	**5.0**	**2.8**	**2.8**
A.5.1	Information on the geographical extent of hazards used to define safe areas and evacuation zones	3	5	5.0	3	3
A.5.2	Risk information on vulnerable groups (hazard, exposure, differential vulnerability) used to identify and define evacuation routes and location of temporary shelters	2	5	5.0	2	2
A.5.3	Risk information on different types of assets reviewed to outline procedures to minimize damage or loss of such assets once a warning is issued	3		-	3	3
A.5.4	Process established for continuous update on new or emerging risks (e.g., due to urban expansion or establishment of new settlements) and potential changes to some hazards (due to changes in land use) to update safe areas, evacuation zones and shelters	3		-	3	3

(Appendix C: Raw Data Score Sheets Continued…)

Viet Nam

Hazard Detection, Monitoring, Analysis, and Forecasting

No.	Sub-Element	Desk Study Score	Stakeholder Inputs	SH Score Average	Post-FGD Adjusted Score	Final Score
			VN1			
B.1 Are there monitoring systems in place?		**4.0**	**5.0**	**5.0**	**3.4**	**3.5**
B.1.1	Monitoring network established that monitors hazards that impact the country	5		-	4	4
B.1.2	Measurement parameters and specifications documented for each relevant hazard	-		-	-	4
B.1.3	Technical equipment, suited to local conditions and circumstances, in place and personnel trained in its use and maintenance	3	5	5.0	4	4
B.1.4	Monitoring data received, processed and available in an interoperable format in real time or near real time	-	5	5.0	3	3
B.1.5	Monitoring data and metadata routinely curated with quality controls, archived and accessible for verification, research purposes and other applications	-	5	5.0	-	-
B.1.6	Monitoring hardware and software maintenance conducted routinely, and costs and resources considered from the beginning to ensure optimal operation of the system over time	-	5	5.0	2	2
B.1.7	The system is able to combine and benefit from new and older technology allowing for exchange of data among countries with different technical capabilities	-		-	4	4
B.2 Are there forecasting and warning services in place?		**3.0**	**4.4**	**4.4**	**3.5**	**3.5**
B.2.1	Data analysis and processing, modelling, prediction, and warning products generated based on accepted scientific and technical methodologies and disseminated within international standards and protocols	-	3	3.0	4	4
B.2.2	New data analysis and processing, modelling, prediction, and warning products can be integrated easily in the system as science and technology evolve	-		-	-	-
B.2.3	Warning centers are operational at all times (24 hours/day, seven days/week) and staffed by trained personnel following appropriate national and international standards	3		-	3	3
B.2.4	Warning messages are clear, consistent and include risk and impact information and are designed with consideration for linking threat levels to emergency preparedness and response actions	-	5	5.0	4	4
B.2.5	Software and data analysis for the received data updated periodically and to high security standards	-		-	-	-
B.2.6	The state of the monitoring and data analysis systems continuously monitored for any data gaps, connection issues or processing issues	3	5	5.0	3	3
B.2.7	Warnings generated and disseminated in an efficient and timely manner for each type of hazard	3	5	5.0	4	4
B.2.8	Warning system(s) subjected to regular system-wide tests and exercises	3	4	4.0	3	3
B.3 Are there institutional mechanisms in place?		**3.8**	**-**	**-**	**3.3**	**3.3**
B.3.1	Plans and documents for monitoring networks available and agreed upon with experts and relevant authorities	4		-	2	2
B.3.2	Agreements and interagency protocols established within country for exchange of monitoring systems data and baseline data needed for certain data products (e.g., bathymetric, and topographic data for tsunami modelling)	3		-	4	4
B.3.3	Agreements and interagency protocols established to ensure consistency of warning language and communication responsibilities where different hazards are handled by different agencies	-		-	2	2
B.3.4	A multi-hazard coordination strategy established to obtain mutual efficiencies and effectiveness among different warning systems	4		-	4	4
B.3.5	Warning system partners, including local authorities and the media, are aware of and respect which organizations are responsible for generation and issuance of warnings	4		-	4	4
B.3.6	Cross-border exchange of warnings and observation data realized through bilateral/ multilateral agreements, especially for concerns such as tropical cyclones, floods, diseases, shared basins, data exchange, and technical capacity-building	-		-	4	4

(Appendix C: Raw Data Score Sheets Continued…)

Viet Nam

Warning Dissemination and Communication

No.	Sub-Element	Desk Study Score	Stakeholder Inputs	SH Score Average	Post-FGD Adjusted Score	Final Score
			VN1			
C.1 Are organizational and decision-making processes in place and operational?		**3.2**	**5.0**	**5.0**	**3.2**	**3.2**
C.1.1	Functions, roles, and responsibilities of each actor in the warning dissemination process enforced through government policy or legislation at all levels and included in the standard operating procedures	5		-	5	5
C.1.2	Warning communication strategies at the national, subnational, and local levels in place that ensure coordination across warning issuers and dissemination channels	3	5	5.0	3	3
C.1.3	Regular coordination, planning and review meetings between the warning issuers, the media, and other stakeholders	2	5	5.0	2	2
C.1.4	Professional and volunteer networks established to receive and disseminate warnings widely	3		-	3	3
C.1.5	Feedback mechanisms in place to verify that warnings have been received and to correct potential failures in dissemination and communication	-	5	5.0	-	-
C.1.6	Mechanisms to update the information are in place and are resilient to the event	3	5	5.0	3	3
C.2 Are communication systems and equipment in place and operational?		**2.0**	**5.0**	**5.0**	**2.1**	**2.1**
C.2.1	Communication and dissemination systems tailored to the different needs of specific groups (urban and rural populations, women and men, older people and youth, people with disabilities, etc.)	2	5	5.0	2	2
C.2.2	Understanding of last-mile connectivity to know which population groups can be reached by different services, including mobile-cellular, satellite and radio services	2	5	5.0	2	2
C.2.3	Warning communication and dissemination systems reach the entire population, including seasonal populations and those in remote locations, through multiple communication channels (e.g., satellite and mobile-cellular networks, social media, flags, sirens, bells, public address systems, door-to-door visits, community meetings)	2		-	2	2
C.2.4	Communication strategies evaluated to ensure messages are reaching the population	-	5	5.0	2	2
C.2.5	Agreements developed to utilize private sector resources where appropriate (e.g., mobile-cellular, satellite, television, radio broadcasting, amateur radio, social media) to disseminate warnings	2		-	2	2
C.2.6	Equipment maintained and upgraded to utilize new technologies (when appropriate) to ensure interoperability	-	5	5.0	3	3
C.2.7	Backup systems and processes in place in the event of failure	-	5	5.0	-	-
C.2.8	Resilience of communication channels and early warning system hardware evaluated in advance to reduce the impact of events on the infrastructure	-	5	5.0	-	-
C.2.9	Coverage of communication channels and multiple-channel systems assessed to identify gaps and possible points of failure that may increase vulnerability	-	5	5.0	2	2
C.3 Are impact-based early warnngs communicated effectively to prompt action by target groups?		**3.0**	**5.0**	**5.0**	**2.3**	**2.3**
C.3.1	Warning messages provide clear guidance to trigger reactions (e.g., evacuation)	3		-	3	3
C.3.2	In the case of events with a short timeframe for reaction (e.g., earthquake early warning), automated systems should be in place to mitigate impacts (e.g., automatic stop of transport, activation of red lights in tunnels, stopping elevators on the closest floor, opening of fire-truck gates, etc.)	-	5	5.0	1	1
C.3.3	Early warnings should take into account the different risks and needs of subpopulations, including differential vulnerabilities (urban and rural, women and men, older people and youth, people with disabilities, etc.)	-		-	2	2
C.3.4	Public and other stakeholders are aware of which authorities issue the warnings and trust their message	3		-	3	3

(Appendix C: Raw Data Score Sheets Continued...)

Viet Nam

Preparedness and Response Capabilities

No.	Sub-Element	Desk Study Score	Stakeholder Inputs	SH Score Average	Post-FGD Adjusted Score	Final Score
			VN1			
D.1 Are disaster preparedness measures, including response plans, developed and operational?		**1.9**	**5.0**	**5.0**	**2.2**	**2.6**
D.1.1	Disaster preparedness, including plans or standard operating procedures, developed in a participatory manner, disseminated to the community, practiced, and underpinned by legislation where appropriate	2	5	5.0	4	4
D.1.2	Disaster preparedness measures, including plans and standard operating procedures, account for the needs of people with different degrees of vulnerability	2		-	2	3
D.1.3	Multi-hazard risk assessments utilized to develop and design evacuation strategies (evacuation routes, demarcation of safe areas and location of temporary shelters, use of vertical evacuation if needed)	2		-	2	2
D.1.4	Community's ability to communicate in response to early warnings assessed	1	5	5.0	1	1
D.1.5	Contingency planning developed in a scenario-based manner following forecasts or likely scenarios across different timescales and informed by climate projections and scientific research	-	5	5.0	-	-
D.1.6	Early action and response options across time and geographical scales are linked to the provision of funding to support them	2	5	5.0	2	2
D.1.7	Strategies implemented to maintain preparedness for longer return-periods and cascading hazard events	2		-	2	2
D.1.8	Protocols incorporated in the plans or standard operating procedures to reach emergency and health services that need to be ready to respond to events promptly	2		-	2	2
D.1.9	Protocols established to activate and mobilize last-mile operators (e.g., local police, firefighters, volunteers, health services) who disseminate warnings to the public and decide public measures, including issuing orders for evacuation or sheltering in place	2	5	5.0	3	3
D.1.10	Regular exercises undertaken to test and optimize the effectiveness of early warning dissemination processes, preparedness, and response to warning	2	5	5.0	2	4
D.2 Are public awareness and education campaigns conducted?		**3.2**	**5.0**	**5.0**	**3.4**	**3.4**
D.2.1	Ongoing public awareness and education pro-grammes on hazards that could impact the population, vulnerabilities, exposure and how to reduce disaster impacts built into school curricula from primary through university	3		-	4	4
D.2.2	Public education provided to recognize hydro-meteorological and geophysical hazard signals and disease signs and symptoms in order to contribute to community surveillance and to allow and promote robust no-regret response measures	3		-	3	3
D.2.3	People educated on how warnings will be disseminated, which sources are reliable and how to respond	3	5	5.0	3	3
D.2.4	Utilization of the most effective media (e.g., established broadcasting media, social networks, alter-native media) to improve public awareness	4		-	4	4
D.2.5	Public awareness and education campaigns tailored to the specific needs of vulnerable groups (e.g., women, children, older people, and people with disabilities)	3		-	3	3
D.3 Is public awareness and response tested and evaluated?		**2.0**	**5.0**	**5.0**	**2.0**	**2.0**
D.3.1	Previous emergency and disaster events and responses analyzed, and lessons learned incorporated into preparedness and response plans and into capacity-building strategies	2	5	5.0	2	2
D.3.2	Public awareness strategies and programmes evaluated regularly and updated as required	2		-	2	2

(Appendix C: Raw Data Score Sheets Continued…)
Regional Level

Summary

Thematic Area	Desk Study Score	Revised Score Based on FGD	Final Score
A. Disaster Risk Knowledge			
A.1 Are key hazards and related threats identified?	4.5	4.5	4.5
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?	3.0	3.0	3.0
A.3 Are roles and responsibilities of stakeholders identified?	4.0	4.0	4.0
A.4 Is risk information consolidated?	4.0	4.0	4.0
Thematic Area Score	**3.5**	**3.9**	**3.9**
B. Detection, Monitoring, Analysis			
B.1 Are there monitoring systems in place?	3.3	3.3	3.3
B.2 Are there forecasting and warning services in place?	2.6	3.1	3.3
B.3 Are there institutional mechanisms in place?	3.3	3.7	3.7
Thematic Area Score	**3.1**	**3.4**	**3.4**
C. Warning Dissemination and Communications			
C.1 Are organizational and decision-making processes in place and operational?	2.3	3.2	3.2
C.2 Are communication systems and equipment in place and operational?	2.1	-	3.5
C.3 Are impact-based early warnngs communicated effectively to prompt action by target groups?	2.3	-	4.0
Thematic Area Score	**2.2**	**3.2**	**3.6**
D. Preparedness and Response			
D.1 Are disaster preparedness measures, including response plans, developed and operational?	2.6	3.2	3.3
D.2 Are public awareness and education campaigns conducted?	3.4	3.4	3.4
D.3 Is public awareness and response tested and evaluated?	3.0	3.0	3.0
Thematic Area Score	**3.0**	**3.2**	**3.2**

(Appendix C: Raw Data Score Sheets Continued…)
Regional Level

Disaster Risk Knowledge

No.	Sub-Element	Desk Study Score	Stakeholder Inputs		SH Score Average	Post-FGD Adjusted Score	Final Score
			AR1	AR2			
A.1 Are key hazards and related threats identified?		**4.5**	**-**	**-**	**-**	**4.5**	**4.5**
A.1.A	Characteristics of key hazards (e.g., geographical extent, magnitude, intensity, disease transmissibility, frequency, probability), including possible cascading hazardous events, are analyzed, historical data evaluated, and potential future risks assessed for the ASEAN region	5			-	5	5
A.1.2	Hazard maps (dynamic and multi-hazard, when possible) are developed that identify the geographical areas/people that could be affected by hazards for the ASEAN region	4			-	4	4
A.2 Are exposure, vulnerabilities, capacities, and risks assessed?		**3.0**	**4.0**	**3.0**	**3.5**	**3.0**	**3.0**
A.2.1	Assessment and quantification of exposed people, services (e.g., hospitals) and critical infrastructure (e.g., electricity and water works, quality of building stock) conducted and mapped for all relevant hazards, as well as of any compounding risks, at the ASEAN regional level	4			-	4	4
A.2.2	Impacts to critical infrastructure and secondary risks associated with these impacts are evaluated, and risk management solutions considered to increase resilience for the ASEAN region	3			-	3	3
A.2.3	Vulnerability factors such as gender, disability, access to infrastructure, economic diversity, societal inequalities, and environmental sensitivities considered for the ASEAN region	4			-	4	4
A.2.4	Vulnerabilities of key economic sectors at the ASEAN regional level assessed	3			-	3	3
A.2.5	Historical and indigenous knowledge integrated into risk assessments for the ASEAN region	2	4	3	3.5	2	2
A.2.6	Activities that increase or compound risks (e.g., urbanization and land use) identified and evaluated for the ASEAN region	2			-	2	2
A.2.8	Legislation and cultural norms assessed to identify gaps that may increase vulnerability for the ASEAN region	-			-	3	3
A.3 Are roles and responsibilities of stakeholders identified?		**4.0**	**-**	**-**	**-**	**4.0**	**4.0**
A.3.1	Key regional agencies involved in risk assessments (including hazard, vulnerability, and capacity assessments) are identified and roles defined	4			-	4	4
A.3.2	Legislation or government policy mandating the preparation of hazard, vulnerability and capacity assessments for all areas are in place for the ASEAN region	4			-	4	4
A.3.3	Responsibility for coordinating hazard identification and risk information (exposure, social and physical vulnerability, and capacity) assigned to one regional organization with a view to consolidating approaches and monitoring linkages and cascading impacts	4			-	4	4
A.3.4	Process developed for scientific and technical experts to assess and review the accuracy of risk data and information	4			-	4	4
A.3.5	Process developed to actively engage communities in assessments taking into consideration the needs of all people (women, children, older people, people with disabilities, etc.) for the ASEAN region	4			-	4	4
A.4 Is risk information consolidated?		**4.0**	**-**	**4.0**	**4.0**	**4.0**	**4.0**
A.4.1	Central standardized repository (including but not limited to a Geographic Information System) established to store all event/disaster and risk information for the ASEAN region	4			-	4	4
A.4.2	Regional standards (where possible, following international standards) established for the systematic collection, sharing and assessment of risk information and data related to hazards, exposures, vulnerabilities, and capacities	4			-	4	4
A.4.3	Standardized vulnerability data and information disaggregated by sex, age, and disability for the ASEAN region	4		4	4.0	4	4
A.4.4	Process established to maintain, regularly review, and update risk data, including information on any new or emerging vulnerabilities and hazards, with roles and responsibilities of stakeholders identified along with appropriate funding for the ASEAN region	4			-	4	4

(Appendix C: Raw Data Score Sheets Continued…)

Regional Level

Hazard Detection, Monitoring, Analysis, and Forecasting

No.	Sub-Element	Desk Study Score	Stakeholder Inputs				SH Score Average	Post-FGD Adjusted Score	Final Score
			AR1	AR2	AR3	AR4			
B.1 Are there monitoring systems in place?		**3.3**	**3.6**	**4.2**	**2.6**	**4.4**	**3.7**	**3.3**	**3.3**
B.1.1	Monitoring network established that monitors hazards that impact the ASEAN region	4	4	5	4	4	4.3	4	4
B.1.2	Measurement parameters and specifications documented for each relevant hazard for the ASEAN region	4					-	4	4
B.1.3	Technical equipment, suited to regional conditions and circumstances, in place and personnel trained in its use and maintenance for the ASEAN region	3	4	4	2	4	3.5	3	3
B.1.4	Monitoring data received, processed and available in an interoperable format in real time or near real time for the ASEAN region	3	4	4	2	4	3.5	3	3
B.1.5	Monitoring data and metadata routinely curated with quality controls, archived and accessible for verification, research purposes and other applications for the ASEAN region	2	3	3	2	5	3.3	2	2
B.1.6	Monitoring hardware and software maintenance conducted routinely, and costs and resources considered from the beginning to ensure optimal operation of the system over time for the ASEAN region	4	3	5	3	5	4.0	4	4
B.1.7	Monitoring systems are able to combine and benefit from new and older technology allowing for exchange of data among countries with different technical capabilities for the ASEAN region	3					-	3	3
B.2 Are there forecasting and warning services in place?		**3.1**	**3.5**	**3.3**	**2.7**	**5.0**	**3.6**	**3.1**	**3.3**
B.2.1	Data analysis and processing, modelling, prediction, and warning products generated based on accepted scientific and technical methodologies and disseminated within international standards and protocols for the ASEAN region	4	3	4	3	5	3.8	4	4
B.2.2	New data analysis and processing, modelling, prediction, and warning products can be integrated easily in the system as science and technology evolve for the ASEAN region	3					-	3	3
B.2.3	Regional warning centers are operational at all times (24 hours/day, seven days/week) and staffed by trained personnel following appropriate national and international standards	-	4	2	4	5	3.8	-	4
B.2.4	Warning messages are clear, consistent and include risk and impact information and are designed with consideration for linking threat levels to emergency preparedness and response actions for the ASEAN region	3	4	4	2	5	3.8	3	3
B.2.5	Software and data analysis for the received data updated periodically and to high security standards for the ASEAN region	3					-	3	3
B.2.6	The state of the monitoring and data analysis systems continuously monitored for any data gaps, connection issues or processing issues for the ASEAN region	2	2	3	2	5	3.0	2	2
B.2.7	Warnings generated and disseminated in an efficient and timely manner for each type of hazard for the ASEAN region	3	4	4	3	5	4.0	3	3
B.2.8	Regional warning system(s) subjected to regular system-wide tests and exercises	4	4	3	2	5	3.5	4	4
2.C Are there institutional mechanisms in place?		**3.7**	**3.6**	**3.7**	**2.4**	**4.5**	**3.4**	**3.7**	**3.7**
B.3.1	Plans and documents for monitoring networks available and agreed upon with experts and relevant authorities for the ASEAN region	4	4	4	3	4	3.8	4	4
B.3.2	Agreements and interagency protocols established within the ASEAN region for exchange of monitoring systems data and baseline data needed for certain data products (e.g., bathymetric, and topographic data for tsunami modelling)	3	4	3	2	-	3.0	3	3
B.3.3	Agreements and interagency protocols established to ensure consistency of warning language and communication responsibilities where different hazards are handled by different agencies in the ASEAN region	4	4	3	2	-	3.0	4	4
B.3.4	A multi-hazard coordination strategy established to obtain mutual efficiencies and effectiveness among different warning systems for the ASEAN region	3		4			4.0	3	3
B.3.5	Regional warning system partners, including the media, are aware of and respect which organizations are responsible for generation and issuance of warnings	4	3	5	2	-	3.3	4	4
B.3.6	Cross-border exchange of warnings and observation data realized through bilateral/ multilateral agreements, especially for concerns such as tropical cyclones, floods, diseases, shared basins, data exchange, and technical capacity-building for the ASEAN region	4	3	3	3	5	3.5	4	4

(Appendix C: Raw Data Score Sheets Continued…)

Regional Level

Warning Dissemination and Communication

No.	Sub-Element	Desk Study Score	Stakeholder Inputs				SH Score Average	Post-FGD Adjusted Score	Final Score
			AR1	AR2	AR3	AR4			
C.1 Are organizational and decision-making processes in place and operational?		**3.2**	**3.7**	**3.3**	**2.5**	**5.0**	**3.7**	**3.2**	**3.2**
C.1.1	Functions, roles, and responsibilities of each actor in the warning dissemination process enforced through policy or legislation at all levels and included in the standard operating procedures for the ASEAN region	2	4	3	3	5	3.8	2	2
C.1.2	Warning communication strategies at the regional level are in place that ensure coordination across warning issuers and dissemination channels	3	4	-	3	5	4.0	3	3
C.1.3	Regular coordination, planning and review meetings between the warning issuers, the media, and other stakeholders	4	4	-	2	5	3.7	4	4
C.1.4	Professional and volunteer networks established in the ASEAN region to receive and disseminate warnings widely	3	3	3	2	5	3.3	3	3
C.1.5	Feedback mechanisms in place to verify that warnings have been received and to correct potential failures in dissemination and communication for the ASEAN region	4	3	3	2	5	3.3	4	4
C.1.6	Mechanisms to update the information are in place and are resilient to the event for the ASEAN region	3	4	4	3	5	4.0	3	3
3.B Are communication systems and equipment in place and operational?		**-**	**3.5**	**3.2**	**2.5**	**4.8**	**3.5**	**-**	**3.5**
C.2.4	Regional communication strategies evaluated to ensure messages are reaching intended audience	-	4	3	2	4	3.3	-	4
C.2.5	Agreements developed to utilize private sector resources where appropriate (e.g., mobile-cellular, satellite, television, radio broadcasting, amateur radio, social media) to disseminate warnings for the ASEAN region	-	3	-	2	5	3.3	-	3
C.2.6	Regional early warning equipment maintained and upgraded to utilize new technologies (when appropriate) to ensure interoperability	-	-	3	3	5	3.7	-	3
C.2.7	Backup systems and processes in place in the event of failure for the ASEAN region	-	-	4	3	5	4.0	-	4
C.2.8	Resilience of communication channels and early warning system hardware evaluated in advance to reduce the impact of events on the infrastructure for the ASEAN region	-	-	3	3	5	3.7	-	3
C.2.9	Coverage of communication channels and multiple-channel systems assessed to identify gaps and possible points of failure that may increase vulnerability for the ASEAN region	-	-	3	2	5	3.3	-	4
C.3 Are impact-based early warnngs communicated effectively to prompt action by target groups?		**4.0**	**4.0**	**4.0**	**3.0**	**5.0**	**4.0**	**#DIV/0!**	**4.0**
C.3.1	Regional warning messages provide clear guidance to trigger reactions (e.g., evacuation)	4	4	4	3	5	4.0	-	4

(Appendix C: Raw Data Score Sheets Continued…)

Regional Level

Preparedness and Response Capabilities

No.	Sub-Element	Desk Study Score	Stakeholder Inputs			SH Score Average	Post-FGD Adjusted Score	Final Score
			AR1	AR2	AR3			
D.1 Are disaster preparedness measures, including response plans, developed and operational?		**3.2**	**-**	**3.0**	**4.0**	**3.5**	**3.2**	**3.3**
D.1.1	Disaster preparedness, including plans or standard operating procedures, developed in a participatory manner, practiced, and underpinned by legislation where appropriate for the ASEAN region	-		3	4	3.5	-	4
D.1.2	Disaster preparedness measures, including plans and standard operating procedures, account for the needs of people with different degrees of vulnerability for the ASEAN region	2				–	2	2
D.1.5	Contingency planning developed in a scenario-based manner following forecasts or likely scenarios across different timescales and informed by climate projections and scientific research for the ASEAN region	3		3	4	3.5	3	3
D.1.6	Early action and response options across time and geographical scales are linked to the provision of funding to support them for the ASEAN region	4				–	4	4
D.1.7	Strategies implemented to maintain preparedness for longer return-periods and cascading hazard events for the ASEAN region	3				–	3	3
D.1.8	Protocols incorporated in the plans or standard operating procedures to reach emergency and health services that need to be ready to respond to events promptly for the ASEAN region	4				–	4	4
D.1.10	Regular exercises undertaken to test and optimize the effectiveness of early warning dissemination processes, preparedness, and response to warning for the ASEAN region	3				–	3	3
D.2 Are public awareness and education campaigns conducted?		**3.4**	**-**	**3.5**	**3.5**	**3.5**	**3.4**	**3.4**
D.2.1	Ongoing public awareness and education programmes on hazards that could impact the population, vulnerabilities, exposure and how to reduce disaster impacts built into regional training curricular	4				-	4	4
D.2.2	Regional public education provided to recognize hydro-meteorological and geophysical hazard signals and disease signs and symptoms in order to contribute to community surveillance and to allow and promote robust no-regret response measures	3		3	3	3.0	3	3
D.2.3	People educated on how warnings will be disseminated, which sources are reliable and how to respond for the ASEAN region	4				-	4	4
D.2.4	Utilization of the most effective media (e.g., established broadcasting media, social networks, alter-native media) to improve public awareness in the ASEAN region	3		4	4	4.0	3	3
D.2.5	Public awareness and education campaigns tailored to the specific needs of vulnerable groups (e.g., women, children, older people, and people with disabilities) in the ASEAN region	3				-	3	3
4.C Is public awareness and response tested and evaluated?		**3.0**	**-**	**3.5**	**3.0**	**3.3**	**3.0**	**3.0**
D.3.1	Previous emergency and disaster events and responses analyzed, and lessons learned incorporated into preparedness and response plans and into capacity-building strategies for the ASEAN region	4		4	3	3.5	4	4
D.3.2	Public awareness strategies and programmes evaluated regularly and updated as required for the ASEAN region	2		3	3	3.0	2	2

APPENDIX D: GLOBAL AND REGIONAL INITIATIVES, SYSTEMS, AND FRAMEWORKS

Global

CAP[125] | Common Alerting Protocol

The Common Alerting Protocol (CAP) is an international standard format for emergency alerting and public warning designed for all hazards, particularly weather events, earthquakes, tsunamis, volcanoes, public health, power outages, and many other emergencies. Developed by the International Telecommunication Union, the CAP sends a standardized alerting message to different platforms to ensure coverage, increase impact, and avoid confusion. According to UNESCAP, 90% of the world population resides in areas covered by CAP; however, least developed countries (LDCs) continue to face challenges in fully adopting CAP due to information and communication technologies (ICT) limitations.

CREWS[126] | Climate Risk and Early Warning Systems

The Climate Risk and Early Warning Systems Initiative (CREWS) financially supports Least Developed Countries and Small Island Developing states (SIDS), aiding in the establishment of risk-informed early weather warnings and risk information services. Created through the tripartite partnership of World Bank/ Global Facility for Disaster Reduction and Recovery (GFDRR), World Meteorological Organization (WMO), and United Nations Office for Disaster Risk Reduction (UNDRR), CREWS projects and initiatives are geared towards WMO's 2030 vision wherein "all nations are more resilient to the socio-economic consequences of extreme weather, climate, water and other environmental events."

DisasterAWARE[127] | Disaster All-hazards Warning, Analysis, and Risk Evaluation

The Pacific Disaster Center (PDC)'s integrated platform for hazard situational awareness, decision support, and information exchange, known as DisasterAWARE® (Disaster All-hazards Warning, Analysis, and Risk Evaluation) continually monitors information feeds from reliable and authoritative meteorological, geological, and hazard-reporting agencies around the world ensuring accurate, real-time reporting of hazard events within the system. Decision makers receive early warning alerts delivered via email or to their mobile devices by reliable, up-to-the-minute alert services. Subscribers to the DisasterAWARE Smart Alert Service can elect to receive alerts according to hazard type, severity, and geographic region. Hazard data are put into context for responders in an easy-to-use, but sophisticated geospatial information environment. Collaborating disaster management experts can instantly share analyses and situational reports to achieve shared situational awareness of unfolding events with all stakeholders. DisasterAWARE has provided the foundation for customized instances of the system in Indonesia (InAWARE), Viet Nam (VinAWARE), Thailand (ThaiAWARE), and the Philippines (PhilAWARE), as well as the Disaster Monitoring and Response System (DMRS) operated by the AHA Centre and used by ASEAN Member States.

GDACS[128] | Global Disaster Alert and Communication System

Global Disaster Alert and Communication System (GDACS) is a cooperation framework between

the United Nations and the European Commission, together with disaster managers worldwide, with the primary objective to improve alerts, information exchange and coordination in the first phase after major sudden-onset disasters. GDACS was designed to provide real-time access to web-based disaster information systems and related coordination tools as seen in GDACS Disaster Alerts, Virtual OSOCC, and maps and satellite imagery.

ICG/PTWS[129] | Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System

Under the supervision of the United Nations Educational, Scientific and Cultural Organization (UNESCO) Intergovernmental Oceanographic Commission (IOC), the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS) was established 1965. As an international cooperative effort of 46 Pacific member states and marginal seas, the programme aims to alleviate and mitigate the destructive effects of tsunami events. Their initiatives focus on strengthening community resilience through disaster preparedness training activities. PTWS' operational warning headquarters is through the Pacific Tsunami Warning Center (PTWC) which coordinates with other operation centers from international to national centers to effectively monitor the Pacific Ocean's seismic and sea level stations, particularly for earthquakes and tsunami alerts. The hazard and disaster warning messages are then sent to more than 100 locations across the region.

Multi-Regional

AEIC[130] | ASEAN Earthquake Information Centre

The ASEAN Earthquake Information Centre (AEIC) was established in 2000 following the proposal of the Directors of the ASEAN National Meteorological Services in August 1990. AEIC was created to disseminate information on earthquakes occurring in the ASEAN countries, conduct research and training programs for ASEAN members' seismologists, and maintain information management on earthquake data for the National Seismological Centres of the ASEAN Member States.

ASMC[131] | ASEAN Specialised Meteorological Centre

Since its establishment in 1993, the ASEAN Specialised Meteorological Centre (ASMC) has been hosted by the Meteorological Service Singapore in the ASEAN Centre to initially aid in monitoring and assessing land and forest fires, as well as to provide early warning for smoke haze in the southern ASEAN region. Its scope has expanded through the years as ASMC is now involved in research and development for studying weather and climate systems present in the region. ASMC also conducts regional capability development programs in science and technology.

IOTWMS[132] | Indian Ocean Tsunami Warning and Mitigation System

Following the 2004 Indian Ocean Tsunami, the Indian Ocean Tsunami Warning and Mitigation System was established by UNESCO's Intergovernmental Oceanographic Commission. Being supported through a multilevel international cooperation, its tsunami monitoring and warning services cover 36 Indian Ocean basin countries and is holistically referred to as a unified Probabilistic Tsunami Hazard Assessment. IOWTMS has also strengthened its work on scientific advances, national and sub-national warning and response capabilities. To date, the IOWTWMS

has established 11 Tsunami Service Providers (TPS) in different parts of the world.

RIMES[133] | The Regional Integrated Multi-Hazard Early Warning System for Africa and Asia
The Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES) is a regional early warning system within a multi-hazard framework for the generation and communication of early warning information, and capacity-building for preparedness and response to transboundary hazards. With the support of ESCAP, RIMES' systems and programs is owned and managed by the respective ASEAN Member States. Its significant contribution is to fill in the gaps of global data to the national and local networks in LDCs and SIDS.

SCSTAC[134] | South China Sea Tsunami Advisory Center
Launched in 2019, the South China Sea Tsunami Advisory Center (SCSTAC) was primarily operated to provide timely tsunami advisories to the national tsunami warning centers and tsunami warning focal points of the ASEAN Member States and China itself. SCSTAC is part of the Pacific Tsunami Warning and Mitigation System Program, and UNESCO's Intergovernmental Oceanographic Commission (IOC)'s Global Tsunami Warning System.

TTF[135] | Trust Fund for Tsunami, Disaster and Climate Preparedness
Established in 2005, the ESCAP Trust Fund for Tsunami, Disaster and Climate Preparedness (TTF) was initially intended for tsunami early warning using a multi-hazard approach. The aftermath of the 2004 Indian Ocean Tsunami strongly emphasized the need for a regional disaster preparedness mechanism in the Indian Ocean and Southeast Asia. Since its establishment, the TTF has expanded its scope to cover disaster and climate preparedness, include SIDS in the Southwest Pacific, and increased its EWS initiatives in 19 countries.

Regional

AADMER[136] | ASEAN Agreement on Disaster Management and Emergency Response
The ASEAN Committee on Disaster Management (ACDM) developed the ASEAN Agreement on Disaster Management and Emergency Response (AADMER) in 2005. This regional legally binding agreement unites ASEAN Member States to promote regional cooperation and collaboration in reducing disaster losses and intensifying joint emergency response to disasters in the ASEAN region. The most recent AADMER Work Programme (2021-2025) was developed under the leadership of the ACDM and its Working Groups with full support from the ASEAN Secretariat and the AHA Centre. The Work Programme places early warning as a priority for the ASEAN region to support disaster risk reduction.

ACDM[137] | ASEAN Committee on Disaster Management
Established in 2003, the ASEAN Committee on Disaster Management (ACDM) facilitates regional cooperation in addressing problems associated with disaster management. The ACDM is comprised of the region's NDMOs who meet on a regular (at least annual) basis to advance regional disaster management. The ACDM's main roles include provision of leadership and guidance towards fulfilling the goals and objectives of AADMER; coordination, development, monitoring and implementation of the AADMER Work Programme and other initiatives implemented by the respective working groups; strengthening of coordination with relevant ASEAN bodies; and

collaboration with ASEAN Dialogue Partners, multilateral agencies, NGOs and the private sector. The ACDM is supported by five ACDM Working Groups (WG), namely: (i) Risk Assessment and Awareness; (ii) Prevention and Mitigation; (iii) Preparedness and Response; (iv) Recovery; and (v) Knowledge and Innovation Management. The Working Group for Prevention and Mitigation develops and supports the regions early warning initiatives.

ADINet[138] | ASEAN Disaster Information Network

The ASEAN Disaster Information Network (ADINet) serves as a repository of hazards and disasters that have occurred in the ASEAN region. Managed by the AHA Centre since 2012, ADINet is an open platform wherein the public is able to submit information on hazards or disasters that will be validated by the center. Additionally, the AHA Centre supplements in public data with additional hazard information, as required.

AHA Centre[139] | ASEAN Coordinating Centre for Humanitarian Assistance on disaster management

An intergovernmental organization, the ASEAN Coordinating Centre for Humanitarian Assistance on disaster management (AHA Centre) was established by the ten ASEAN Member States with the aim to facilitate cooperation and coordination of disaster management amongst ASEAN Member States. Central to the AHA Centre's work is engagement with National Disaster Management Organizations (NDMOs) of the ASEAN Member States to support their disaster risk reduction activities. Furthermore, the AHA Centre partners with international organizations, private sector, and civil society organizations, such as the Red Cross and Red Crescent Movement, the United Nations, and AADMER Partnership Group. The AHA Centre maintains and administers the custom early warning and decision support tool, DMRS (see below.)

DMRS[140] | Disaster Monitoring and Response System

The ASEAN Disaster Monitoring and Response System (DMRS) is a custom version of PDC's DisasterAWARE platform, deployed at the AHA Centre. The system integrates custom regional hazard information and provides a regional monitoring and response tool for the ASEAN region. It also acts as a regional repository for regional and ASEAN Member State hazard and non-hazard data. The DMRS system is maintained, administered, and operationally used by the AHA Centre and is also utilized by the Governments of the Union of Myanmar and Lao PDR to support their national disaster management objectives.

MRC[141] | Mekong River Commission

As supported by the Mekong Agreement of several partner countries in 1995, the Mekong River Commission (MRC) was established as an international organization to foster regional dialogue and cooperation on water diplomacy, water resource management, and increase the monitoring and communication of the ASEAN Member States. MRC's early warning initiatives focus on the region's top hazards particularly drought, that could result in wildfires, smoke haze, and water crises. MRC partnered with the Mekong Drought and Crop Watch (MDCW) supported by Asian Disaster Preparedness Center (ADPC) to develop a web-based interface that aids member countries in decision-making in facing challenges from the effects of climate change.

SAOFFG[142] | Southeastern Asia-Oceania Flash Flood Guidance

The Southeastern Asia-Oceania Flash Flood Guidance (SAOFFG) system is a part of Global Flash Flood Guidance System (FFGS), providing operational forecasters and NDMOs with real-time informational guidance products pertaining to the threat of small-scale flash flooding. The system is designed to provide the required products to support the development of flash flood warnings from rainfall events using remote-sensed precipitation (radar and satellite-based rainfall estimates) and hydrological models. Indonesia acts as the regional center for SAOFFG, responsible for providing regional and national verification of SAOFFG flash flood forecasts and warnings.

SCMG[143] | ASEAN Sub-Committee on Meteorology and Geophysics

Initiated in 1989, the ASEAN Sub-Committee on Meteorology and Geophysics (SCMG) has planned its 2016-2025 targets to include capacity building on climate information; strengthened timely data exchange on weather and climate services together with earthquake, volcano, and tsunami hazards; continued monitoring of transboundary marine and air pollution; and increased use of information technology for facilitation of data products dissemination on weather and seismological information.

SERVIR-SEA[144] | SERVIR Southeast Asia

SERVIR Southeast Asia (SERVIR-SEA) leverages a unique partnership between the U.S. Agency for International Development (USAID) and the U.S. National Aeronautics and Space Agency (NASA), to harness such space technology and open data to help address development challenges related to a changing climate. In partnership with leading regional organizations, SERVIR-SEA supports Cambodia, Indonesia, Lao PDR, Myanmar (Burma), Philippines, Thailand, and Viet Nam through the use of information provided by Earth observing satellites and geospatial technologies to manage climate risks. The Asian Disaster Preparedness Center (ADPC), a recognized leader in strengthening disaster resilience in Asia, is the prime implementer for SERVIR SEA.

APPENDIX E: DESK STUDY BIBLIOGRAPHIES

ASEAN Regional

ADB. (2009). The Economics of Climate Change in Southeast Asia: A Regional Review. Retrieved from https://www.adb.org/publications/economics-climate-change-southeast-asia-regional-review

ADPC. (2023). ADPC, USAID, and NASA Jointly Launch SERVIR-Southeast Asia to Address Climate Change. Retrieved from https://www.adpc.net/igo/contents/Media/media-news.asp?pid=1852

AHA Centre. (2017). DMRS - Raw Population Exposure. Retrieved from https://dmrs.ahacentre.org/dmrs/

AHA Centre. (2017). DMRS - Risk & Vulnerability Data. Retrieved from https://dmrs.ahacentre.org/dmrs/

AHA Centre. (2020). ARMOR 2nd Edition. Retrieved from https://ahacentre.org/publication/armor-2nd-2020/

AHA Centre. (2022). ARMOR 3rd Edition. Retrieved from https://ahacentre.org/wp-content/uploads/2022/07/ARMOR-3rd-Ed.pdf

ASEAN. (2002). ASEAN Agreement on Transboundary Haze Pollution. Retrieved from https://asean.org/wp-content/uploads/2021/01/ASEANAgreementonTransboundaryHazePollution-1.pdf

ASEAN. (2006). AADMER. Retrieved from https://ahacentre.org/wp-content/uploads/2017/05/AADMER.pdf

ASEAN. (2006). The 28th Meeting of the Asean Sub-committee on Meteorology and Geophysics. Retrieved from http://itic.ioc-unesco.org/images/docs/final%20report%20of%20the%2028th%20scmg%20meeting.pdf

ASEAN. (2015). ASEAN Regional Haze Action Plan. Retrieved from https://asean.org/wp-content/uploads/2021/01/Roadmap-ASEAN-Haze-Free_adoptedbyCOP12.pdf

ASEAN. (2016). ASEAN Recovery Guideline. Retrieved from https://asean.org/asean2020/wp-content/uploads/2021/01/ASEAN-Disaster-Recovery-Reference-Guide-Final-Version-as-of-5-NOV-2016.pdf

ASEAN. (2016). ASEAN Vision 2025 on Disaster Management. Retrieved from https://ahacentre.org/wp-content/uploads/2017/02/ASEAN-Vision-on-DIsaster-Management.pdf

ASEAN. (2016). SCHOOL DISASTER RISK MANAGEMENT GUIDELINES for Southeast Asia. Retrieved from https://www.rcrc-resilience-southeastasia.org/wp-content/uploads/2016/11/Full-SDRM-Guidelines.pdf-27-May-2016.pdf

ASEAN. (2017). Disaster Management Research Roadmap for the ASEAN Region. Retrieved from https://ahacentre.org/wp-content/uploads/2018/03/ASEAN-Region_Disaster-Management_0228_optimize.pdf

ASEAN. (2018). ASEAN Enabling Masterplan 2025: Mainstreaming the Rights of Persons with Disabilities. Retrieved from https://asean.org/asean2020/wp-content/uploads/2021/01/ASEAN-Enabling-Masterplan-2025-Mainstreaming-the-Rights-of-Persons-with-Disabilities-2018.pdf

ASEAN. (2019). The ICT Roadmap on Disaster Management for 2025 and Beyond. Retrieved from https://ahacentre.org/wp-content/uploads/2020/03/ICT-Roadmap-on-Disaster-Management-for-2025-and-Beyond.pdf

ASEAN. (2020). AADMER Work Program. Retrieved from https://asean.org/wp-content/uploads/2021/08/AADMER-Work-Programme-2021-2025.pdf

ASEAN. (2020). ASEAN Declaration on the Strengthening of Adaptation to Drought. Retrieved from https://asean.org/wp-content/uploads/2021/11/PGI_Framework_2021-2025.pdf

ASEAN. (2021). ASEAN Disaster Resilience Outlook 2025. Retrieved from https://asean.org/wp-content/uploads/2021/10/ASEAN-Disaster-Resilience-Outlook-Preparing-for-the-Future-Beyond-2021-FINAL.pdf

ASEAN. (2021). Roadmap on ASEAN Cooperation Towards Transboundary Haze Pollution Control With Means of Implementation . Retrieved from https://asean.org/wp-content/uploads/2021/01/Roadmap-ASEAN-Haze-Free_adoptedbyCOP12.pdf

ASEAN. (2022). ASEAN Dengue Day. Retrieved from https://asean.org/asean-health-cluster-2-statement-for-the-2022-asean-dengue-day-commemoration/

ASEAN. (2022). ASEAN Framework on Anticipatory Action in Disaster Management. Retrieved from https://asean.org/wp-content/uploads/2022/06/ASEAN-Framework-on-Anticipatory-Action-in-Disaster-Management.pdf

Bisri, M. (2019). State of Early Warning Systems in ASEAN. Retrieved from https://www.researchgate.net/publication/333055546_State_of_Early_Warning_Systems_in_ASEAN

BMKG. (2011). RTSP Services User Guide. Retrieved from https://rtsp.bmkg.go.id/manual/Indonesia-RTSP_User_Guide_V.2.pdf

BMKG. (2017). BMKG Participates in the 39th Meeting of ASEAN Sub Committee on Meteorology and Geophysics (SCMG-39). Retrieved from https://www.bmkg.go.id/berita/?p=bmkg-ikuti-the-39th-meeting-of-asean-sub-committee-on-meteorology-and-geophysics-scmg-39&lang=ID&tag=asean-scmg

BMKG. (2023). BMKG Tsunami Service Provider. Retrieved from https://rtsp.bmkg.go.id/

BMKG. (2023). Multi Hazard Disaster Mitigation in the Region, BMKG Initiates the Establishment of a Coordination Center between ASEAN Countries. Retrieved from https://www.bmkg.go.id/press-release/?p=mitigasi-bencana-multi-hazard-di-kawasan-bmkg-gagas-pembentukan-pusat-koordinasi-antar-negara-negara-asean&tag=press-release&lang=ID

CFE DMHA. (2022). ASEAN Disaster Management Reference Handbook. Retrieved from https://reliefweb.int/report/world/asean-disaster-management-reference-handbook-june-2022

ESCAP. (2009). Tsunami Early Warning Systems in the Indian Ocean and Southeast Asia: report on regional unmet needs. Retrieved from https://repository.unescap.org/handle/20.500.12870/4211

ESCAP. (2019). The Disaster Riskscape across South-East Asia. Retrieved from https://www.unescap.org/sites/default/d8files/IDD-APDR-Subreport-SEA.pdf

ESCAP. (2020). The Disaster Riskscape across South-East Asia. Retrieved from https://www.unescap.org/sites/default/files/IDD-APDR-Subreport-SEA.pdf

ESCAP. (2023). ESCAP Trust Fund for Tsunami, Disaster and Climate Preparedness - Ongoing Projects. Retrieved from https://www.unescap.org/disaster-preparedness-fund/projects

ESCAP/RIMES. (2023). Enhancing weather and climate resilience in RIMES member states through capacity building on impact forecasting. Retrieved from https://www.rimes.int/

ESCAP-ASMC. (2019). Applying Subseasonal-toseasonal Predictions to Improve Disaster Risk Reduction in South-east Asia. Retrieved from https://www.unescap.org/resources/applying-subseasonal-seasonal-predictions-improve-disaster-risk-reduction-south-east-asia

Indigenous Knowledge for Disaster Risk Reduction: Good Practices and Lessons Learned from Experiences in the Asia-Pacifi c Region. (2008). Retrieved from https://www.unisdr.org/files/3646_IndigenousKnowledgeDRR.pdf

JRC EU. (2022). INFORM Risk Index 2023. Retrieved from https://drmkc.jrc.ec.europa.eu/inform-index/Portals/0/InfoRM/2022/INFORM_Risk_2023__v065.xlsx

Leiden University. (2007). Indigenous peoples in Southeast Asia, sharing knowledge, building capacity, fighting poverty, saving diversity. Retrieved from https://scholarlypublications.universiteitleiden.nl/access/item%3A2867544/view

Lisa, H. (2014). Local and indigenous knowledge on climate-related hazards of coastal and small island communities in Southeast Asia. Retrieved from https://rp2u.unsyiah.ac.id/index.php/welcome/prosesDownload/2678/4

Mekong River Commission (MRC). (2023). Mekong River Commission (MRC) - Dialogue Partners. Retrieved from https://www.mrcmekong.org/about/mrc/dialogue-partners/

MIMU. (2023). Myanmar Information Management Unit (MIMU). Retrieved from https://themimu.info/

PDC. (2022). Global Risk and Vulnerability. Retrieved from https://www.pdc.org/big-data/Indonesia/

PDC. (2023). PDC Country Profile. Retrieved from https://www.pdc.org/big-data/

PHIVOLCS. (2023). Earthquake-triggered Landslide Susceptibility Map Based on Critical Acceleration Values and Earthquake Intensities . Retrieved from https://www.phivolcs.dost.gov.ph/index.php/2-uncategorised/281-earthquake-hazard-maps-2

RIMES. (2021). Regional Integrated Multi-Hazard Early Warning System (RIMES) for Africa and Asia. Retrieved from https://www.rimes.int/

Samphantharak, K. (2019). Natural Disaster and Economic Development in Southeast Asia. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3388396

SCSTAC. (2023). South China Sea Key Sea Level Monitoring Stations Inventory 2023. Retrieved from http://scstac.oceanguide.org.cn/topic.htm?opType=ipTopic&chelID=9&arId=551

SEI Asia. (2019). Indigenous Peoples of Southeast Asia reaffirm their rights. Retrieved from https://www.sei.org/perspectives/indigenous-peoples-of-southeast-asia-reaffirm-their-rights/

The World Bank. (2005). Natural Disaster Hotspots A Global Risk Analysis. Retrieved from https://openknowledge.worldbank.org/handle/10986/7376

UNDP. (2010). Developing a National Risk Profile of Lao PDR. Retrieved from https://www.adpc.net/igo/category/ID275/doc/2013-sWNa61-ADPC-Final_Report_Part1.pdf

UNESCO. (2005). Intergovernmental Oceanographic Commission - Twenty-third Session of the Assembly . Retrieved from http://www.ioc-tsunami.org/index.php?option=com_oe&task=viewDocumentRecord&docID=17951

UNESCO. (2009). PTWS Implementation Plan. Retrieved from http://www.ioc-tsunami.org/images/stories/documents/ptws%20ip%20draft.pdf

UNESCO. (2011). PTWS User Guide. Retrieved from http://itic.ioc-unesco.org/images/stories/ptws/ptws_userguide2011_180097e.pdf

UNESCO. (2017). Definition of Services provided by Tsunami Service Providers of the IOTWMS. Retrieved from https://oceanexpert.org/downloadFile/39387&version=1.0&lang=1&format=1

UNESCO. (2017). IOTWMS users guide for national tsunami warning centres, version 2.0. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000370886?posInSet=4&queryId=N-3f2fa233-444b-4e87-a5c4-0277499c4be4

UNESCO. (2017). Tsunami Advisory Products for the South China Sea Regional Tsunami Warning and Mitigation System . Retrieved from http://itic.ioc-unesco.org/images/stories/about_warnings/what_are_they/Tsunami%20Advisory%20Products%20for%20the%20South%20China%20Sea%20Regional%20Tsunami%20Warning%20and%20Mitigation%20System-v1.3_Dec2017.pdf

UNESCO. (2019). Indian Ocean Tsunami Warning and Mitigation System (IOTWMS): Medium Term Strategy, 2019–2024. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000370770.locale=en

UNESCO. (2021). The Twenty-ninth Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS-XXIX). Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000381014.locale=en

UNESCO. (2022). PacWave2022. Retrieved from http://itic.ioc-unesco.org/index.php?option=com_content&view=article&id=2218&Itemid=3320

UNESCO. (2023). Indian Ocean Tsunami Information Center (IOTIC). Retrieved from https://iotic.ioc-unesco.org/

UNISDR & WB. (2010). Synthesis Report on Ten ASEAN Countries Disaster Risks Assessment. Retrieved from https://www.unisdr.org/files/18872_asean.pdf

UNOCHA. (2011). OCHA Regional Office for Asia Pacific LAO PDR: Natural Hazard Risks. Retrieved from https://www.preventionweb.net/publication/lao-peoples-democratic-republic-composite-hazard-map

UNOCHA. (2011). Physical Exposure to Drought in Asia-Pacific. Retrieved from https://www.preventionweb.net/files/23474_ocharoapdroughtv6110501.pdf

WMO. (2023). Tropical Cyclone Programme (TCP). Retrieved from https://community.wmo.int/en/activity-areas/tropical-cyclone-programme-tcp

Brunei Darussalam

The ASEAN Coordinating Center for Humanitarian Assistance on Disaster Management (AHA Centre) and Japan International Cooperation Agency (JICA). (2015). Country Report Brunei: Natural Disaster Risk Assessment and Area Business Continuity Plan Formulation for Industrial Agglomerated Areas in the ASEAN Region. OYO International Corporation, Mitsubishi Research Institute, Inc., CTI Engineering International Co., Ltd. Retrieved from https://landportal.org/pt/node/93458

ASEANPLUS NEWS. (2023, April 5). Brunei gets new weather radar to boost forecast accuracy. The Star. Retrieved from https://www.thestar.com.my/aseanplus/aseanplus-news/2023/04/05/brunei-gets-new-weather-radar-to-boost-forecast-accuracy

Bakar, N., & Franco, F. M. (2022). The fading popularity of a local ecological calendar from Brunei Darussalam, Borneo. Journal of Ethnobiology and Ethnomedicine, 18(1). https://doi.org/10.1186/s13002-022-00525-9

Brunei Country Profile. (2014). Retrieved from https://nidm.gov.in/easindia2014/err/pdf/country_profile/brunei_darussalam.pdf

Brunei Darussalam Meteorological Department. (n.d.). Brunei Darussalam Meteorological Department. Retrieved from https://www.facebook.com/bruneiweather

Brunei Darussalam Meteorological Department. (n.d.). Brunei Darussalam Meteorological Department. Retrieved from http://www.met.gov.bn/

Brunei Darussalam Meteorological Department. (n.d.). bruneiweather. Retrieved from https://www.instagram.com/bruneiweather/?hl=en

Brunei Darussalam Meteorological Department. (n.d.). Your Guide to Color Coded Severe Weather Warnings and Weather Advisory. Retrieved from http://www.met.gov.bn/admin/upload/downloads1581472370.pdf

BRUNEI DARUSSALAM PRESENTATION: Community Based Disaster Preparedness to Support Vulnerable People. (2015). Retrieved from https://www.academia.edu/26884506/Dynamics_of_Hydro_Meteorological_Disasters_Revisiting_the_Mechanisms_and_Drivers_of_Recurrent_Floods_and_Landslides_in_Brunei_Darussalam

Brunei Institute of Leadership & Islamic Finance (BILIF). (n.d.). Operational Risk Management. Retrieved from https://bilif.com.bn/events/operational-risk-management/

Center for Excellence in Disaster Management & Humanitarian Assistance. (2022). Brunei: Disaster Management Reference Handbook. Center for Excellence in Disaster Management & Humanitarian Assistance. Retrieved from https://www.cfe-dmha.org/LinkClick.aspx?fileticket=wqnWHgroAn8%3D&portalid=0

Climate Change Knowledge Portal. (n.d.). Risk: Historical Hazards. (T. W. Group, Producer) Retrieved from Country Brunei Darussalam: https://climateknowledgeportal.worldbank.org/country/brunei-darussalam/vulnerability

Daniel K. Inouye Asia Pacific Center for Security Studies. (n.d.). Brunei Outreach focuses on Disaster Management. Retrieved from Daniel K. Inouye Asia Pacific Center for Security Studies: https://dkiapcss.edu/brunei-outreach-focuses-on-disaster-management/

Food and Agriculture Organization - FAO. (n.d.). Brunei Darussalam. Retrieved from GIEWS - Global Information and Early Warning System: https://www.fao.org/giews/countrybrief/country.jsp?code=BRN&lang=en

Integrated Environmental Consultants - IEC. (n.d.). SUNGAI TUTONG EARLY FLOOD WARNING SYSTEM. Retrieved from Integrated Environmental Consultants: https://iec-brunei.com/IEC_project_pages/Sg_Tutong.htm

International Federation of Digital Seismograph Network. (n.d.). BB: Brunei Darussalam National Seismic Network. Retrieved from International Federation of Digital Seismograph Network: https://www.fdsn.org/networks/detail/BB/

ISP Today. (2023, June 24). The Role of Telecommunications in Brunei's Disaster Management and Emergency Response. Retrieved from https://isp.page/news/the-role-of-telecommunications-in-bruneis-disaster-management-and-emergency-response/

Jamalullail, S. N. R., Sahari, S., Shah, A. A., & Batmanathan, N. (2021). Preliminary analysis of landslide hazard in Brunei Darussalam, SE Asia. Environmental Earth Sciences, 80(16). https://doi.org/10.1007/s12665-021-09815-z

Jha, D. K., Bhattacharyya, R. K., Shyam, S., & Ratnayke, U. R. (2020). Indicator Based Assessment of Integrated Flood Vulnerability Index for Brunei Darussalam. International Journal of Disaster Risk Management, 2(2), 47–70. https://doi.org/10.18485/ijdrm.2020.2.2.4

Lassa, J., & Sembiring, M. (2017). Singapore and a Senior Lecturer at the Charles Darwin University, Australia. 2 Margareth Sembiring is a Senior Analyst at the Centre for Non-Traditional Security Studies. In NTS Insight. Retrieved from https://www.jstor.org/stable/pdf/resrep26808.pdf?acceptTC=true&coverpage=false&addFooter=false

Mahmud, Z. H., & Shah, M. F. M. (2019). RAS/9/077: Supporting Regional Nuclear Emergency Preparedness and Response in the Member States of ASEAN Region for the Pattaya: Safety, Health and Environment Authority. Retrieved from https://www.oap.go.th/images/documents/offices/baea/proap/training/Brunei.pdf

Mclellan, J., Haji-Othman, N. A., & Deterding, D. (2016). The Language Situation in Brunei Darussalam. In The Use and Status of Language in Brunei Darussalam (pp. 9–16). Singapore: Springer. https://doi.org/10.1007/978-981-10-0853-5_2

Ndah, A. B., & Odihi, J. O. (2017). A Systematic Study of Disaster Risk in Brunei Darussalam and Options for Vulnerability-Based Disaster Risk Reduction. International Journal of Disaster Risk Science, 8(2), 208–223. https://doi.org/10.1007/s13753-017-0125-x

Ndah, A. B., Dagar, L., & Becek, K. (2016). Dynamics of Hydro-Meteorological Disasters: Revisiting the Mechanisms and Drivers of Recurrent Floods and Landslides in Brunei Darussalam. International Journal of Earth and Atmospheric Science, 3(1). Retrieved from https://www.researchgate.net/publication/305316042_Dynamics_of_Hydro-Meteorological_Disasters_Revisiting_the_Mechanisms_and_Drivers_of_Recurrent_Floods_and_Landslides_in_Brunei_Darussalam

Pusat Pengurusan Bencana Kebangsaan, Kementerian Hal Ehwal Dalam Negeri, & Negara Brunei Darussalam. (2012). Strategic national action plan (SNAP) for disaster risk reduction 2012-2025. Retrieved from https://iss.ndl.go.jp/books/R100000002-I026312571-00?ar=4e1f&locale=en

Rahman, E. K. A., Ratnayake, U., Tan, S. J., Mahri, A. R. H., Tan, A. E. H., Othman, D. H., … Hamzah, H. H. (2018). A review of planning guidelines and standards for earthwork development near slopes in Brunei Darussalam. 7th Brunei International Conference on Engineering and Technology 2018 (BICET 2018). https://doi.org/10.1049/cp.2018.1560

Russo, A. (2015). Applying the Revised Universal Soil Loss Equation model to land use planning for erosion risk in Brunei Darussalam. Australian Planner, 52(2), 139–155. https://doi.org/10.1080/07293682.2014.957332

Soe, K. N., Othman, S. D., Salazar, V., & Shahari, M. K. A. bin H. (2015). Building the Capacity of Brunei Darussalam on Disaster Management. Retrieved from https://www.rcrc-resilience-southeastasia.org/wp-content/uploads/2017/12/2015_soe_et_al_building_the_capacity_of_brunei_darussalam_on_disaster_management.pdf

Shahriar, S., El-Said M. M., Z., Safwanah N. M., S., Kho J., H., Lee, N. N. D. H. M. F., & Hasim, N. H. H. (2019). Risk assessment for forest fire in Brunei Darussalam. MATEC Web of Conferences, 2019(258), 05033. https://doi.org/10.1051/matecconf/201925805033

Sukri, R. S., & Wah, D. (2018). Climate Change Adaptation in Brunei Darussalam. Climate Change Adaptation in Southeast Asia, 25–41. https://doi.org/10.1007/978-981-16-6088-7

The Brunei Times. (2010, May 27). Brunei: Call to include disaster risk reduction in school curriculum. The Brunei Times. Retrieved from https://www.preventionweb.net/quick/36950

The Brunei Times. (2011, October 19). Brunei: Asean early warning systems crucial. The Brunei Times. Retrieved from https://www.preventionweb.net/quick/35300

The Knowledge Academy. (n.d.). Certified Risk Management Professional CRMP - Brunei Darussalam. Retrieved from https://www.theknowledgeacademy.com/bn/courses/management-of-risk-mor/certified-risk-management-professional-crmp-/

United Nations Economic and Social Commission for Asia and the Pacific. (n.d.). Country SDG Profile - Brunei Darussalam. Retrieved from SDG Gateway: https://data.unescap.org/stories/country-sdg-profile-brunei-darussalam

United Nations Framework for Climate Change. (2016). Brunei Darussalam's Initial National Communication. The Energy and Industry Department. Retrieved from https://unfccc.int/sites/default/files/resource/brnnc1.pdf

Wawasan Brunei 2035. (2019). Wawasan Brunei 2035. Wawasan Brunei 2035. Retrieved from https://www.wawasanbrunei.gov.bn/en/SitePages/home.aspx

Ang, W. S., Law, J. W.-F., Letchumanan, V., Ong, Y. S., Kumari, Y., Ming, L. C., & Tan, L. T.-H. (2023). COVID-19 Pandemic in Brunei Darussalam. Progress in Microbes & Molecular Biology, 6(1). https://doi.org/10.36877/pmmb.a0000326

Yaacob, H., Ali, Q., Anissa Sarbini, N., Nasir Rani, A., & Zaini, Z. (2021). Resilience of Bruneian Economy amidst Covid-19 based on the United Nations Disaster Risk Reduction (UNDRR) framework. Problems and Perspectives in Management, 19(1), 90–102. https://doi.org/10.21511/ppm.19(1).2021.08

Cambodia

Cambodia Ministry of Education, Youth and Sport. (2019). Emergency Preparedness and Response Plan for Education Sector 2019. https://www.humanitarianresponse.info/en/operations/cambodia/document/emergency-preparedness-and-response-plan-education-sector-2019

Cambodia Ministry of Education, Youth and Sport. (2020, July). Cambodia Education Response Plan to COVID 19 Pandemic. https://planipolis.iiep.unesco.org/sites/default/files/ressources/cambodia_education_response_plan_to_covid19_panademic_july_2020.pdf

Center for Excellence in Disaster Management & Humanitarian Assistance. (2020). CAMBODIA Disaster Management Reference Handbook. https://www.cfe-dmha.org/LinkClick.aspx?fileticket=E1Z6eKaOq9g%3d&portalid=0

Chea, C. (2021, January 28). Embassy of Japan and the World Food Programme (WFP) Visit Newly-Built Safe Evacuation Center and a School Feeding Programme | United Nations in Cambodia. UN Cambodia. https://cambodia.un.org/en/109456-embassy-japan-and-world-food-programme-wfp-visit-newly-built-safe-evacuation-center-and

Chowdhary, J. (2022). Early Warning System 1294. In People in Need. https://resources.peopleinneed.net/documents/1055-1.pdf

Creitaru, I., & Allen, B. (2022, February 10). What if technological innovation is the future of inclusive early warning systems? UNDP Asia and the Pacific. https://www.undp.org/asia-pacific/blog/what-if-technological-innovation-future-inclusive-early-warning-systems

Kadir, U. (2020). Private Sector Engagement in Climate Information Services and Early Warning System in Cambodia . UNDP. https://www.adaptation-undp.org/sites/default/files/resources/cis_private_sector_engagement_cambodia_-_june_30_-_final_draft.pdf

Mekong River Commission. (2023, August 7). MRC launches a channel to improve public awareness on flood and drought risks in the Lower Mekong River Basin - Cambodia. https://reliefweb.int/report/cambodia/mrc-launches-channel-improve-public-awareness-flood-and-drought-risks-lower-mekong-river-basin

Ministry of Water Resources and Meteorology. (n.d.). Ministry of Water Resources and Meteorology About Us. Cambodia Department of Meteorology. http://www.cambodiameteo.com/articles?menu=115&lang=en

National Committee for Disaster Management (NCDM), & United Nations Development Programme Cambodia. (n.d.). CamDi. NCDM CamDi. http://camdi.ncdm.gov.kh/DesInventar/profiletab.jsp?countrycode=kh2&continue=y

Open Development Cambodia. (2021, August 31). Disaster preparedness and emergency response policy and administration | Open Development Cambodia (ODC). Open Development Cambodia. https://opendevelopmentcambodia.net/topics/disaster-preparedness-and-emergency-response-policy-and-administration/

Open Development Mekong. (n.d.). OD Mekong Datahub. Open Development Cambodia. Retrieved September 7, 2023, from https://data.opendevelopmentcambodia.net/map-explorer

People in Need. (2022, March 22). Cambodia's Early Warning System 1294: An Adaptable Technology. People in Need. https://www.peopleinneed.net/cambodias-early-warning-system-1294-8693gp

Ramthun, J. (2021, January 14). SERVIR Flood Mapping Service Brings Speed to Cambodia Disaster Management. Climate Links. https://www.climatelinks.org/blog/servir-flood-mapping-service-brings-speed-cambodia-disaster-management

Royal Government of Cambodia. (2015, June 8). Cambodia Law on Disaster Management. http://chfcambodia.net/wp-content/uploads/2017/12/DM-Law_English.pdf

Royal Government of Cambodia. (2013, November). National Action Plan for Disaster Risk Reduction (NAP-DRR) 2014-2018. https://www.rcrc-resilience-southeastasia.org/wp-content/uploads/2017/12/2014_national_action_plan_for_disaster_risk_reduction__nap-drr__2014-2018_english.pdf

Royal Government of Cambodia. (2019, July 25). National Strategic Development Plan (NSDP) 2019-2023. https://data.opendevelopmentcambodia.net/en/laws_record/national-strategic-development-plan-nsdp-2019-2023

Sen, D. (2021, May 23). Six Evacuation Centres Ready for Potential Flood Victims - Khmer Times. Khmer Times. https://www.khmertimeskh.com/50860964/six-evacuation-centres-ready-for-potential-flood-victims/

United Nations Economic and Social Commission for Asia and the Pacific. (n.d.). EWS 1294 Early Warning System Cambodia. UN ESCAP ICT & DRR Gateway. Retrieved September 7, 2023, from https://drrgateway.net/e-resilience/tool/ews-1294-early-warning-system-cambodia

United Nations Economic and Social Commission for Asia and the Pacific. (n.d.). EWS 1294 Early Warning System Cambodia. UN ESCAP ICT & DRR Gateway. Retrieved September 7, 2023, from https://drrgateway.net/e-resilience/tool/ews-1294-early-warning-system-cambodia

United Nations Development Programme Cambodia. (2018, April 25). UNDP Trains Teachers to Lead Emergency Evacuations during Natural Disasters in Cambodia - Cambodia | ReliefWeb. Relief Web. https://reliefweb.int/report/cambodia/undp-trains-teachers-lead-emergency-evacuations-during-natural-disasters-cambodia

United Nations Development Programme Cambodia. (2019, July 9). Dial 1294: UNDP and People in Need expand early warning phone service in Cambodia | United Nations Development Programme. UNDP. https://www.undp.org/cambodia/news/dial-1294-undp-and-people-need-expand-early-warning-phone-service-cambodia

United Nations Development Programme Cambodia. (2019, March 21). UNDP-supported project hands over 53 automatic hydrological and meteorological stations to Cambodia, revolutionizing climate and disaster preparedness | United Nations Development Programme. UNDP. https://www.undp.org/cambodia/press-releases/undp-supported-project-hands-over-53-automatic-hydrological-and-meteorological-stations-cambodia-revolutionizing-climate-and

United Nations Development Programme Cambodia. (2020). Changing the Face of Early Warning in Cambodia. In UNDP. https://www.undp.org/cambodia/publications/changing-face-early-warning-cambodia

United Nations Development Programme Cambodia. (n.d.). Early Warning System (EWS) Standard Operating Procedures | Cambodia | UNDP Climate Change Adaptation. UNDP Climate Change Adaptation. Retrieved September 7, 2023, from https://www.adaptation-undp.org/Cambodia-EWS-standard-operating-procedures

United Nations Office for Disaster Risk Reduction. (2019). Disaster Risk Reduction in Cambodia. In UNDRR. https://www.preventionweb.net/files/68249_682301cambodiaupdaed16oct2019.pdf

United Nations Office for Disaster Risk Reduction. (2022). Words in Action: TRADITIONAL AND INDIGENOUS KNOWLEDGES FOR DISASTER RISK REDUCTION. In UNDRR. https://www.undrr.org/words-action-using-traditional-and-indigenous-knowledges-disaster-risk-reduction

World Food Programme. (n.d.). PRISM | WFP Innovation. Innovation.wfp.org. Retrieved July 18, 2023, from https://innovation.wfp.org/project/prism

World Meteorological Organization. (2020, November 30). 2020 State of Climate Services: Risk Information and Early Warning Systems | World Food Programme. WFP. https://www.wfp.org/publications/2020-state-climate-services-risk-information-and-early-warning-systems

World Meteorological Organization. (2022, December 19). Implementing Community-based Flood Management in Cambodia. WMO. https://public.wmo.int/en/resources/meteoworld/implementing-community-based-flood-management-cambodia

Indonesia

Badan Nasional Penanggulangan Bencana. (2014). Peraturan Kepala Badan Penanggulangan Bencana Nomor 13 Tahun 2014 Tentang Pengarusutamaan Gender di Bidang Penanggulangan Bencana. Retrieved from https://bnpb.go.id/storage/app/media/uploads/regulation/1083/Perka%20No%2013%20Tahun%202014.pdf

Badan Nasional Penanggulangan Bencana. (2015). Indonesia's Disaster Risk Management Baseline Status Report 2015: Towards identifying national and local priorities for the implementation of the Sendai Framework for Disaster Risk Reduction (2015-2030) (SFDRR). In Prevention Web. Retrieved from https://www.preventionweb.net/files/50832_5083220161031indobaselinereportfina.pdf

Badan Nasional Penanggulangan Bencana. (2016). Risiko Bencana Indonesia. Retrieved from https://bnpb.go.id/storage/app/media//uploads/24/buku-rbi-1.pdf

Badan Nasional Penanggulangan Bencana. (2019). National Agency Presentation On Disaster Management In Indonesia. Retrieved from https://aseanregionalforum.asean.org/wp-content/uploads/2019/07/Annex-8-National-Agency-Presentation-by-Indonesia-BNPB-11th-ARF-ISM-on-DR.pdf

Center for Excellence in Disaster Management & Humanitarian Assistance. (2021). INDONESIA: Disaster Management Reference Handbook. Center for Excellence in Disaster Management & Humanitarian Assistance. Retrieved from https://www.cfe-dmha.org/LinkClick.aspx?fileticket=BcQ7lZPdVD4%3d&portalid=0

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. (2020). Integrated development of early warning systems: Tsunami early warning systems in Indonesia. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. Retrieved from https://reliefweb.int/report/indonesia/integrated-development-early-warning-systems-tsunami-early-warning-systems

Government of Indonesia. (2007). Indonesia: Law No. 24/2007 Regarding Disaster Management. Retrieved from http://seaknowledgebank.net/e-library/indonesia-law-no-242007-disaster-management

Indonesian – German Working Group on Tsunami Risk Assessment. (2011). Guideline for tsunami risk assessment in. the Joint Indonesian-German Working Group on Tsunami Risk Assessment. https://www.gitews.de/tsunami-kit/en/E1/further_resources/GITEWS%20Guideline%20for%20Tsunami%20Risk%20Assessment%20in%20Indonesia.pdf

Juwitasari, R. (2022, March 23). Disaster Management in Indonesia: Complex Challenges of a Dual Early Warning System. Heinrich-Böll-Stiftung Southeast Asia. Retrieved from https://th.boell.org/en/2022/03/23/disaster-management-indonesia

Pacific Disaster Center. (2020). National Disaster Preparedness Baseline Assessment: Indonesia. Retrieved from https://www.pdc.org/wp-content/uploads/NDPBA_IDN_Final_Report_English.pdf

Paripurno, E. T. (2011). Best Practices Community Based Disaster Management in East Java Indonesia. Tudor Rose on behalf of UNISDR. Retrieved from https://www.academia.edu/12633575/Best_Practices_Community_Based_Disaster_Management_in_East_Java_Indonesia

Pemerintah Republik Indonesia. (2018). Keputusan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 234/p/2018 Tentang Sekretariat Penanggulangan Bencana Kementerian Pendidikan dan Kebudayaan. Retrieved from https://spab.kemdikbud.go.id/wp-content/uploads/2021/10/JDIH_234-Tahun-2018_20181040.pdf

Pemerintah Republik Indonesia. (2019). Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 33 Tahun 2019 Tentang Penyelenggaraan Program Satuan Pendidikan Aman Bencana. Retrieved from https://spab.kemdikbud.go.id/wp-content/uploads/2021/11/PERMENDIKBUD-33-TAHUN-2019-TENTANG-PENYELENGGARAAN-PROGRAM-SPAB-Revisi-Kumham.pdf

Pemerintah Republik Indonesia. (2020). Peraturan Presiden Nomor 87 Tahun 2020 Tentang Rencana Induk Penanggulangan Bencana Tahun 2020-2044. Retrieved from https://peraturan.go.id/files/ps87-2020.pdf

Sett, D., Widjaja, C. N., Sanady, P., Greco, A., Setiadi, N., Sagala, S., Rozanna, C. S., & Sandholz, S.. (2022). Hazards, exposure and vulnerability in Indonesia: A risk assessment across regions and provinces to inform the development of an adaptive social protection road map (March 2022). In Relief Web. GIZ and United Nations University. https://reliefweb.int/report/indonesia/hazards-exposure-and-vulnerability-indonesia-risk-assessment-across-regions-and

Universitas Gadjah Mada, GNS Science, & Deltares USA. (2020). Laporan Teknis: Studi dan Analisa Acuan Kesiapan Sistem dan Kapasitas Pemangku Kepentingan untuk Platform Peringatan Dini Multi-Bahaya Secara Menyeluruh. Global Facility for Disaster Reduction and Recovery and the World Bank.

Lao PDR

ADPC & UNDP. (2010). Developing a National Risk Profile of Lao PD, Part 1: Hazard Assessment. Retrieved from https://data.opendevelopmentmekong.net/library_record/developing-a-national-risk-profile-of-lao-pdr-part-1-hazard-assessment

Center for Excellence in Disaster Management and Humanitarian Assistance. (2021). Disaster Management Reference Handbooks: Disaster Risk Profile (p. 29). Retrieved from https://www.cfe-dmha.org/Publications/Disaster-Management-Reference-Handbooks

Lao People's Democratic Republic. Ministry of Labour and Social Welfare. (2000). Decision on the Assignment of NDMC Roles and Responsibilities (No. 097/MLSW).

PreventionWeb. (N/A). Women's Resilience in the Lao People's Democratic Republic: How Laws and Policies Promote Gender Equality in Climate Change and Disaster Risk Management. Retrieved from https://openjicareport.jica.go.jp/pdf/1000023401.pdf

ReliefWeb. (2019). Disaster Risk Reduction in Lao PDR (pp. 9-13, Status Report July 2019). Retrieved from https://reliefweb.int/report/lao-peoples-democratic-republic/disaster-risk-reduction-lao-pdr-status-report-july-2019

ReliefWeb. (2018). Lao PDR: Disaster Response Plan (August 2018-December 2018). Retrieved from https://reliefweb.int/report/lao-peoples-democratic-republic/lao-pdr-disaster-response-plan-august-2018-december-2018

UNDRR. (2019). Lao PDR DRM Status Report (p. 15). Retrieved from https://www.preventionweb.net/files/68252_682303laopdrdrmstatusreport.pdf

Malaysia

ABU DRRGroup. (2013, June 20). Early warning and coordination system of Malaysia. Retrieved September 8, 2023, from www.slideshare.net website: https://www.slideshare.net/ABU_DRRGroup/disaster-abu-18jun2013latest

Adnan, A., Ramli, M. Z., & Razak, S. M. S. A. (2015). Disaster Management and Mitigation for Earthquakes: Are We Ready? Retrieved from https://www.researchgate.net/publication/286360217_Disaster_Management_and_Mitigation_for_Earthquakes_Are_We_Ready

Ahmad, N. M., Shah, H. A. R., Saleh, N. S. S. N., Supaat, D., Ismail, F. S. M., Shukor, S. A., & Ghafar, A. A. (2022). Natural Disaster and Vulnerable Victims in Malaysia: A Preliminary Study. Retrieved from https://www.researchgate.net/publication/358571656_NATURAL_DISASTER_AND_VULNERABLE_VICTIMS_IN_MALAYSIA_A_PRELIMINARY_STUDY

Alias, N. E., Salim, N. A., Taib, S. M., Mohd Yusof, M. B., Saari, R., Adli Ramli, M. W., … Blenkinsop, S. (2019). Community responses on effective flood dissemination warnings—A case study of the December 2014 Kelantan Flood, Malaysia. Journal of Flood Risk Management, 13(S1). https://doi.org/10.1111/jfr3.12552

Anas, Ir. R. (2016). TELEKOM MALAYSIA S INITIATIVE IN PUBLIC SAFETY AND DISASTER MANAGEMENT: THE MALAYSIAN EXPERIENCE - PDF Free Download. Retrieved September 8, 2023, from docplayer.net website: https://docplayer.net/45965193-Telekom-malaysia-s-initiative-in-public-safety-and-disaster-management-the-malaysian-experience.html

ASEAN Coordinating Centre for Humanitarian Assistance on disaster management (AHA Centre). (2019, March 20). ASEAN Risk Monitor and Disaster Management Review (ARMOR). Retrieved January 9, 2021, from AHA Centre website: https://ahacentre.org/publication/armor/

Auzzir, Z., Haigh, R., & Amaratunga, D. (2018). Impacts of Disaster to SMEs in Malaysia. Procedia Engineering, 212, 1131–1138. https://doi.org/10.1016/j.proeng.2018.01.146

Ayobami, A. S. and , & Rabi'u, S. (2012). SMS as a Rural Disaster notification system in Malaysia: A feasibility. International Conference on Communication and Media. http://dx.doi.org/10.13140/2.1.2727.3925

Azad, W. H., Hassan, Nor, Weisgerber, A., & Fuad Febrian Ahmad. (2019). National Flood Forecasting and Warning System of Malaysia: An Overview. Water Resources Development and Management. https://doi.org/10.1007/978-981-15-1971-0_27

Aziz, J. I. and F. (2023, May 9). Is Malaysia prepared to deal with quakes? Retrieved September 8, 2023, from Asia News Network website: https://asianews.network/is-malaysia-prepared-to-deal-with-quakes/

Azmani, S., Juliana, N., Idrose, A. M., Amin, N. A., & Saudi, A. S. M. (2018). Challenges of communication system during emergency disaster response in Malaysia: A review. Journal of Fundamental and Applied Sciences, 9(4S), 890. https://doi.org/10.4314/jfas.v9i4s.51

Badd. (2022, March 9). Malaysia has a siren system for practically every disaster… including air raids. Retrieved September 8, 2023, from https://cilisos.my/malaysia-actually-has-a-siren-for-air-raids-heres-what-it-sounds-like/ website: https://cilisos.my/malaysia-actually-has-a-siren-for-air-raids-heres-what-it-sounds-like/

BERNAMA. (2023, June 26). CDF conducts Public Warning System siren test. Retrieved September 8, 2023, from Sinar Daily website: https://www.sinardaily.my/article/199746/malaysia/national/cdf-conducts-public-warning-system-siren-test%20-%20testing%20occurred%20of%20warning%20sirens

Bhuiyan, T. R., Er, A. C., Lim, C.-S., Muhamad, N., Bakar, A. A., & Pereira, J. J. (2022). Disaster loss indicators for reporting to DesInventar Sendai and enabling rapid monetary valuation in Malaysia. Weather and Climate Extremes, 37, 100488. https://doi.org/10.1016/j.wace.2022.100488

Brown, E. (2023). Malaysia raises the bar for tropical flood forecasting. Retrieved September 8, 2023, from www.hrwallingford.com website: https://www.hrwallingford.com/insight/malaysia-raises-bar-tropical-flood-forecasting

Center for Excellence in Disaster Management & Humanitarian Assistance. (2022). MALAYSIA Disaster Management Reference Handbook. Retrieved from https://www.cfe-dmha.org/LinkClick.aspx?fileticket=QjwIR4LYZew%3d&portalid=0

Che Hamid, H. E., MSaad, N. J. A., Mat Razali, N. A., Khairuddin, M. A., Ismail, M. N., Ramli, S., … Shah, P. N. N. A. (2019). Disaster Management Support Model for Malaysia. Advances in Visual Informatics, 570–581. https://doi.org/10.1007/978-3-030-34032-2_50

Cyber Security Malaysia. (2023). CyberSecurity Malaysia. Retrieved September 8, 2023, from www.cybersecurity.my website: https://www.cybersecurity.my/en/our_services/myvac/main/detail/2659/index.html

Datuk, M., Thajudeen, A., & Wahab. (2012). Malaysia National Progress Report on the Implementation of the Hyogo Framework for Action (2011-2013). Retrieved from https://www.preventionweb.net/files/28824_mys_NationalHFAprogress_2011-13.pdf

Department of Statistics Malaysia (DOSM). (2022). Department of Statistics Malaysia. Retrieved from www.dosm.gov.my website: https://www.dosm.gov.my/portal-main/release-content/b0812501-7b67-11ed-80ec-0cc47a9b694a

Drury, P. (2017, February 21). Flood risk analysis & flood warning systems for Malaysia. Retrieved November 21, 2022, from Ambiental Risk website: https://www.ambientalrisk.com/flood-risk-analysis-flood-warning-systems-malaysia/

How, V., Azmi, E. S., Abdul Rahman, H., & Othman, K. (2020). The Way Forward: Opportunities and Challenges of Sustainable School Disaster Education in Malaysia. International Journal of Academic Research in Business and Social Sciences, 10(15). https://doi.org/10.6007/ijarbss/v10-i15/8252

Idid, S. N. K. A.-I. S. A. (2022a, October 11). Comment | Enhancing Malaysia's early warning system to save lives. Retrieved September 8, 2023, from Malaysiakini website: https://www.malaysiakini.com/columns/639066

Idid, S. N. K. A.-I. S. A. (2022b, December 14). COMMENT | Enhancing Malaysia's disaster risk reduction strategy. Retrieved from Malaysiakini website: https://www.malaysiakini.com/columns/648028

International Federation of Red Cross and Red Crescent Societies. (2022). Malaysia Floods 2022, DREF Application (MDRMY009) - Malaysia | ReliefWeb. In reliefweb.int. Retrieved from https://reliefweb.int/report/malaysia/malaysia-floods-2022-dref-application-mdrmy009

Isahak, A., Reza, M. I. H., Siwar, C., Ismail, S. M., Sulaiman, N., Hanafi, Z., … Taha, M. R. (2018). Delineating risk zones and evaluation of shelter centres for flood disaster management along the Pahang River Basin, Malaysia. Jàmbá: Journal of Disaster Risk Studies, 10(1). https://doi.org/10.4102/jamba.v10i1.501

Ismail, M. K. Z., & Omar, B. Z. C. (2017). Malaysian Science Technology Plan for Disaster Risk Reduction. Science Technology Plan for Disaster Risk Reduction: Asian and Pacific Perspectives. Retrieved from https://www.researchgate.net/publication/322244280_Malaysian_Science_Technology_Plan_for_Disaster_Risk_Reduction

J, S., Edre, M. A., Juni, M. H., & Farhan A. F., A. (2016). Governance of Flood Disaster Management: Malaysian Case Study. International Journal of Public Health and Clinical Sciences, 3(1). Retrieved from https://www.researchgate.net/publication/310445129_GOVERNANCE_OF_FLOOD_DISASTER_MANAGEMENT_MALAYSIAN_CASE_STUDY

Janius, R., Abdan, K., & Zulkaflli, Z. A. (2017). Development of a disaster action plan for hospitals in Malaysia pertaining to critical engineering infrastructure risk analysis. International Journal of Disaster Risk Reduction, 21, 168–175. https://doi.org/10.1016/j.ijdrr.2016.12.002

Kang, B. G., Fazlie, M. A., Goh, B. H., Song, M. K., & Zhang, C. (2015). Current Practice of Risk Management in the Malaysia Construction Industry–The Process and Tools/Techniques. International Journal of Structural and Civil Engineering Research, 4(4). https://doi.org/10.18178/ijscer.4.4.371-377

Khairilmirizal, S., M. F., H., Hussain, A. R., Jusoh, M. H., Sulaiman, A. A., & Ainul Husna, K. (2016). Implementation of Disaster Management Policy in Malaysia and Its Compliance Towards International Disaster Management Framework - ProQuest. International Information Institute, 19(8), 3301–3306. Retrieved from https://www.proquest.com/openview/9f777f4d2d1750930d1b4a8a21b15e3f/1?pq-origsite=gscholar&cbl=936334

Khalid, M. S., Mustaffa, C. S., Marzuki, M. N., Sakdan, M. F., Sipon, S., Ariffin, M. T., & Shafiai, S. (2015). Failure to React Positively to Flood Early Warning Systems: Lessons Learned by Flood Victims from Flash Flood Disasters: The Malaysia Experience. International Journal of Social, Behavioral, Educational, Economic and Management Engineering, 9(5). Retrieved from https://www.researchgate.net/profile/Sapora-Sipon/publication/280114495_Failure_to_React_Positively_to_Flood_Early_Warning_Systems_Lessons_Learned_by_Flood_Victims_from_Flash_Flood_Disasters_The_Malaysia_Experience/links/55aadf8208aea3d086827da1/Failure-t

Latiff, R., Teo, A., & Lee, L. (2021, December 20). Malaysian emergency services, volunteers rescue 21,000 from flooding. Reuters. Retrieved from https://www.reuters.com/markets/commodities/more-than-21000-people-displaced-by-floods-malaysia-state-media-2021-12-19/

Lim, I. (2022, January 2). Getting Malaysians involved in disaster drills: Overcoming the “hearing fire alarm but not knowing what to do” problem. Retrieved September 8, 2023, from Malay Mail website: https://www.malaymail.com/news/malaysia/2022/01/02/getting-malaysians-involved-in-disaster-drills-overcoming-the-hearing-fire/2032453

Loi, D. W., Raghunandan, M. E., & Swamy, V. (2018). Revisiting seismic hazard assessment for Peninsular Malaysia using deterministic and probabilistic approaches. Natural Hazards and Earth System Sciences, 18(9), 2387–2408. https://doi.org/10.5194/nhess-18-2387-2018

Mageswari, M. (n.d.). ENSURING MALAYSIA’S DISASTER PREPAREDNESS. Retrieved September 8, 2023, from The Star website: https://www.thestar.com.my/news/nation/2022/04/03/ensuring-malaysias-disaster-preparedness#.YkjnsARAHJg.whatsapp

Maksom, Z. (2012). Developing Malaysian community-based flood warning initiatives through Activity Centered Design i Developing Malaysian community based flood warning initiatives through Activity Centered Design. Retrieved from https://researchbank.swinburne.edu.au/file/c7743618-6d58-47a7-97b7-6c80acfc32d2/1/Zulisman%20Maksom%20Thesis.pdf

Masud, M. M., Sackor, A. S., Ferdous Alam, A. S. A., Al-Amin, A. Q., & Abdul Ghani, A. B. (2018). Community responses to flood risk management – An empirical Investigation of the Marine Protected Areas (MPAs) in Malaysia. Marine Policy, 97, 119–126. https://doi.org/10.1016/j.marpol.2018.08.027

Mead, M. I., Castruccio, S., Latif, M. T., Nadzir, M. S. M., Dominick, D., Thota, A., & Crippa, P. (2018). Impact of the 2015 wildfires on Malaysian air quality and exposure: a comparative study of observed and modeled data. Environmental Research Letters, 13(4), 044023. https://doi.org/10.1088/1748-9326/aab325

Mohd Hussain, M. R., Rabe, N. S., Zen, I., Tukiman, I., Muda, R. S., & Mamat, A. F. (2019). AN ASSESSMENT ON EARLY WARNING SYSTEM: INITIAL SURVEY ANALYSIS. PLANNING MALAYSIA, 17. https://doi.org/10.21837/pm.v17i10.653

Muhamad, N., Arshad, S. H. M., & Pereira, J. J. (2021). Exposure Elements in Disaster Databases and Availability for Local Scale Application: Case Study of Kuala Lumpur, Malaysia. Frontiers in Earth Science, 9. https://doi.org/10.3389/feart.2021.616246

Noorhashirin, H., Faiza, T.N., Farhan, R.M., & Juni, M.H. (2016). Assessing Malaysian disaster preparedness for flood. International Journal of Public Health and Clinical Sciences, 3, 1-15. https://www.researchgate.net/publication/338594431_ASSESSING_MALAYSIAN_DISASTER_PREPAREDNESS_FOR_FLOOD

Nor Diana, M. I., Muhamad, N., Taha, M. R., Osman, A., & Alam, Md. M. (2021). Social Vulnerability Assessment for Landslide Hazards in Malaysia: A Systematic Review Study. Land, 10(3), 315. https://doi.org/10.3390/land10030315

Omar Chong, N., & Kamarudin, K. H. (2018). DISASTER RISK MANAGEMENT IN MALAYSIA: ISSUES AND CHALLENGES FROM THE PERSEPCTIVE OF AGENCIES. PLANNING MALAYSIA, 16(1), 105–117. https://doi.org/10.21837/pm.v16i5.415

Pusat Geospatial Negara. (2014). Malaysia Geospatial Metadata Standard (MGMS) | MyGeoportal. Retrieved from Mygeoportal.gov.my website: https://www.mygeoportal.gov.my/malaysia-geospatial-metadata-standard-mgms

Ramli, M. W. A., Alias, N. E., Mohd Yusof, H., Yusop, Z., & Taib, S. M. (2021). Development of a Local, Integrated Disaster Risk Assessment Framework for Malaysia. Sustainability, 13(19), 10792. https://doi.org/10.3390/su131910792

Razak, R. (2022, December 23). Expert says Malaysia's early warning system needs upgrade, flood risk map not reaching community. Retrieved September 8, 2023, from https://malaysia.news.yahoo.com/expert-says-malaysia-early-warning-020243498.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvLnVrLw&guce_referrer_sig=AQAAAG9LW2AsZE4ou1Nu8CTJDSVoIRrxf4hqhEuNzKkSKon-byAfVEd3bFVftRocvTiUjJHSlFiKmeucScaSNo7yJxQxw

Reuters. (2021, December 22). Malaysia warns of more floods as Prime Minister admits lapse in rescue efforts. Retrieved September 8, 2023, from CNN website: https://edition.cnn.com/2021/12/21/asia/malaysia-floods-response-intl-hnk/index.html

Romali, N. S., & Yusop, Z. (2021). Flood damage and risk assessment for urban area in Malaysia. Hydrology Research, 52(1), 142–159. https://doi.org/10.2166/nh.2020.121

Roosli, R. (2010). Managing disasters in Malaysia: the attitude of officials towards compliance with the MNSC Directive 20 [Doctoral thesis]. https://nrl.northumbria.ac.uk/id/eprint/2925/

Rosinski, M. (2021). Flood Early Warning System in Malaysia. Retrieved from Electronic outdoor sirens and early warning and emergency notification systems website: https://www.electronic-sirens.com/flood-early-warning-system-in-malaysia/

S. Khairilmizal, Hussin, M., Ihsan, A., Hussain, A., K. Ainul Husna, Mohamad Huzaimy Jusoh, … Mohd Haikal Kasri. (2016). Policy on Disaster Management in Malaysia: The Need of Supporting Governance. Advance Science Letters, 22(12), 4213–4215. https://doi.org/10.1166/asl.2016.8108

Seman, Z. A. bin A. (n.d.). Asian Disaster Reduction Center (ADRC). Retrieved from www.adrc.asia website: https://www.adrc.asia/acdr/2017/documents/7%20Malaysia%20National%20Disaster%20Management%20Agency%20(NADMA)%20and%20its%20philosophy

Shariff, N. N. M., & Hamidi, Z. S. (2019). Community-based approach for a flood preparedness plan in Malaysia. Jàmbá: Journal of Disaster Risk Studies, 11(1). https://doi.org/10.4102/jamba.v11i1.598

Suparta, W., Rahman, R., Singh, M. S. J., & Latif, M. T. (2015). Investigation of Flash Flood Over the West Peninsular Malaysia by Global Positing System Network. Advanced Science Letters, 21(2), 153–157. https://doi.org/10.1166/asl.2015.5845

Telegrafia Company. (2016). Tsunami siren warning system for the Malaysian government agency. Retrieved September 8, 2023, from Electronic outdoor sirens and early warning and emergency notification systems website: https://www.electronic-sirens.com/tsunami-siren-warning-system-malaysian/

The ASEAN Secretariat. (2022). ASEAN Framework on Anticipatory Action in Disaster Management. Retrieved from https://asean.org/wp-content/uploads/2022/06/ASEAN-Framework-on-Anticipatory-Action-in-Disaster-Management.pdf

The Malaysian Administrative Modernisation and Management Planning Unit - MAMPU. (n.d.). MyGOV - The Government of Malaysia's Official Portal. Retrieved from www.malaysia.gov.my website: https://www.malaysia.gov.my/portal/content/30605

The Malaysian Insight. (2022, February 25). Flood warning in Kuala Krai, Tanah Merah | The Malaysian Insight. Retrieved September 8, 2023, from www.themalaysianinsight.com website: https://www.themalaysianinsight.com/s/368643?utm_source=dlvr.it&utm_medium=facebook&utm_campaign=the%20malaysian%20insight

The United Nations Office for Disaster Risk Reduction and Asian Disaster Preparedness Center. (2020). Disaster Risk Reduction in Malaysia. Retrieved from https://www.undrr.org/media/48531/download?startDownload=true

Water Security and Sustainable Development Hub. (n.d.). Community disaster risk preparedness and awareness in Malaysia. Retrieved September 8, 2023, from Water Security & Sustainable Development Hub website: https://www.watersecurityhub.org/news-events/news/community-disaster-risk-preparedness-and-awareness-malaysia

Xiung, C. J. (2022, November 11). Terato Tech Releases Flood Monitoring Feature for Its Kitajaga App. Retrieved September 8, 2023, from Tatler Asia website: https://www.tatlerasia.com/gen-t/leadership/terato-tech-releases-flood-monitoring-feature-for-its-kitajaga-app

Yeong, A. (2022, November 8). Nadma issues flood alert for seven states. Retrieved September 8, 2023, from Malay Mail website: https://www.malaymail.com/news/malaysia/2022/11/08/nadma-issues-flood-alert-for-seven-states/38324

Yusof, D. Dr. N. Mohd. Z. bin Hj. N. (1997). The National Infrastructure for Land Information System (NaLIS), Applying Information Technology to Improve the Utilisation of Land Data in Malaysia. https://www.oicrf.org/-/the-national-infrastructure-for-land-information-system-nalis-applying-information-technology-to-improve-the-utilisation-of-land-data-in-malaysia

Zahari, N. Z., & Hashim, A. M. (2018). Adequacy of Flood Relief Shelters: A Case Study in Perak, Malaysia. E3S Web of Conferences, 34, 02016. https://doi.org/10.1051/e3sconf/20183402016

Zolfagharian, S., Irizarry, J., Ressang, A., Nourbakhsh, M., & Gheisari, M. (2014). Automated safety planning approach for residential construction sites in Malaysia. International Journal of Construction Management, 14(3), 134–147. https://doi.org/10.1080/15623599.2014.926190

Myanmar

Aguirre-Ayerbe, Ignacio., et al . (2020, October). An evaluation of availability and adequacy of Multi-Hazard Early Warning Systems in Asian countries: A baseline study. International Journal of Disaster Risk Reduction, 49. doi:https://doi.org/10.1016/j.ijdrr.2020.101749

Badri Bhakta Shrestha, A. K. (2020). Quantitative assessment of flood risk with evaluation of the effectiveness of dam operation for flood control: A case of the Bago River Basin of Myanmar. International Journal of Disaster Risk Reduction,, 50. doi:https://doi.org/10.1016/j.ijdrr.2020.101707

Baker, J. e. (2019). Myanmar's Urbanization: Creating Opportunities for All. The World Bank Group. Retrieved from https://www.worldbank.org/en/country/myanmar/publication/myanmars-urbanization-creating-opportunities-for-all

Center for Excellence in Disaster Management & Humanitarian Assistance. (2020). MYANMAR: Disaster Management Reference Handbook. Center for Excellence in Disaster Management & Humanitarian Assistance. Retrieved from https://www.cfe-dmha.org/LinkClick.aspx?fileticket=ruMUcWpK0E4%3D&portalid=0

Dixon, N., Smith, A. & Pietz, M. (2022). A Community-operated Landslide Early Warning Approach: Myanmar case study. Geoenvironmental Disasters, 9(18). doi:https://doi.org/10.1186/s40677-022-00220-7

Government of Myanmar. (n.d.). Standing Order on Natural Disaster Management in Myanmar. Retrieved from http://www.rrdmyanmar.gov.mm/wp-content/uploads/2013/08/Standing-Order-on-Natural-Disaster-management-in-Myanmar.pdf

Humanitarian Assistance and Resilience Programme Facility & the Myanmar Information Management Unit. (2018). Vulnerability in Myanmar: A Secondary Data Review of Needs, Coverage and Gaps. the United Kingdom's Department for International Development, the Government of Canada and European Union humanitarian aid. Retrieved from https://themimu.info/sites/themimu.info/files/documents/Report_Vulnerability_in_Myanmar_HARP-MIMU_Jun2018_ENG_Print_version.pdf

Khaing ZM, Z. K. (2019). Flood hazard mapping and assessment in data-scarce Nyaungdon area, Myanmar. PLoS ONE. doi:https://doi.org/10.1371/journal.pone.0224558

Malteser International. (2015). Mapping of Stakeholders and Initiatives of Early Warning Systems in Myanmar. (M. Carette, Ed.) Yangon, Myanmar: Malterser International. Retrieved from https://www.preventionweb.net/publication/mapping-stakeholders-and-initiatives-early-warning-systems-myanmar

Mercer, D. J. (2016). Building Resilience of Rural Communities in Myanmar: Handbook for field practitioners, 2nd Edition. Malteser International. Retrieved from https://themimu.info/sites/themimu.info/files/documents/Building_resilience_of_rural_communities_in_Myanmar_-_Handbook_for_fi

Ministry of Religious Affairs and Culture of the Government of the Union of Myanmar. (n.d.). Bagan Disaster Risk Management Plan (DRMP). The Japan-World Bank Program for Mainstreaming Disaster Risk Management (DRM) and the Tokyo DRM Hub. Retrieved from https://documents1.worldbank.org/curated/en/671391544633861934/pdf/132874-WP-P162815-PUBLIC-Bagan-DRM-Eng.pdf

Ministry of Social Welfare Relief and Resettlement, Relief and Resettlement Department. (2012). Myanmar Action Plan on Disaster Risk Reduction. Ministry of Social Welfare Relief and Resettlement, Relief and Resettlement Department. Retrieved from https://reliefweb.int/report/myanmar/myanmar-action-plan-disaster-risk-reduction-mapdrr

Miyamoto International. (2020). Review of disaster risks and structural vulnerability assessments in Myanmar: VOLUME 1 – Overview of Yangon's disaster risk profile. The World Bank Group. Retrieved from https://understandrisk.org/wp-content/uploads/WB_Myanmar01_Report

Murugesan, J. (2020). Myanmar Disaster Risk Assessment. ADB and Canada. Retrieved from https://events.development.asia/system/files/materials/2020/11/202011-myanmar-disaster-risk-assessment.pdf

Myanmar Consortium for Community Resilience. (2013). Review of Myanmar's Disaster Management Law from the Angle of Inclusivity. European Commission's DIsaster Preparedness Programme (DIPECHO), Humanitarian Aid and Civil Protection,. Retrieved from https://oxfamilibrary.openrepository.com/bitstream/handle/10546/312201/rr-myanmar-disaster-management-law-050214-summ-en.pdf;jsessionid=F6C1F523594F231DBDF5E10FC646EE27?sequence=2

Myanmar Information Management Unit. (n.d.). Retrieved from https://themimu.info/search/external?field_search=&field_sectors=0&field_clusters=0&field_emergency_names=0&field_state_regions=0&field_product_type=0

Myanmar Information Management Unit. (2021). Disability in Myanmar (2014 - 2019). UK Aid. Retrieved from https://themimu.info/sites/themimu.info/files/documents/Report_Analytical_Brief_Disability_MIMU_18Aug2021_ENG.pdf

Myanmar Information Management Unit. (2022). Climate, Environmental Degradation and Disaster Risk in Myanmar. Nexus Response Mechanism and European Union. Retrieved from https://themimu.info/sites/themimu.info/files/documents/Report_Analytical_Brief_Climate_MIMU_May2022_ENG.pdf

Myanmar Information Management Unit. (2022). Household Amenities in Myanmar 2014 - 2019. Nexus Response Mechanism and European Union. Retrieved from https://themimu.info/sites/themimu.info/files/documents/Report_Analytical_Brief_Household_Amenities_MIMU_05May2022_ENG_0.pdf

Myanmar Red Cross Society. (2019). Hazards Mapping in Myanmar States and Divisions. Myanmar Red Cross Society. Retrieved from https://www.rcrc-resilience-southeastasia.org/document/hazards-mapping-in-myanmar-states-and-divisions/

Myanmar's News Agency. (2022, May 23). The Global New Highlight of Myanmar. Retrieved from https://www.gnlm.com.mm/sac-vice-chairman-national-disaster-management-committee-chairman-vice-senior-general-soe-win-meets-with-people-affected-by-natural-disasters-provides-relief-supplies-to-mon-state-disaster-management/

National Disaster Management Committee, Republic of the Union of Myanmar. (2017, November 29). The Myanmar Action Plan on Disaster Risk Reduction 2017. Nay Pyi Taw, Myanmar: National Disaster Management Committee, Relief and Settlement Department, Ministry of Social Welfare, Relief and Settlement, Republic of the Union of Myanmar. Retrieved from https://www.undp.org/myanmar/publications/myanmar-action-plan-disaster-risk-reduction-2017

National Natural Disaster Management Committee. (n.d.). Myanmar National Framework for Community Disaster Resilience. Retrieved from https://faolex.fao.org/docs/pdf/mya168037.pdf

Office for the Coordination of Humanitarian Affairs (OCHA). (2011). MYANMAR: Natural Hazard Risks. Retrieved from MYANMAR: Natural Hazard Risks: https://www.preventionweb.net/files/4164_ochamyahazardv3110606.pdf

Paz González, Q. F. (2017). Myanmar Disaster Risk Profile. Emergency and Disaster, 4(4). Retrieved from https://dialnet.unirioja.es/descarga/articulo/7886511.pdf

Phongsapan, Kittiphong et al. (2019, December 11). Operational Flood Risk Index Mapping for Disaster Risk Reduction Using Earth Observations and Cloud Computing Technologies: A Case Study on Myanmar. Frontiers in Environmental Science, 7. doi:https://doi.org/10.3389/fenvs.2019.00191

Relief and Resettlement Department. (2015). Risk Assessment Roadmap: Myanmar. ADPC and UNICEF. Retrieved from https://www.adpc.net/igo/category/ID937/doc/2015-x1SFw3-ADPC-Myanmar_Risk_Assessment_Roadmap.pdf

Servir Global. (2017). Supporting Near Real-Time Flood Monitoring in Myanmar. Retrieved from https://servirglobal.net/ServiceCatalogue/details/5c35af9d9ff7d708e49cc97c

Shelly Win, W. W. (2018, June). Establishment of flood damage function models: A case study in the Bago River Basin, Myanmar. International Journal of Disaster Risk Reduction, 28, 688-700. doi:https://doi.org/10.1016/j.ijdrr.2018.01.030

Shiddiqi, Hasbi Ash., et al. . (2018, September 1). Source Study of the 24 August 2016 Mw 6.8 Chauk, Myanmar, Earthquake. Seismological Research Letters, 89(5), 1773-1785. doi:https://doi.org/10.1785/0220170278

Somsa-Ard, Nanthaporn and Santi Pailoplee. (2013). Seismic Hazard Analysis for Myanmar. Journal of Earthquake and Tsunami, 7(4). doi:https://doi.org/10.1142/S1793431113500292

Tun, M. M. (2020). FY2020 Country Report of Myanmar. Department of Disaster Management, Ministry of Social Welfare, Relief and Resettlement, Republic of the Union of Myanmar. Retrieved from https://www.adrc.asia/countryreport/MMR/2020/MMR_CR2020.pdf

Tun, S. (2013). Flood Management in Myanmar. Regional Workshop on Climate Change and Urban Flood Management. Daegu, Republic of Korea. Retrieved from https://www.unescap.org/sites/default/files/S3b2_Myanmar.pdf

United Nations Conference on Trade and Development. (2022). Vulnerability Profile: Myanmar. Geneva: United Nations Publications. Retrieved from https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/CDP-PL-2021-4C-VP.pdf

United Nations Human Settlements Programme - UN-Habitat. (2015). Enhancing and Developing Seismic Risk Assessment for Sagaing City of Myanmar. UN Habitat, Norwegian Ministry of Foreign Affairs, European Commission. Retrieved from https://unhabitat.org/sites/default/files/2020/01/seismic-risk-assessment-for-sagaing.pdf

United Nations Office for Disaster Risk Reduction. (2011). Myanmar: composite hazard map. UNDRR. Retrieved from https://www.preventionweb.net/quick/52745

Vaughan, E. (n.d.). Myanmar Country Report. ESPA and ACCCRN. Retrieved from https://www.acccrn.net/sites/default/files/publication/attach/myanmar_paper_rev.pdf

Win Win Zin, A. K. (2018). Flood Hazard Assessment of Bago River Basin, Myanmar. Journal of Disaster Research, 13(1), 14-21. doi:https://doi.org/10.20965/jdr.2018.p0014

Witze, A. (2019). Quake-prone Myanmar leads the way in seismic monitoring. Nature Publishing Group. Retrieved from https://www.preventionweb.net/quick/22856

Philippines

Baron, G. (2021, May 21). DICT activates free Wi-Fi in remote areas in Luzon. Manila Bulletin. https://mb.com.ph/2021/05/15/dict-activates-free-wi-fi-in-remote-areas-in-luzon

Department of Education Disaster Risk Reduction and Management Service. (2020). Strengthening Resilience in Basic Education. https://www.deped.gov.ph/wp-content/uploads/2020/11/09_TLM_DRRMS-Brochure_20190830.pdf

Department of Education. (2021, August 20). School-based Disaster Preparedness and Response Measures for Tropical Cyclones, Flooding, and other Weather-related Disturbances and Calamities. https://www.deped.gov.ph/wp-content/uploads/2021/08/DO_s2021_033.pdf

Department of the Interior and Local Governance. (2018). Memorandum Circular on Policy Procedures and Guidelines in the Implementation of the FY 2018 Local Government Support Fund-Assistance to the Municipalities (LSGF-AM) Program. https://dilg.gov.ph/PDF_File/issuances/memo_circulars/dilg-memocircular-201821_3776382c33.pdf

Department of the Interior and Local Government, & National Disaster Risk Reduction and Management Council. (2018). Operation Listo Disaster Preparedness Manual for LGUs 2018. DILG Local Government Academy. https://lga.gov.ph/uploads/publication/attachments/1590478478.pdf

Department of Science and Technology. (2018, July 9). DEWS - Deployment of Early Warning System. DOST-ASTI. https://asti.dost.gov.ph/projects/dews/

Department of Science and Technology Philippine Atmospheric, Geophysical and Astronomical Services Administration. (2023). Calibration Services. DOST PAGASA. https://www.pagasa.dost.gov.ph/products-and-services/calibration-services

Department of Science and Technology Philippine Atmospheric, Geophysical and Astronomical Services Administration. (2023). Engineering and Technical Services Division. DOST PAGASA. https://prsd.pagasa.dost.gov.ph/index.php/12-about-pagasa/74-engineering-and-technical-services-division

Department of Science and Technology Philippine Atmospheric, Geophysical and Astronomical Services Administration. (n.d.). Climatological Data. DOST PAGASA. https://www.pagasa.dost.gov.ph/climate/climate-data

Department of Science and Technology Philippine Institute of Volcanology and Seismology. (n.d.). Strategic Initiatives FY 2017-2022. DOST PHIVOLCS. https://www.phivolcs.dost.gov.ph/index.php/programs-and-projectss

Department of Science and Technology Philippine Atmospheric, Geophysical and Astronomical Services Administration S&T Media Service. (2022, March 22). DOST-PAGASA Modifies Tropical Cyclone Wind Signal (TCWS) System. DOST PAGASA. https://www.pagasa.dost.gov.ph/press-release/108

Global System for Mobile Communications Association. (2022). Early Warning Systems in the Philippines: Building resilience through mobile and digital technologies. In GSMA. https://www.gsma.com/mobilefordevelopment/resources/ews-philippines-mobile-and-digital-technologies/

Lloyd, S., Gray, J., Healey, S., & Opdyke, A. (2022). Social vulnerability to natural hazards in the Philippines. International Journal of Disaster Risk Reduction. https://doi.org/10.1016/j.ijdrr.2022.103103

Miasco, M. (2017, July 30). Disaster preparedness now part of school curriculum. Philstar.com; The Freeman. https://www.philstar.com/the-freeman/cebu-news/2017/07/30/1723194/disaster-preparedness-now-part-school-curriculum

National Privacy Commission. (2020). Republic of the Philippines National Privacy Commission Subject: Data Sharing Agreements. https://www.privacy.gov.ph/wp-content/uploads/2021/01/Circular-Data-Sharing-Agreement-amending-16-02-21-Dec-2020-clean-copy-FINAL-LYA-and-JDN-signed-minor-edit.pdf

Official Gazette of the Republic of the Philippines. (2010, May 27). Republic Act No. 10121 | GOVPH. Official Gazette of the Republic of the Philippines. https://www.officialgazette.gov.ph/2010/05/27/republic-act-no-10121/

Philippine Star. (2023, February 7). LGUs urged to set up emergency communication system in Philippines. Philippine Institute for Development Studies. https://www.pids.gov.ph/details/news/in-the-news/lgus-urged-to-set-up-emergency-communication-system-in-philippines

Philippine Statistics Authority. (n.d.). Community-Based Monitoring System | Philippine Statistics Authority. Philippine Statistics Authority CBMS. https://cbms.psa.gov.ph/

Republic of the Philippines National Disaster Risk Reduction and Management Council. (2010, September 27). RA 10121 Implementing Rules and Regulations. https://mirror.officialgazette.gov.ph/downloads/2019/07jul/20100927-IRR-RA10121-GMA.pdf

Republic of the Philippines. (2014, June 20). Republic Act No. 10639: An Act Mandating the Telecommunications Service Providers to Send Free Mobile Alerts in the Event of Natural and Man-Made Disasters and Calamities. https://www.officialgazette.gov.ph/2014/06/20/republic-act-no-10639/

Republic of the Philippines. (2016, January 30). Disaster preparedness is part of K-12 program - Philippines. ReliefWeb. https://reliefweb.int/report/philippines/disaster-preparedness-part-k-12-program

Republic of the Philippines. (2019, April 25). DILG to LGUs: Inspect all buildings in your areas to ensure public safety – Philippines. ReliefWeb. https://reliefweb.int/report/philippines/dilg-lgus-inspect-all-buildings-your-areas-ensure-public-safety

Republic of the Philippines National Disaster Risk Reduction and Management Council. (2015). National Disaster Preparedness Plan 2015-2028. In International Federation of Red Cross and Red Crescent Societies. https://www.rcrc-resilience-southeastasia.org/wp-content/uploads/2018/01/2015-National-Disaster-Preparedness-Plan-2015-2018-Vol-1.pdf

Republic of the Philippines National Disaster Risk Reduction and Management Council. (2018). National Disaster Response Plan. In Prevention Web. https://www.preventionweb.net/files/62898_nationaldisasterresponseplanforeart.pdf

Republic of the Philippines National Disaster Risk Reduction and Management Council. (2020). National Disaster Risk Reduction and Management Plan 2020-2030. Office of Civil Defense. https://ocd.gov.ph/attachments/category/40/NDRRMP-Pre-Publication-v2.pdf?fbclid=IwAR3gy6vUKdQ6uQnGJX5gC7rAtGfvDwDNpeVaM25x_TZUxS_BaDYMDDGMWL0

Torregoza, H. (2022, September 26). Bong Go: Amendments to Nat'l Building Code a must for safer, disaster-resilient communities. Manila Bulletin. https://mb.com.ph/2022/09/26/bong-go-amendments-to-natl-building-code-a-must-for-safer-disaster-resilient-communities/

UN-SPIDER. (n.d.). Philippines Mines and Geosciences Bureau | UN-SPIDER Knowledge Portal. Www.un-Spider.org. Retrieved July 17, 2023, from https://www.un-spider.org/philippines-mines-and-geosciences-bureau

United Nations Development Programme. (2021). Mapping and Analysis of Vulnerable Groups (MAVG) in the Philippines for Climate Change Adaptation and Disaster Risk Reduction (CCA-DRR) in Support of the Digital Readiness Strategy in the Philippines. Bangkok: UNDP Bangkok Regional Hub.

United Nations Office for Disaster Risk Reduction. (2019). Disaster Risk Reduction in the Philippines. In UNDRR. https://www.undrr.org/publication/disaster-risk-reduction-philippines

World Food Programme. (2023, April 4). Global Innovation in Emergency Telecommunications: Strengthening Disaster Response in the Philippines - Philippines | ReliefWeb. Relief Web. https://reliefweb.int/report/philippines/global-innovation-emergency-telecommunications-strengthening-disaster-response-philippines

Singapore

99.co. (2021). Singapore's flash flood risk warning: The most flood prone housing estates in Singapore, according to PUB. Retrieved from https://www.99.co/singapore/insider/the-most-flood-prone-housing-estates-in-singapore-according-to-pub/

ADB. (2009). The Economics of Climate Change in Southeast Asia: A Regional Review. Retrieved from https://www.adb.org/publications/economics-climate-change-southeast-asia-regional-review

ADPC/UNDRR. (2020). Disaster Risk Reduction in Singapore Status Report 2020. Retrieved from https://www.undrr.org/media/48536/download

ADRC. (1999). Singapore Country Report 1999. Retrieved from https://www.adrc.asia/countryreport/SGP/SGPeng99/Singapore99.pdf

AHA Centre. (2022). Singapore Critical Infrastructure Layers (via DMRS). Retrieved from https://dmrs.ahacentre.org/dmrs/

AHA CENTRE/JICA. (2015). Natural Disaster Risk Assessment and Area Business Continuity Plan Formulation for Industrial Agglomerated Areas in the ASEAN Region - Country Report Singapore. Retrieved from https://openjicareport.jica.go.jp/pdf/1000023403.pdf

Ariando, W., & Limjirakan, S. (2019). Traditional Ecological Knowledge of Indonesian Sea Nomads "Orang Suku Laut" on Climate Change Adaptation. Retrieved from https://www.researchgate.net/publication/333844860_Traditional_Ecological_Knowledge_of_Indonesian_Sea_Nomads_Orang_Suku_Laut_on_Climate_Change_Adaptation/link/5d08c73ba6fdcc35c1560759/download

ASEAN Specialised Meteorological Centre (ASMC) . (2023). ASMC Annual Report 2022/2023. Retrieved from http://asmc.asean.org/publication-asmc-annual-report-2022-2023/

BBC. (2021). The forgotten first people of Singapore. Retrieved from https://www.bbc.com/travel/article/20210824-the-forgotten-first-people-of-singapore

Cannel News Asia. (2021). Sabah sea gypsies grapple with dwindling fish catch, sinking villages as climate change threatens way of life. Retrieved from https://www.channelnewsasia.com/climatechange/malaysia-sabah-baju-laut-weather-patterns-sea-level-rise-1883016

Catalao, J., & Giovanni, N. (2020). Insar Maps of Land Subsidence and Sea Level Scenarios to Quantify the Flood Inundation Risk in Coastal Cities: The Case of Singapore. Retrieved from https://www.mdpi.com/2072-4292/12/2/296

Center for Excellence in Disaster Management and Humanitarian Assistance. (2021). Singapore Disaster Management Reference Handbook. Retrieved from https://www.cfe-dmha.org/LinkClick.aspx?fileticket=DW0AIEU959M%3d&portalid=0

Centre for Climate Research Singapore (CCRS). (2023). CCRS Research Areas. Retrieved from http://ccrs.weather.gov.sg/research-areas

Centre for Strategic Futures, Prime Minister's Office Singapore. (2019). Whole-of government integrated risk management in Singapore. Retrieved from https://irgc.org/wp-content/uploads/2018/09/6.-Jonathan-NG_IRGC-Beijing-2013_WOG-IRM-in-Singapore.pdf

Civil Service College, Singapore. (2016). Singapore's Whole-of-Government Approach in Crisis Management: An Administrative History, 1974 – 2013. Retrieved from https://text2fa.ir/wp-content/uploads/Text2fa.ir-Singapore%E2%80%99s-Whole-of-Government-Approach-in-Crisis-Management-1.pdf

Department of Statistic Singapore. (2020). Census of Population SR1. Retrieved from https://www.singstat.gov.sg/-/media/files/publications/cop2020/sr1/cop2020sr1.ashx

Department of Statistic Singapore. (2020). Census of Population SR2. Retrieved from https://www.parliament.gov.sg/docs/default-source/default-document-library/cop2020sr2.pdf

Du, W., & Pan, T.-C. (2020). Probabilistic seismic hazard assessment for Singapore. Retrieved from https://link.springer.com/article/10.1007/s11069-020-04107-4

GFDRR. (2020). Think Hazard! - Singapore. Retrieved from https://thinkhazard.org/en/report/222

Government of Singapore. (1986). Civil Defence Act 1986. Retrieved from https://sso.agc.gov.sg/Act/CDA1986

Government of Singapore. (1997). Civil Defence Shelter Act 1997. Retrieved from https://sso.agc.gov.sg/Act/CDSA1997

Government of Singapore. (2002). National Environment Agency Act 2002. Retrieved from https://sso.agc.gov.sg//Act/NEAA2002?ViewType=Advance&Phrase=environment&WiAl=1

Government of Singapore. (2014). Transboundary Haze Pollution Act 2014. Retrieved from https://sso.agc.gov.sg/Act/THPA2014

Government of Singapore. (2018). International Organisations (Immunities and Privileges) (World Meteorological Organization) Order 2018. Retrieved from https://sso.agc.gov.sg//SL/IOIPA1948-S552-2018?DocDate=20180906

JRC EU. (2022). INFORM Annual Report 2022. Retrieved from https://drmkc.jrc.ec.europa.eu/inform-index/Portals/0/InfoRM/2022/INFORM%20Annual%20Report%202022.pdf

JRC EU. (2022). INFORM Risk Index 2023. Retrieved from https://drmkc.jrc.ec.europa.eu/inform-index/Portals/0/InfoRM/2022/INFORM_Risk_2023__v065.xlsx

Land Transport Authority. (2023). Wayfinding in Public Transportation. Retrieved from https://www.lta.gov.sg/content/ltagov/en/getting_around/public_transport/a_better_public_transport_experience/wayfinding.html

Meteorological Services Division, National Environment Agency. (2009). National Report on Hyogo Framework. Retrieved from https://www.rcrc-resilience-southeastasia.org/wp-content/uploads/2018/01/2009-National-Report-on-Implementation-of-the-Hyogo-Framework-for-Action-1.pdf

Meteorological Services Singapore. (2015). Singapore's Second National Climate Change Study (Website/Complete Report). Retrieved from http://ccrs.weather.gov.sg/Publications-Second-National-Climate-Change-Study-Science-Reports

Meteorological Services Singapore. (2015). Singapore's Second National Climate Change Study Chapter 10 Long Term Projections of Sea Level, Temperature and Rainfall Change. Retrieved from https://ccrs.weather.gov.sg/wp-content/uploads/2015/07/V2_Ch9_Extreme_Sea_Level_Projections.pdf

Meteorological Services Singapore. (2015). Singapore's Second National Climate Change Study Chapter 9 Extreme Sea Level Projections. Retrieved from https://ccrs.weather.gov.sg/wp-content/uploads/2015/07/V2_Ch9_Extreme_Sea_Level_Projections.pdf

Meteorological Services Singapore. (2015). Singapore's Second National Climate Change Study Climate Projections to 2100 - Report for Stakeholders. Retrieved from https://ccrs.weather.gov.sg/wp-content/uploads/2015/04/Publications-Second-National-Climate-Change-Study-Report-for-Stakeholders.pdf

Meteorological Services Singapore. (2023). Astronomical Data and Tides. Retrieved from http://www.weather.gov.sg/weather-astronomical-and-tidal-information-today/

Meteorological Services Singapore. (2023). Climate Trends. Retrieved from http://www.weather.gov.sg/climate-trends/

Meteorological Services Singapore. (2023). Haze Information. Retrieved from http://www.weather.gov.sg/warning-haze-information/

Meteorological Services Singapore. (2023). Historical Daily Record. Retrieved from http://www.weather.gov.sg/climate-historical-daily/

Meteorological Services Singapore. (2023). List of Climate Station. Retrieved from http://www.weather.gov.sg/learn_climate/#climate3

Meteorological Services Singapore. (2023). MSS Website - Forecasting. Retrieved from http://www.weather.gov.sg/forecasting-2/#forecast_2

Meteorological Services Singapore. (2023). Our Organization. Retrieved from http://www.weather.gov.sg/about-our-organisation/

Meteorological Services Singapore. (2023). Regional Earthquake/Tsunami. Retrieved from http://www.weather.gov.sg/warning-regional-seismic-information/

Meteorological Services Singapore. (2023). Regional Volcanic Eruptions. Retrieved from http://www.weather.gov.sg/warning-volcanic-eruption

Meteorological Services Singapore. (2023). Satellite Images. Retrieved from http://www.weather.gov.sg/weather-satellite-geo-stationary/

Meteorological Services Singapore. (2023). Weather Forecast. Retrieved from http://www.weather.gov.sg/weather-forecast-24hrforecast

Meteorological Services Singapore. (2023). Weather Monitoring & Forecast. Retrieved from http://www.weather.gov.sg/home/

Ministry of Education. (2021). Emergency preparedness. Retrieved from https://www.moe.gov.sg/about-us/emergency-preparedness

Ministry of Home Affair (MoHA). (2022). Protecting Infrastructure. Retrieved from https://www.mha.gov.sg/what-we-do/managing-security-threats/protecting-infrastructure

National Climate Change Secretariat (NCCS). (2012). Singapore National Climate Change Strategies. Retrieved from https://www.nccs.gov.sg/files/docs/default-source/publications/national-climate-change-strategy.pdf

National Climate Change Secretariat (NCCS). (2016). Singapore's Climate Action Plan: A Climate-Resilient Singapore, For a Sustainable Future. Retrieved from https://www.nccs.gov.sg/files/docs/default-source/publications/take-action-today-for-a-carbon-efficient-singapore.pdf

National Climate Change Secretariat (NCCS). (2016). Singapore's Climate Action Plan: Take Action Today, for a Sustainable Future. Retrieved from https://www.nccs.gov.sg/files/docs/default-source/publications/take-action-today-for-a-carbon-efficient-singapore.pdf

National Climate Change Secretariat (NCCS). (2020). Public Sector Sustainability Plan 2017-2020. Retrieved from https://www.nccs.gov.sg/files/docs/default-source/publications/public-sector-sustainability-plan-2017-2020.pdf

National Climate Change Secretariat (NCCS). (2023). ADAPTATION EFFORTS. Retrieved from https://www.nccs.gov.sg/singapores-climate-action/overview/adaptation-overview

National Climate Change Secretariat (NCCS). (2023). Impact of Climate Change & Adaptation Measures (NCCS Website). Retrieved from https://www.nccs.gov.sg/faqs/impact-of-climate-change-and-adaptation-measures/

National Environment Agency. (2015). Climate Change How it Affects you. Retrieved from https://www.nccs.gov.sg/files/docs/default-source/publications/climate-change-how-it-affects-you.pdf

National Environment Agency. (2022). NEA and SLA Sign MOU to Share Global Navigation Satellite System (GNSS)-Derived Moisture Data for Weather Monitoring Application. Retrieved from https://www.nea.gov.sg/media/news/news/index/nea-and-sla-sign-mou-to-share-global-navigation-satellite-system-(gnss)-derived-moisture-data-for-weather-monitoring-application

National Environment Agency. (2022). Singapore's Fifth National Communication and Fifth Biennial Update Report. Retrieved from https://www.nccs.gov.sg/files/docs/default-source/publications/Singapore-NC5BUR5.pdf

National Environment Agency. (2023). Climate Information Data. Retrieved from https://www.nea.gov.sg/weather/overview/singapore's-climate-information-data

National Environment Agency. (2023). Dengue Clusters (website). Retrieved from https://www.nea.gov.sg/dengue-zika/dengue/dengue-clusters

National Environment Agency. (2023). NEA Haze Microsite. Retrieved from https://www.haze.gov.sg/

National Environment Agency. (2023). Regional Haze Situation (website). Retrieved from https://www.nea.gov.sg/weather/regional-haze-situation

National Environment Agency. (2023). Tropical Cyclone Information. Retrieved from http://www.weather.gov.sg/warning-tropical-cyclone-information/

National Environment Agency. (2023). Tropical Cyclone Warning (website). Retrieved from https://www.nea.gov.sg/weather/tropical-cyclone-warnings

Nikkei Com. (2021). Books: Understanding Southeast Asia's sea nomads. Retrieved from https://asia.nikkei.com/Life-Arts/Books/Books-Understanding-Southeast-Asia-s-sea-nomads

Orang Laut SG. (2023). Orang Laut in Singapore. Retrieved from https://oranglaut.sg/

Pacific Disaster Center. (2022). PDC Big Data of Singapore. Retrieved from https://www.pdc.org/big-data/singapore/

PUB Singapore's National Water Agency. (2011). Managing Stormwater in Urbanised Singapore for Flood Control. Retrieved from https://www.seisakukikaku.metro.tokyo.lg.jp/en/diplomacy/pdf/1101-03-timely-e.pdf

PUB Singapore's National Water Agency. (2014). Managing Storm Water for our Future. Retrieved from https://www.pub.gov.sg/Documents/ManagingStormwater.pdf

PUB Singapore's National Water Agency. (2020). PUB to lead Singapore's coastal protection efforts. Retrieved from https://sites.google.com/view/nuscoastalgroup/research/national-coastal-inland-flood-model-for-climate-change

PUB Singapore's National Water Agency. (2021). Hotspots in Singapore. Retrieved from https://www.pub.gov.sg/Documents/Hotspots_in_Singapore.pdf

PUB Singapore's National Water Agency. (2021). PUB Rainfall Monitoring. Retrieved from https://www.pub.gov.sg/innovationchallenge/Documents/GICRainfallMonitoring.pdf

PUB Singapore's National Water Agency. (2022). Annual Report 2021/2022. Retrieved from https://www.pub.gov.sg/Documents/Publications/PUB_AnnualReport_2122.pdf

PUB Singapore's National Water Agency. (2022). Flash Flood Public Advisory (Flood). Retrieved from https://www.pub.gov.sg/drainage/floodmanagement/publicadvisory

PUB Singapore's National Water Agency. (2022). List of Flood Prone Areas in Singapore (in PUB Website As at 2022). Retrieved from https://www.pub.gov.sg/Documents/List_of_Flood_Prone_Areas_AsAt_2022.pdf

PUB Singapore's National Water Agency. (2022). Water Level Sensors & CCTVs. Retrieved from https://app.pub.gov.sg/waterlevel/pages/WaterLevelSensors.aspx

RCRC. (2012). Emergency Response in Singapore. Retrieved from https://www.rcrc-resilience-southeastasia.org/wp-content/uploads/2018/01/2012-SCDF-Emergency-Response-in-Singapore-powerpoint-presentation.pdf

SCDF. (2009). Public Warning System (PPT). Retrieved from http://www.drs.dpri.kyoto-u.ac.jp/pw/workshop/pdfs/13jr_scdf_pws_presentation_japan.pdf

SCDF. (2011). Fire Safety Requirements for Persons With Disabilities. Retrieved from https://www.scdf.gov.sg/docs/default-source/scdf-library/p-fm/erp-fire-safety-requirements-for-persons-with-disabilities.pdf

SCDF. (2011). Standard Announcement. Retrieved from https://www.scdf.gov.sg/docs/default-source/scdf-library/fssd-downloads/fsm_fep_standard_announcements1a597c5130b74964bd868660a676b649.pdf

SCDF. (2017). Permitted and Not Permitted Works for Household Shelters (HS). Retrieved from https://www.scdf.gov.sg/docs/default-source/scdf-library/PERMITTED_AND_NOT_PERMITTED_WORKS_FOR_HS.pdf

SCDF. (2017). Technical Requirements for Houshold Shelters. Retrieved from https://www.scdf.gov.sg/docs/default-source/scdf-library/fssd-downloads/technical-requirements-for-household-shelters-(hstr)-2017_updated-28-may-2018.pdf

SCDF. (2018). Company Emergency Response Team. Retrieved from https://www.scdf.gov.sg/home/fire-safety/cert

SCDF. (2018). Emergency Response Plan. Retrieved from https://www.scdf.gov.sg/home/fire-safety/erp

SCDF. (2018). Evacuation Planning Guidelines. Retrieved from https://www.scdf.gov.sg/docs/default-source/scdf-library/fssd-downloads/evacuation-planning-guidelines-(approved-mar-2018).pdf

SCDF. (2021). Emergency Handbook. Retrieved from https://www.scdf.gov.sg/docs/default-source/scdf-library/publications/publications/cd-emergency-handbook-(9thedition)-english.pdf

SCDF. (2023). Ensuring Civil Defence and Emergency Preparedness. Retrieved from https://www.mha.gov.sg/what-we-do/civil-defence-and-emergency-preparedness

SCDF. (2023). Public Warning System (website). Retrieved from https://www.scdf.gov.sg/home/civil-defence-shelter/public-warning-system

Singapore Department of Statistics . (2023). Singapore Statistic. Retrieved from https://www.singstat.gov.sg/

Singapore Infopedia. (2022). Major floods in Singapore. Retrieved from https://eresources.nlb.gov.sg/infopedia/articles/SIP_780_2004-12-30.html

Singapore Land Athority. (2023). One Map Gov Sg. Retrieved from https://www.onemap.gov.sg/

Smartnation Gov Sg. (2023). Cybersecurity In The Public Sector. Retrieved from https://www.smartnation.gov.sg/about-smart-nation/secure-smart-nation/cybersecurity-public-sector#ensuring-whole-of-government-cybersecurity-readiness

storymaps arcgis. (2019). How does Singapore manage pluvial flooding? Retrieved from https://storymaps.arcgis.com/stories/b52c8d66083c4911a84585fc35550d90

Swiss Re. (2021). The Economics of Climate Change: Impacts for Asia. Retrieved from https://www.swissre.com/risk-knowledge/mitigating-climate-risk/economics-of-climate-change-impacts-for-asia.html

The Centre of Excellence for National Security and the Homeland Security and Engineering Centre. (2007). Land Transport Security in Singapore. Retrieved from https://www.rsis.edu.sg/wp-content/uploads/2014/07/ER070205_Land_Transport_Security_in_Singapore.pdf

UNISDR. (2010). Synthesis Report on Ten ASEAN Countries Disaster Risks Assessment. Retrieved from https://www.unisdr.org/files/18872_asean.pdf

Wei, S., & Mendelsohn, R. (2005). The impact of sea level rise on Singapore. Retrieved from https://www.researchgate.net/profile/Robert-Mendelsohn/publication/4768127_The_impact_of_sea_level_rise_on_Singapore/links/53da61ee0cf2631430c821fa/The-impact-of-sea-level-rise-on-Singapore.pdf

Thailand

ASEAN. (n.d.). Strengthening the capacity of ASEAN Member States to design and implement risk-informed and shock-responsive social protection systems for resilience: Thailand Case Study (pp. 8-10).

ASEAN Risk Monitor and Disaster Management Review. (2020). Risk monitor and disaster management review, 72-90. Retrieved from https://drive.google.com/file/d/1sYAo_0vCiL_whpBBgXH91cmJSOx-kNGTc/view

Bangkok Risk Map system. (n.d.). Retrieved from https://bmagis.bangkok.go.th/portal/apps/sites/?fromEdit=true#/bkk-risk-bangkok

Community-level landslide hazards map. (n.d.). Retrieved from https://data.dmr.go.th/nl/dataset/landslide_report

Department of Disaster Prevention and Mitigation. (n.d.). Action Plan (in Thai), p. 20. Retrieved from http://policy.disaster.go.th/site6/cms-download_content.php?did=35879

Department of Disaster Prevention and Mitigation. (n.d.). Provincial Disaster Prevention and Mitigation Plan and Emergency Operation Support Plan (Chapters 4-6, 76 provinces across the country). Retrieved from https://www.disaster.go.th/th/download/download/25

Department of Disaster Prevention and Mitigation. (n.d.). Thailand's National Disaster Prevention and Mitigation Plan. Retrieved from https://dmcrth.dmcr.go.th/attachment/dw/download.php?WP=nKq4MUNjoGy3ZHkCoMOahKGtnJg4WaN4oGA3A0j1oH9axUF5nrO4MNo7o3Qo7o3Q (Original work published in Thai)

Disaster Communication Development Center. Retrieved from https://dxc.thaipbs.or.th/

Disaster Management Reference Handbook. (2022, January). Thailand (pp. 75-77). Retrieved from https://reliefweb.int/report/thailand/disaster-management-reference-handbook-thailand-january-2022

Forecasting and Monitoring System of Heavy Rain Spatial with High Performance Computers of the Thai Meteorological Department. Retrieved from http://www.model.tmd.go.th, http://www2.tmd.go.th/wrf_tmd/images/BKK_WRFDA1/zoom_bkk_prec3h.html

Government of Thailand. (n.d.). Thailand. Biennial update report (BUR). BUR 3. (p. 35). Retrieved from https://unfccc.int/sites/default/files/resource/BUR3_Thailand_251220%20.pdf

Government of Thailand. (n.d.). Thailand's National Disaster Prevention and Mitigation Plan (In Thai) (pp. 1-9, 11, 21, 26, 37-39, 43-56, 124-126). Retrieved from https://dmcrth.dmcr.go.th/attachment/dw/download.php?WP=nKq4MUNjoGy3ZHkCoMOahKGtnJg4WaN4oGA3A0j1oH9axUF5nrO4MNo7o3Qo7o3Q

Hazard map/risk map of flood and drought. (n.d.). Retrieved from http://mekhala.dwr.go.th/download-cate.php?txtdoccate=30

National Disaster Data Center System (Department of Disaster Prevention and Mitigation). (n.d.). In Thai. Retrieved from http://110.78.23.203/in.datacenter-5.289

National Disaster Warning Center. (2021). SOP of National Warning Services. Retrieved from http://ndwc.disaster.go.th/site9/cms-download_content.php?did=34734

National Disaster Warning Center. (2023). National Warning Tower System. Retrieved from http://ndwc.disaster.go.th/site9/cms-download_content.php?did=36766

National Disaster Warning Center. (n.d.). Regulation of the Prime Minister's Office on the Administration of the National Disaster Warning System, B.E. 2552. Retrieved from http://ndwc.disaster.go.th/site9/cms-download_content.php?did=34732

NBTC. Retrieved from https://www.nbtc.go.th/News/Press-Center/56563.aspx?lang=th-th, https://www.nbtc.go.th/getattachment/News-(1).pdf.aspx

SOP of National Weather Service. (2023). Retrieved from https://www.weathersurvey.tmd.go.th/sop.html

Thawatchai Palakhamarn. (Date not specified). An Institutional Analysis of the Flood Early Warning System in Thailand: A Case Study of Tropical Storm Pabuk Influence 2019 in Nakhon Si Thammarat Province. Retrieved from https://so08.tci-thaijo.org/index.php/ssjpolsci/article/view/899

The Meteorological Department's Seasonal Climate Forecasting System. Retrieved from http://climate.tmd.go.th/content/category/6

UNDRR. (2022). Disaster Risk Reduction in Thailand (Status Report 2022): Disaster Risk Profile (pp. 7, 11, 16-17, 24, 33).

UNDRR. (2022). Disaster Risk Reduction in Thailand (Status Report 2022): Disaster Risk Profile-exposure (pp. 13-15).

UNDRR. (2022). Disaster Risk Reduction in Thailand (Status Report 2022): Disaster Risk Profile, Exposure (pp. 11, 24).

United Nations Environment Programme & UNDRR. (n.d.). Global Risk Platform. Retrieved from https://wesr.unepgrid.ch/?project=MX-XVK-HPH-OGN-HVE-GGN&language=en

World Bank Group. (2021). Climate Risk Profile of Thailand (pp. 17-24). Retrieved from https://climateknowledgeportal.worldbank.org/sites/default/files/2021-08/15853-WB_Thailand%20Country%20Profile-WEB_0.pdf

World Bank Group. (n.d.). Thai Flood 2011: Rapid Assessment for Resilient Recovery and Reconstruction Planning (pp. 20-23).
World Bank Group. (Date not specified). Climate Risk Profile of Thailand, pp. 13-17. Retrieved from https://climateknowledgeportal.worldbank.org/sites/default/files/2021-08/15853-WB_Thailand%20Country%20Profile-WEB_0.pdf

Viet Nam

ASEAN ADINet.

Government of Vietnam. (2021, June 2). Early warning of flash floods and landslides - Viet Nam. ReliefWeb. https://reliefweb.int/report/viet-nam/early-warning-flash-floods-and-landslides

Lan Huong, T. T., Van Anh, D. T., Dat, T. T., Truong, D. D., & Tam, D. D. (2022). Disaster risk management system in Vietnam: progress and challenges. Heliyon, 8(10), e10701. https://doi.org/10.1016/j.heliyon.2022.e10701
Nguyen, M. T., Sebesvari, Z., Souvignet, M., Bachofer, F., Braun, A., Garschagen, M., Schinkel, U., Yang, L. E., Nguyen, L. H. K., Hochschild, V., Assmann, A., & Hagenlocher, M. (2021). Understanding and assessing flood risk in Vietnam: Current status, persisting gaps, and future directions. Journal of Flood Risk Management, 14(2). https://doi.org/10.1111/jfr3.12689

Open Development Vietnam. (2021, December 22). Disasters - Open Development Vietnam. Open Development Mekong. https://vietnam.opendevelopmentmekong.net/topics/disasters/#return-note-3848842-12

Sài Gòn Giải Phóng. (2020, June 5). Ministry launches smart operation center. SGGP English Edition. https://en.sggp.org.vn/ministry-launches-smart-operation-center-post83915.html

Save the Children. (2016, August 10). Early warning system innovations in Viet Nam: SMS technology and education | PreventionWeb. Prevention Web. https://www.preventionweb.net/news/early-warning-system-innovations-viet-nam-sms-technology-and-education

Socialist Republic of Vietnam. (2014, May 1). Law No. 33/2013/QH13 on Natural Disaster Prevention and Control. https://www.fao.org/faolex/results/details/en/c/LEX-FAOC164788/

Symonds, D. (2022, August 10). Vietnam's met agency launches flash flood early warning system for Southeast Asia. Meteorological Technology International. https://www.meteorologicaltechnologyinternational.com/news/early-warning-systems/vietnams-met-agency-launches-flash-flood-early-warning-system-for-southeast-asia.html

Tien, H., Van, N. P., & Kato, T. (2023). Practicing Rescue Plans of Vietnamese Firefighters: Situation and Solutions. Journal of Disaster Research, 18(4), 436–446. https://doi.org/10.20965/jdr.2023.p0436
UN WOMEN. (2022). Good Practices from ASEAN: Ensuring Gender Responsive DRR . https://wrd.unwomen.org/sites/default/files/2022-07/Good-Practices-from-ASEAN-on-Ensuring-Gender-Responsive-Disaster-Risk-Reduction.pdf

United Nations Office for Disaster Risk Reduction. (2020). Disaster Risk Reduction in Viet Nam. In UNDRR. https://www.preventionweb.net/publication/disaster-risk-reduction-viet-nam-status-report-2020-0

Viet Nam News. (2023). Early warning of disaster risks means better response and prevention. Viet Nam News. https://vietnamnews.vn/environment/1536731/early-warning-of-disaster-risks-means-better-response-and-prevention.html

Vu, B. D., Nguyen, H. T., Dinh, H.-V. T., Nguyen, Q.-A. N., & Ha, X. V. (2023). Natural Disaster Prevention Literacy Education among Vietnamese High School Students. Education Sciences, 13(3), 262–262. https://doi.org/10.3390/educsci13030262

World Meteorological Organization. (2020, December 16). Impact-based forecast and warning services training in Vietnam. https://public.wmo.int/en/media/news-from-members/impact-based-forecast-and-warning-services-training-vietnam

ENDNOTES

1 ADINet (2023) AHA Centre. https://adinet.ahacentre.org/. Accessed November 20, 2023

2 The ASEAN Secretariat. (2021). ASEAN Agreement on Disaster Management and Emergency Response(AADMER)WorkProgramme2021-2025.Asean.org.https://asean.org/book/asean-agreement-on-disaster-management-and-emergency-response-aadmer-work-programme-2021-2025/

3 World Meteorological Organization. (2018). Multi-hazard Early Warning Systems: A Checklist Outcome of the first Multi-hazard Early Warning Conference 22 to 23 May 2017 -Cancún, Mexico Prepared by the partners of the International Network for Multi-hazard Early Warning Systems. https://library.wmo.int/doc_num.php?explnum_id=4463

4 See Appendix A for a full list of stakeholders engaged in the assessment and Appendix E for focus group discussion participant lists.

5 ADMER Partnership Group, Plan International, Save the Children, Mercy Malaysia, World Vision, European Commission, and Australian Aid (2016). "ASEAN Common Framework for Comprehensive School Safety". July 16, 2020. https://bit.ly/39R1zdi

6 Inter-Agency Standing Committee Reference Group on Risk, Early Warning and Preparedness, & European Commission. (2023). INFORM 2023 Report [Review of INFORM 2023 Report]. In https://drmkc.jrc.ec.europa.eu/inform-index

7 Government of Brunei. (n.d.). WAWASAN BRUNEI 2035. www.wawasanbrunei.gov.bn. https://www.wawasanbrunei.gov.bn/en/SitePages/home.aspx

8 2006 Disaster Management Order, (2006). https://www.rcrc-resilience-southeastasia.org/wp-content/uploads/2017/12/2006_disaster_management_order.pdf.

9 Brunei Ministry of Home Affairs. (n.d.). Home - Pusat Pengurusan Bencana Kebangsaan, Ministry of Home Affairs. Ndmc.gov.bn. Retrieved July 17, 2023, from http://ndmc.gov.bn/

10 Brunei Darussalam Meteorological Department. (n.d.). BDMD Home Page. Www.met.gov.bn Retrieved July 17, 2023, from http://www.met.gov.bn/

11 Royal Brunei Police Force. (n.d.). Royal Brunei Police Force. Www.aseanapol.org. Retrieved July 17, 2023, from http://www.aseanapol.org/information/royal-brunei-police-force

12 Inter-Agency Standing Committee Reference Group on Risk, Early Warning and Preparedness, & European Commission. (2023).

13 Center for Excellence. (2023) 2050-Indo-Pacific Climate Change Impact Analysis

14 Royal Government of Cambodia. (2008) Strategic national action plan for disaster risk reduction. https://www.preventionweb.net/publication/cambodia-strategic-national-action-plan-disaster-risk-reduction

15 Cambodia Law on Disaster Management, (2015). http://chfcambodia.net/wp-content/uploads/2017/12/DM-Law_English.pdf

16 https://www.ncdm.gov.kh/

17 Cambodia Ministry of Water Resources and Meteorology. (n.d.). Cambodia Ministry of water resources and meteorology. Www.cambodiameteo.com Retrieved July 17, 2023, from http://www.cambodiameteo.com/articles?menu=115&lang=en

18 Cambodia Ministry of water resources and meteorology. (n.d.). Cambodia Ministry of water resources and meteorology. Www.cambodiameteo.com. Retrieved July 17, 2023, from http://www.cambodiameteo.com/articles?menu=115&lang=en

19 People in Need. (2022, March 22). Cambodia's Early Warning System 1294: An Adaptable

(Endnotes Continued...)

Technology. People in Need. https://www.peopleinneed.net/cambodias-early-warning-system-1294-8693gp

20 UN World Food Programme. (n.d.). PRISM | WFP Innovation. Innovation.wfp.org. Retrieved July 18, 2023, from https://innovation.wfp.org/project/prism

21 Inter-Agency Standing Committee Reference Group on Risk, Early Warning and Preparedness, & European Commission. (2023).

22 Center for Excellence. (2023) 2050-Indo-Pacific Climate Change Impact Analysis

23 2007 Disaster Management , (2007). http://seaknowledgebank.net/sites/default/files/ID%20-%20Law%20No.%2024-2007%20Disaster%20Management_0.pdf.

24 Indonesia State Ministry for National Development Planning, UNDP Indonesia, The World Bank, & SC-DRR. (2010). National Action Plan for Disaster Risk Reduction 2010-2012. https://bnpb.go.id/storage/app/media/uploads/migration/pubs/451.pdf

25 Badan Nasional Penanggulangan Bencana. (2020). BNPB Home Page Badan Nasional Penanggulangan Bencana. BNPB. https://bnpb.go.id/

26 BMKG. (n.d.). Tugas dan Fungsi | BMKG. BMKG | Badan Meteorologi, Klimatologi, Dan Geofisika. Retrieved July 17, 2023, from https://www.bmkg.go.id/profil/?p=tugas-fungsi&lang=ID

27 Republic of Indonesia. (2019). Perpres Nomor 93 Tahun. Bpk.go.id. https://peraturan.bpk.go.id/Download/120114/Perpres%20Nomor%2093%20Tahun%202019

28 KOMINFO, P. (n.d.). Kementerian Komunikasi dan Informatika. Resmi Kementerian Komunikasi Dan Informatika RI. https://www.kominfo.go.id/

29 http://www.lapan.go.id/ (unable to open link)

30 MINISTRY OF ENERGY AND MINERAL RESOURCES REPUBLIC OF INDONESIA. (n.d.). Kementerian ESDM RI - Site. Www.esdm.go.id. https://www.esdm.go.id/en

31 Badan Pengembangan Infrastruktur Wilayah. (n.d.). Badan Pengembangan Infrastruktur Wilayah. Bpiw.pu.go.id. https://bpiw.pu.go.id/

32 Malaysia MOHA. (2021). Ministry of Home Affairs. https://www.moha.gov.my/index.php/en/ministry-of-home-affairs

33 Indonesia Peta Bencana. (n.d.). PetaBencana.id. https://info.petabencana.id/

34 Pacific Disaster Center. (n.d.). PDC. Pacific Disaster Center. https://www.pdc.org/

35 Inter-Agency Standing Committee Reference Group on Risk, Early Warning and Preparedness, & European Commission. (2023).

36 Center for Excellence in Disaster Management and Humanitarian Assistance. (2021). LAO PDR Disaster Management Reference Handbook. https://www.cfe-dmha.org/LinkClick.aspx?fileticket=BsMS42nJjdE%3D&portalid=0

37 Center for Excellence in Disaster Management and Humanitarian Assistance. (2021).

38 Center for Excellence in Disaster Management and Humanitarian Assistance. (2021).

39 UN FAO. (2017). FAOLEX Lao People's Democratic Republic Law No. 36/NA on Meteorology and Hydrology. Www.fao.org. https://www.fao.org/faolex/results/details/en/c/LEX-FAOC184237/

40 UN FAO. (2017).

(Endnotes Continued...)

41 Center for Excellence in Disaster Management and Humanitarian Assistance. (2021).

42 Center for Excellence in Disaster Management and Humanitarian Assistance. (2021).

43 Center for Excellence in Disaster Management and Humanitarian Assistance. (2021).

44 Center for Excellence in Disaster Management and Humanitarian Assistance. (2021).

45 Center for Excellence in Disaster Management and Humanitarian Assistance. (2021).

46 Center for Excellence in Disaster Management and Humanitarian Assistance. (2021).

47 Center for Excellence in Disaster Management and Humanitarian Assistance. (2021).

48 Pacific Disaster Center. (n.d.). Lao PDR - Disaster Risk Reduction. Pacific Disaster Center. Retrieved July 17, 2023, from https://www.pdc.org/big-data/lao-pdr/

49 Inter-Agency Standing Committee Reference Group on Risk, Early Warning and Preparedness, & European Commission. (2023).

50 NATIONAL SECURITY COUNCIL. (1997). POLICY AND MECHANISM OF NATIONAL DISASTER MANAGEMENT AND RELIEF. https://www.rcrc-resilience-southeastasia.org/wp-content/uploads/2017/12/1997_policy_and_mechanism_of_national_disaster_management_and_relief_national_security_council_directive.pdf

51 Malaysia National Disaster Management Agency. (n.d.). Home. Portal NADMA. https://www.nadma.gov.my/en/

52 Department of Meteorology Malaysia. (n.d.). Laman Web Rasmi Jabatan Meteorologi Malaysia. Www.met.gov.my. https://www.met.gov.my/

53 Department of Irrigation and Drainage. (2017). Official Portal for Department of Irrigation and Drainage. Water.gov.my. https://www.water.gov.my/

54 Mohd Khalid, N. B. (n.d.). TSUNAMI EARLY WARNING SYSTEM IN MALAYSIA. Retrieved July 17, 2023, from https://iisee.kenken.go.jp/syndb/data/20080507c32a68cc.pdf

55 Laman Utama JMG. (n.d.). Laman Utama JMG. Jabatan Mineral Dan Geosains Malaysia (JMG). https://www.jmg.gov.my/

56 Inter-Agency Standing Committee Reference Group on Risk, Early Warning and Preparedness, & European Commission. (2023).

57 Center for Excellence. (2023) 2050-Indo-Pacific Climate Change Impact Analysis

58 Government of Myanmar. (2013). Standing Order on Natural Disaster Management in Myanmar. http://www.rrdmyanmar.gov.mm/wp-content/uploads/2013/08/Standing-Order-on-Natural-Disaster-management-in-Myanmar.pdf

59 UNDP Myanmar. (2017). The Myanmar Action Plan on Disaster Risk Reduction 2017 | United Nations Development Programme. UNDP. https://www.undp.org/myanmar/publications/myanmar-action-plan-disaster-risk-reduction-2017

60 Natural Disaster Management Law, (2013). https://cdn.climatepolicyradar.org/navigator/MMR/2013/law-no-21-2013-on-disaster-management_d4682665208c3e329da9a5f1b434370a.pdf

61 Myanmar Relief and Resettlement Department (RRD). (n.d.). Myanmar Relief and Resettlement Department (RRD) Home Page. http://www.rrdmyanmar.gov.mm/

(Endnotes Continued...)

62 Myanmar Department of Meteorology and Hydrology . (n.d.). Department of Meteorology and Hydrology |. Www.moezala.gov.mm. Retrieved July 17, 2023, from https://www.moezala.gov.mm/

63 MIMU Myanmar Information Management Unit. (n.d.). Home | MIMU. Themimu.info. https://themimu.info/

64 Myanmar Red Cross Society. (n.d.). Myanmar Red Cross Society Home Page. Myanmar Red Cross Society (MRCS). Retrieved July 17, 2023, from https://www.redcross.org.mm/my_MM/

65 Inter-Agency Standing Committee Reference Group on Risk, Early Warning and Preparedness, & European Commission. (2023).

66 Center for Excellence. (2023) 2050-Indo-Pacific Climate Change Impact Analysis

67 Official Gazette of the Republic of the Philippines. (2010, May 27). Republic Act No. 10121 | GOVPH. Official Gazette of the Republic of the Philippines. https://www.officialgazette.gov.ph/2010/05/27/republic-act-no-10121/

68 Republic of the Philippines NDRRMC. (2011). National Disaster Risk Reduction and Management Plan (NDRRMP) 2011-2028. https://www.adrc.asia/documents/dm_information/Philippines_NDRRM_Plan_2011-2028.pdf

69 Republic of the Philippines NDRRMC . (2015). National Disaster Preparedness Plan 2015-2028. In International Federation of Red Cross and Red Crescent Societies. https://www.rcrc-resilience-southeastasia.org/wp-content/uploads/2018/01/2015-National-Disaster-Preparedness-Plan-2015-2018-Vol-1.pdf

70 Official Gazette of the Republic of the Philippines. (2010, May 27).

71 Official Gazette of the Republic of the Philippines. (2010, May 27).

72 Official Gazette of the Republic of the Philippines. (2010, May 27).

73 Official Gazette of the Republic of the Philippines. (2010, May 27).

74 Center for Excellence in Disaster Management. (2021). PHILIPPINES Disaster Management Reference Handbook. https://www.cfe-dmha.org/LinkClick.aspx?fileticket=h76R6jCvL24%3d&portalid=0

75 UN SPIDER. (n.d.). Philippines Mines and Geosciences Bureau | UN-SPIDER Knowledge Portal. Www.un-Spider.org. Retrieved July 17, 2023, from https://www.un-spider.org/philippines-mines-and-geosciences-bureau

76 Republic of the Philippines. (2019, August 8). Philippine Space Act. https://www.officialgazette.gov.ph/downloads/2019/08aug/20190808-RA-11363-RRD.pdf

77 Inter-Agency Standing Committee Reference Group on Risk, Early Warning and Preparedness, & European Commission. (2023).

78 National Climate Change Secretariat. (2021). Impact Of Climate Change In Singapore. Www.nccs.gov.sg; National Climate Change Secretariat. https://www.nccs.gov.sg/singapores-climate-action/impact-of-climate-change-in-singapore/

79 Center for Excellence in Disaster Management and Humanitarian Affairs. (2021). SINGAPORE (Assisting State) Disaster Management Reference Handbook. https://www.cfe-dmha.org/LinkClick.aspx?fileticket=DW0AlEU959M%3d&portalid=0

80 Center for Excellence in Disaster Management and Humanitarian Affairs. (2021).

81 Center for Excellence in Disaster Management and Humanitarian Affairs. (2021).

(Endnotes Continued...)

82 Center for Excellence in Disaster Management and Humanitarian Affairs. (2021).

83 Center for Excellence in Disaster Management and Humanitarian Affairs. (2021).

84 Center for Excellence in Disaster Management and Humanitarian Affairs. (2021).

85 PUB, Singapore's National Water Agency. (n.d.). PUB, Singapore's National Water Agency - Flood Management. PUB, Singapore's National Water Agency. https://www.pub.gov.sg/drainage/floodmanagement

86 Inter-Agency Standing Committee Reference Group on Risk, Early Warning and Preparedness, & European Commission. (2023).

87 Government of Thailand. (2015). Thailand: National disaster risk management plan. Www.preventionweb.net. https://www.preventionweb.net/publication/thailand-national-disaster-risk-management-plan

88 Center for Excellence. (2023) 2050-Indo-Pacific Climate Change Impact Analysis

89 REF – need link for this

90 Disaster Prevention and Mitigation Act B.E. 2550, (2007). https://faolex.fao.org/docs/pdf/tha89587.pdf

91 Center for Excellence in Disaster Management and Humanitarian Affairs. (2022). THAILAND Disaster Management Reference Handbook. https://www.cfe-dmha.org/LinkClick.aspx?fileticket=-vaR-HeJKvk%3d&portalid=0

92 Center for Excellence in Disaster Management and Humanitarian Affairs. (2022).

93 Center for Excellence in Disaster Management and Humanitarian Affairs. (2022).

94 Center for Excellence in Disaster Management and Humanitarian Affairs. (2022).

95 Center for Excellence in Disaster Management and Humanitarian Affairs. (2022).

96 Center for Excellence in Disaster Management and Humanitarian Affairs. (2022).

97 Royal Irrigation Department. (n.d.). Royal Irrigation Department. Www.rid.go.th. Retrieved July 17, 2023, from https://www.rid.go.th/eng/duty.php

98 Thai Red Cross Society. (n.d.). Homepage. Thai Red Cross Society . Retrieved July 17, 2023, from https://english.redcross.or.th/#

99 Inter-Agency Standing Committee Reference Group on Risk, Early Warning and Preparedness, & European Commission. (2023).

100 Center for Excellence. (2023) 2050-Indo-Pacific Climate Change Impact Analysis

101 Center for Excellence in Disaster Management & Humanitarian Assistance. (2021b). VIETNAM Disaster Management Reference Handbook. https://www.cfe-dmha.org/LinkClick.aspx?fileticket=GqvC778XPRA%3d&portalid=0

102 Center for Excellence in Disaster Management & Humanitarian Assistance. (2021b).

103 Center for Excellence in Disaster Management & Humanitarian Assistance. (2021b).

104 Center for Excellence in Disaster Management & Humanitarian Assistance. (2021b).

105 Center for Excellence in Disaster Management & Humanitarian Assistance. (2021b).

106 Center for Excellence in Disaster Management & Humanitarian Assistance. (202

107 Center for Excellence in Disaster Management & Humanitarian Assistance. (202

108 Center for Excellence in Disaster Management & Humanitarian Assistance. (202

109 Center for Excellence in Disaster Management & Humanitarian Assistance. (202

110 Center for Excellence in Disaster Management & Humanitarian Assistance. (202

111 Center for Excellence in Disaster Management & Humanitarian Assistance. (202

112 The ASEAN Secretariat. (2016). ASEAN SOCIO-CULTURAL COMMUNITY BLUI https://www.asean.org/wp-content/uploads/2012/05/8.-March-2016-ASCC-Blueprint-202

113 The ASEAN. (2016). ASEAN DECLARATION ON THE STRENGTHENING OF TO DROUGHT. https://asean.org/wp-content/uploads/2023/02/ASEAN_Declara Strengthening_of_Adaptation_to_Drought_2020.pdf

114 The ASEAN Secretariat, & UN WOMEN. (2021). ASEAN Regional Framework o Gender, and Inclusion in Disaster Management 2021-2025 (ARF-PGI). Asean.org. https book/asean-regional-framework-on-protection-gender-and-inclusion-in-disaster-manag 2025-arf-pgi/

115 The ASEAN Secretariat. (n.d.). About the ASEAN Secretariat. Asean.org. https://a asean-secretariat-basic-mandate-functions-and-composition/

116 The ASEAN Secretariat. (n.d.-b). Disaster Management & Humanitarian Assist org. https://asean.org/our-communities/asean-socio-cultural-community/disaster-r humanitarian-assistance/

117 The ASEAN Secretariat. (n.d.-b). ASEAN Committee on Disaster Management. Mı org. Retrieved July 18, 2023, from https://mneawp.asean.org/asean-committe-on-disaste

118 The ASEAN Secretariat. (n.d.-b). ASEAN Committee on Disaster Management.

119 The AHA Centre. (n.d.). About us The AHA Centre. AHA Centre. https://ahacent us/

120 ASEAN, & BMKG. (n.d.). ASEAN Earthquake Information Center. Aeic.bmkg.go.id. 18, 2023, from https://aeic.bmkg.go.id/apps/about

121 https://aeic.bmkg.go.id/apps/about

122 ASEAN, & BMKG. (n.d.). ASEAN Earthquake Information Center.

123 ASEAN Specialised Meteorological Centre (ASMC) . (n.d.). About ASMC. Asmc.asea asmc.asean.org/asmc-about/

124 Regional Integrated Multi-Hazard Early Warning System (RIMES). (n.d.). Overv Www.rimes.int. Retrieved July 18, 2023, from https://www.rimes.int/aboutus/overview

125 United Nations Economic and Social Commission for Asia and the Pacific. (2023) Compendium of Multi-hazard Early Warning Cooperation. UN ESCAP.

Federal Emergency Management Agency. (2021). Common Alerting Protocol. https://ww gov/emergency-managers/practitioners/integrated-public-alert-warning-system/technol developers/common-alerting-protocol#:~:text=The%20Common%20Alerting%20Protocc (CAP,simultaneously%20over%20multiple%20communications%20pathways

126 World Meteorological Organization. (2019, November 29). Climate Risk and Early Systems (CREWS). https://public.wmo.int/en/climate-risk-and-early-warning-systems-cre

127 Pacific Disaster Center. DisasterAWARE. https://disasteraware.org/

128 Global Disaster Alert and Coordination System. (n.d.). GDACS - Global Disaster Alerting and Coordination System. Www.gdacs.org; GDACS - Global Disaster Alerting and Coordination System. https://www.gdacs.org/About/overview.aspx

129 International Tsunami Information Center. (n.d.). Home - International Tsunami Information Center. Itic.ioc-Unesco.org. http://itic.ioc-unesco.org/index.php

130 ASEAN, & BMKG. (n.d.). ASEAN Earthquake Information Center. Aeic.bmkg.go.id. Retrieved July 18, 2023, from https://aeic.bmkg.go.id/apps/about

131 ASEAN Specialised Meteorological Centre. (n.d.). About ASEAN Specialised Meteorological Centre. Asmc.asean.org. http://asmc.asean.org/asmc-about/

132 UNESCO. (n.d.). Indian Ocean Tsunami Warning and Mitigation System. http://www.ioc-tsunami.org/index.php?option=com_content&view=article&id=8&Itemid=13&lang=en

133 United Nations Economic and Social Commission for Asia and the Pacific. (2023). Compendium of Multi-hazard Early Warning Cooperation. UN ESCAP.

134 UNESCO. (2019, November 6). Tsunami Center for South China Sea becomes fully operational on World Tsunami Awareness Day | UNESCO. Www.unesco.org. https://www.unesco.org/en/articles/tsunami-center-south-china-sea-becomes-fully-operational-world-tsunami-awareness-day

135 United Nations Economic and Social Commission for Asia and the Pacific. (n.d.). ESCAP Trust Fund for Tsunami, Disaster and Climate Preparedness. UN ESCAP. Retrieved September 6, 2023, from https://www.unescap.org/disaster-preparedness-fund

136 ASEAN ADMER. (n.d.). AADMER. Aseandrr.org. https://aseandrr.org/about/aadmer#:~:text=The%20ASEAN%20Committee%20on%20Disaster

137 ASEAN. (n.d.). Major Sectoral Bodies/committees. ASEAN. https://asean.org/major-sectoral-bodies-committees-2/

138 The ASEAN Disaster Information Network (ADInet). (2018, January 7). The ASEAN Disaster Information Network (ADInet). AHA Centre. https://ahacentre.org/disaster-monitoring/asean-disaster-information-network-adinet/

139 AHA Centre. (n.d.). About us. AHA Centre. https://ahacentre.org/about-us/

140 AHA Centre. (2018, January 7). Disaster Monitoring & Response System. AHA Centre. https://ahacentre.org/disaster-monitoring/disaster-monitoring-response-system/

141 United Nations Economic and Social Commission for Asia and the Pacific. (2023). Compendium of Multi-hazard Early Warning Cooperation. UN ESCAP.

142 Putra, A. W., Choir, U., & Imaduddin , S. F. (2020). The Efficient Early Warning with South East- Asia Oceania Flash Flood Guidance System (SAOFFGS). Springer EBooks, 245–250. https://doi.org/10.1007/978-3-030-60311-3_28

143 ASEAN. (n.d.). ASEAN Major Sectoral Bodies. ASEAN. Retrieved September 6, 2023, from https://asean.org/our-communities/economic-community/asean-science-technology-and-innovation/major-sectoral-bodies/

144 SERVIR Global. (n.d.). About SERVIR Global. Servirglobal.net. Retrieved September 6, 2023, from https://servirglobal.net/about-servir

asean
@ASEAN
www.asean.org
ASEAN: A Community of Opportunities for All.