Institutional and Legislative Systems for Early Warning and Disaster Risk Reduction

Indonesia

Regional Programme on Capacity Building for Sustainable Recovery and Risk Reduction

Institutional and Legislative Systems for Early Warning and Disaster Risk Reduction
INDONESIA

Contents

Acronyms

AADMER	ASEAN Agreement on Disaster Management and Emergency Response
ACF	Action Contre la Faim (French NGO)
ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
ADRC	Asian Disaster Reduction Center
AM/FM	Amplitude/Frequency Modulation (used to describe broadcasting (radio) methodologies)
AQM	Air Quality Monitoring
ASEAN	Association of Southeast Asian Nations
AusAid	Australian Government Overseas Aid Program
AWD	Acute Watery Diarrhea
BADAN KESBANGLINMAS	National Unity and Public Protection Bodies
BAKORNAS PB	National Coordinating Agency for Disaster Management
BAKORNAS PBP	Disaster and Refugee Relief Coordinating Body
BAKOSURTANAL	National Coordinating Board for Survey and Charting Development
BAPEDAL	Environmental Impact Management Agency
BAPPEDA	Regional Development Planning Board
BAPPENAS	National Development Planning Board
BBC	British Broadcasting Corporation
BGR	Federal Institute for Geosciences and Natural Resources (Germany)
BKTRN	National Spatial Planning Coordinating Agency
BMKG	Meteorological, Climatological and Geophysical Agency
BNPB	National Disaster Management Agency
BPA	Beijing Platform for Action
BPN	National Land Agency
BPPT	Agency for the Assessment and Application of Technology
BPS	Central Bureau of Statistics
BPSDA	Water Resources Management Centre
BRKP	Agency for Marine and Fisheries Research
BRR	Aceh-Nias Rehabilitation and Reconstruction Agency
BSN	National Standardization Agency
Bupati	Head of Regency
CB	Citizen's Band (short-distance radio communications)
CBDRM	Community-based Disaster Risk Management
CEDAW	Convention on the Elimination of All Forms of Discrimination Against Women
CNN	Cable News Network
CPAP	Country Programme Action Plan
CRED	Centre for Research on the Epidemiology of Disasters
CVGHM	Center of Volcanology and Geological Hazard Mitigation
DART	Deep-Ocean Assessment and Reporting of Tsunamis (buoys)
DEPDAGRI	Ministry of Home Affairs
DEPDIKNAS	Ministry of National Education
DEPKES	Ministry of Health
DEPLU	Ministry of Foreign Affairs
DESDM	Ministry of Energy and Mineral Resources
DiBi	Data and Informasi Bencana Indonesia (Disaster Loss Database)
DKI	Special Capital City District (Jakarta)
DKP	Ministry of Marine Affairs and Fisheries
DPD	Regional Representatives Council
DPR	People's Representative Council (Lower House of the Indonesian Legislature)
DPRD	Provincial Legislative Council, Regional House of Representatives, Local Assembly
DPU	Provincial Public Works Office

DRR	Disaster Risk Reduction
DVGHM	Directorate of Volcanology and Geological Hazard Mitigation
EDM	Earthquake Disaster Mitigation Research Center
ENSO	El Niño Southern Oscillation
EWARN	Early Warning and Response Network
EWS	Early Warning System
FAO	Food and Agricultural Organization of the United Nations
FDRS	Fire Danger Rating System
GAM	Free Aceh Movement
GDP	Gross Domestic Product
GIS	Geographic Information System
GLOSS	Global Sea Level Observing System (IOC/UNESCO)
GoI	Government of Indonesia
GPS	Global Positioning System
GROOTS	Grassroots Organizations Operating Together in Sisterhood, Global Coalition
GSM	Global Systems for Mobile Communications
GTZ	German Technical Cooperation Agency
HF	High Frequency (radio)
HPAI	Highly Pathogenic Avian Influenza
IAHRI	Indonesian Agro-climate and Hydrology Research Institute
ICBRR	Integrated Community-Based Risk Reduction (Program of PMI)
ICG	Intergovernmental Coordination Group
ICS	Incident Command System
ICT	Information and Communication Technology
ICZM	Integrated Coastal Zone Management
IDEP	(a Bali-based NGO)
IFRC	International Federation of Red Cross and Red Crescent Societies
ILO	International Labour Organization
ILS	Institutional and Legislative Systems
InaTEWS	Indonesia Tsunami Early Warning System
IOC	International Oceanographic Council
IOTWS	Indian Ocean Tsunami Warning System
ITB	Institute of Technology Bandung
JICA	Japan International Cooperation Agency
JTIC	Jakarta Tsunami Information Centre
KLH	Ministry of Environment
KOMINFO	Ministry of Communication and Information
LAP	Land Administration Projects
LAPAN	National Institute of Aeronautics and Space
LIPI	Indonesian Institute of Sciences
LoGA	Law on Governing Aceh
MDG	Millennium Development Goal
MDRRD	Mainstreaming Disaster Risk Reduction into Development Programme
MENKO KESRA	Coordinating Ministry for People's Welfare
MPBI	Indonesian Society for Disaster Management
MPR	People's Consultative Assembly
NAD	Aceh Special Region
NGO	Non-Governmental Organization
NIED	National Research Institute for Earth Science and Disaster Prevention
NOAA	National Oceanic and Atmospheric Administration (USA)
OCHA	(United Nations) Office for the Coordination of Humanitarian Affairs
PEMDA	Regional Government (regency/city)
PEMDA DKI	Government of Capital City District (Jakarta)
PMB	Centre for Disaster Mitigation (ITB)

PMI	Indonesian Red Cross
POLRI	National Police
POSKO	Coordination Post (Equivalent of BAKORNAS PB at sub-district level)
PTWC	Pacific Tsunami Warning Center (USA)
PU	Ministry of Public Works
RANET	Radio and Internet for the Communication of Hydro-Meteorological and Climate Related Information
RISTEK	State Ministry of Research and Technology
SATKORLAK PB	Provincial Coordinating Unit for Disaster Management
SATLAK PB	Regency or District Coordinating Unit for Disaster Management
SC-DRR	Safer Communities Through Disaster Risk Reduction in Development Programme
SMS	Short Message Service (mobile phones)
SMWE	State Ministry for Women's Empowerment
SNI	Indonesian National Standards (environmental standards)
SOP	Standard Operating Procedures
TEWS	Tsunami Early Warning System
TNI	Indonesian National Defence Force
TRIAMS	Tsunami Recovery Impact Assessment and Monitoring System

UNDP	United Nations Development Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFPA	United Nations Population Fund
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
UNIFEM	United Nations Development Fund for Women
UN/ISDR	United Nations International Strategy for Disaster Reduction
UNTWG-DRR	United Nations Technical Working Group for Disaster Risk Reduction
USA	United States of America
USAID	United States Agency for International Development
USGS	United States Geological Survey
WALHI	Forum on the Environment/ Indonesian Friends of the Earth
WED	Women's Empowerment Division
WFP	World Food Programme
WHO	World Health Organization
WMO	World Meteorological Organization

Executive Summary

Background

The development of Early Warning Systems (EWS) has received an exceptional amount of attention and resources in the aftermath of the 26 December 2004 Indian Ocean tsunami disaster. A lot of emphasis has been placed upon technical and instrumental arrangements, while ***policy, legal and institutional changes that provide the basis for risk reduction are still to be improved, enacted and translated into practice***. This includes the need to devote more attention to community-based or 'people centred' and gender sensitive approaches in the establishment of EWS. Ultimately, the success of EWS must be measured by the degree to which vulnerable communities are empowered to receive, understand and respond to warnings in an effective manner. Unless women participate actively in these systems little progress can be made.

This report summarizes the results of a study commissioned by the United Nations Development Programme (UNDP) in 2007 that captures:

a. The status of Indonesia's institutional, policy and legal framework for EWS and disaster risk reduction (DRR);

b. The main gaps remaining to establish a comprehensive EWS within a holistic DRR policy; and

c. Recommendations for stakeholders[1] on the immediate strengthening of EWS through the policy, legal or institutional framework.

The review of Indonesia's institutional, policy and legislative arrangements is structured around the discussion of six main areas that are at the centre of effective, people-centred EWS. These are:

1. Governance and Institutional Arrangements

2. Risk Knowledge

3. Monitoring and Warning System

4. Dissemination and Communication

5. Response Capacity

6. Gender Aspects

---

1 With particular emphasis on government and UNDP.

Main Findings of the Study

1. Governance and Institutional Arrangements

The Government of Indonesia has demonstrated its commitment to the development of a comprehensive DRR approach by passing a Law on Disaster Management in March 2007, developing a National Action Plan for Disaster Reduction 2006–2009, and establishing a National Disaster Management Agency (BNPB) on 26 January 2008 (as stipulated in the Law on Disaster Management) to provide DRR guidance and support to line ministries, provinces and districts. BNPB will have counterpart agencies at the provincial and district levels in the near future to enhance coordination and cooperation. Disaster mitigation and management is one of the priorities in the Government of Indonesia's National Development Work Plan, and the National Development Planning Agency (BAPPENAS) has allocated funds from the national budget for relevant agencies to integrate DRR into development planning.

Among the numerous laws underpinning DRR, several pieces of legislation form the foundation for EWS. Overall, however, most laws focus on response rather than on prevention and preparedness, and EWS does not figure prominently or proportionate to its significance in legislation and policy. The Law on Disaster Management mentions EWS under the topic of preparedness; further elaboration will be required to set out clear responsibilities. A critical feature of the law is the inclusion of community participation in disaster management (Article 26). The National Action Plan for Disaster Reduction 2006–2009 offers a broad picture of the institutional, legal, societal and technical requirements for an end-to-end multi-hazard EWS. It mentions EWS among the five key priorities that must be addressed as well as activities to support EWS capacity development.

Following the 2004 tsunami, the Indonesian government assigned specific roles to 16 (and later to 20) government institutions to develop the Indonesia Tsunami Early Warning System (InaTEWS), with the State Ministry of Research and Technology (RISTEK) as coordinator. To avoid or minimize overlaps in EWS coverage and confusion over roles and responsibilities, the Coordinating Ministry for People's Welfare (MENKO KESRA) issued a decree on 26 September 2006 stating the duties of each institution involved in developing

InaTEWS. A review and amendment of the decree is planned in 2009 to better map out and define the mandates and authorities of all contributing agencies and actors in light of the progress made in developing InaTEWS. InaTEWS was inaugurated by the President at the Meteorological, Climatological and Geophysical Agency (BMKG) on 22 November 2008 and its full operation is expected by early 2010.

Although the roles and responsibilities for InaTEWS have been assigned to various agencies, the same level of detail for other hazards have not been determined. This gap has resulted in overlaps in EWS coverage as well as confusion over roles and responsibilities.

Generally, resources for DRR and EWS are unevenly spread in the country and do not match levels of risk and vulnerability. Resources devoted to supporting community preparedness are particularly insufficient. There is significant potential to strengthen the role of civil society, the private sector and the media in DRR and EWS. Linkages between local and central actors require clarification. Nonetheless, Indonesia has taken great strides in encourage the participation of 'non-government' actors in DRR and EWS, for instance, in developing standard operating procedures (SOP), establishing the National Platform for DRR, and in the Hyogo Framework for Action progress review and reporting. Indonesia has also made significant progress in incorporating EWS and DRR in development planning through BAPPENAS and BNPB, and through the Safer Communities Through Disaster Risk Reduction in Development Programme (SC-DRR) as part of the Joint UN Strategic Plan on Disaster Reduction for Sustainable Development.

2. Risk Knowledge

Responsible organizations in Indonesia are putting considerable efforts into strengthening the systematic collection, sharing and analysis of data on hazards and vulnerabilities, and in disseminating this knowledge through training and education. However database development suffers from varying formats of data inputs, poor reliability of media sources, imprecise estimates of disaster losses, inaccurate information leading to improper action and difficulty obtaining reliable information from small districts. Recognizing these limitations, BNPB has developed a national disaster loss database – DiBi (Data and Informasi Bencana Indonesia) as part of the SC-DRR and the UNDP regional programme. Following its launch on 29 July 2008 with records of disaster losses from 2002 to 2007, BNPB has been collecting historical disaster data for the past 30 years from six provinces to build up the database. At the same time, BNPB has been organizing a series of training and socialization events on DiBi.

A wide range of different tools are currently used for the historical analysis and prediction of future disasters that would benefit from synchronization within the country and across the region. Very few risk assessments have been conducted at the community level, and the awareness and knowledge of risks is scattered with a few vulnerable communities benefiting from dedicated projects while others remain uncovered. Risk knowledge is not or insufficiently used to inform land use and development planning and/or promote the revision and enforcement of safety and building codes. Extreme population pressures on the environment coupled with obsolete legislation has resulted in dramatic increases in vulnerability.

3. Monitoring and Warning System

Of the five components reviewed in this report, Indonesia is well advanced in the development of hazard monitoring and EWS. Responsible organizations have upgraded computer systems and communication technology in recent years in order to improve access to real time data and reduce the lead time of warnings. Communications between central authorities and regional and international monitoring and warning systems are also getting better. As the main receiver/provider of data and data analysis for InaTEWS, BMKG has installed state-of-the-art equipment in its new building, including a decision support system and an information dissemination system. The systems have been developed to ensure integration with UN plans and strategies for the establishment of global and regional EWS coordinated by the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (IOC/UNESCO).

The systems of InaTEWS have contributed to the successful issuance of a warning within five minutes of the Bengkulu earthquake on 12 September 2007. Nevertheless, capacity development on end to end EWS within BMKG and for local governments is still required to consistently reach the vulnerable public with actionable messages. Moreover, the pace of development and environmental degradation is threatening to overtake the capacity to predict and warn, particularly for floods and landslides. Monitoring and early warning capacity needs to take a multi-hazard approach, and ensure that information generated are meaningful and relevant to the communities, and lead to warnings that can be acted upon.

4. Dissemination and Communication

The regional and national members of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS) have been forerunners in enhancing dissemination and communication systems, and in identifying technical and institutional gaps. In Indonesia, gaps include the fact that there are separate hazard-specific

systems for dissemination of warnings and communications, and SOP for information exchange among government staff, media, civil society and the public require formalization and eventual institutionalization.

InaTEWS is being developed to meet international standards for effective exchange of data, and BMKG has announced its intention to serve as a Regional Tsunami Watch Provider in a coordinated regional warning system for the Indian Ocean.

Central and provincial authorities are cautious to issue warnings, particularly for tsunamis that may prove to be false and/or trigger a panic. To ensure accuracy of warning, the Government of Indonesia has invested in a number of broadband seismographs, tide gauges and the Deep-Ocean Assessment and Reporting of Tsunamis (DART) buoys. Currently, InaTEWS operates 116 units of broadband seismographs, 90 units of tide gauges and 2 units of DART-buoys. InaTEWS grand scenario will consist of 160 broadband seismographs and 500 accellelographs for seismic observation, and 40 global positioning systems, 80 tide gauges and 23 DART-buoys for observing sea-waves. In addition, there are also improvements to minimize false warning. These include:

- Providing detailed information on warning message content;

- Identifying the potentially affected region for every event, prior to warning message dissemination;

- Installing tsunami simulation database that will provide estimate of arrival time;

- Risk mapping of potentially affected people, facilities and safe areas;

- Aggregating information to confirm tsunami on real time basis; and

- Installing a decision support system and its interface dissemination system.

An important weakness of the system, however, is the limited capacity of local government and communities to receive, interpret and further disseminate warning messages. An adequate feedback mechanism from the community to the national level that could help to analyse the effectiveness of warning messages is currently not in place. More can be done to enhance the critical role of the media in the dissemination of early warning messages.

To enhance dissemination and communication, BMKG with the support from UNDP and other stakeholders of InaTEWS, developed national SOP for earthquakes and tsunamis. The SOP development process has been participatory and inclusive involving relevant stakeholders. Subsequently local-level SOP that are linked with national systems have also been developed in the same manner.

5. Response Capacity

Successful warnings should activate an orderly movement of people out of harm's way and motivate them to seek shelter and secure their assets. A technically sound warning is ineffective if people do not know what to do next. Efforts are underway in Indonesia to improve the ability of people to respond to warnings and – more broadly – to the hazardous impact of these events. Good practices in community participation in response to warning are already available from the experience in dealing with volcanic hazards. There are also several promising but small-scale community-based programmes to boost disaster management and response capacity.

While public education and awareness raising activities, disaster planning and warning response practice drills are increasing in numbers, the coverage of vulnerable areas by drills and evacuation information remains inadequate. The Law on Disaster Management mandates regular evacuation drills and they have now become an annual event to commemorate the 2004 tsunami. These drills are also used as opportunities to organize activities to raise public awareness on local preparedness. More efforts need to be undertaken to analyse the effectiveness of public awareness programmes in influencing the public perception of risks.

6. Gender Aspects

The institutional and legal frameworks governing DRR and EWS offer opportunities for ensuring that risk reduction and early warning policy and practices are supportive of the needs of both women and men. Overall progress on the Millennium Development Goals (MDG 3 in particular) is slow in Indonesia. The potential economic role of women is hampered by the Marriage Law, and gender-based violence and discrimination persist.

The Indonesian Ministry of Women's Empowerment is taking the lead to increase access of women to high-level decision-making positions, and has been instrumental in the passing of a law that introduces a 30 percent quota for women in legislative bodies at the national, provincial and district levels. Nevertheless, women have not been able to increase their political voice in the legislature and their participation is lowest at the district level.

Gender aspects in governance include conflicts between adat (customary) laws and the constitution (that guarantees women's equality), as well as issues surrounding the introduction and interpretation of Shari'a law at the local level. Women and children were the majority of casualties in the 2004 tsunami partly due to their activities at the time of day and weaker physical strength. Many men particularly the poorest suffered from loss of livelihoods; both genders were affected by psychosocial issues and lacked sufficient

voice in the design and implementation of assistance strategies. While the 2004 tsunami and the May 2006 earthquake revealed the specific legal constraints women face in recovering from disasters, women also emerged as powerful forces for preparedness and recovery.

There is no doubt that the establishment of an effective EWS requires the participation of both women and men. The new DRR and EWS policies and plans offer opportunities to involve more women. Women are well placed to participate in risk assessments, the design of EWS and the promotion of DRR, and require targeted capacity development. Indonesia has already adopted a number of gender instruments including guidelines for gender mainstreaming, application of a Gender Analysis Pathway in a range of ministries, and the increasing inclusion of gender aspects in annual development plans at the district level. There is relevant capacity in the State Ministry for Women's Empowerment, women's study centres, several hundreds of non-governmental organizations (NGOs) working towards gender equality, and in community groups that arose out of the tsunami and other disasters. These institutions can help to ensure that far more women participate in EWS and that warning messages, processes and procedures employ a gender sensitive approach, and consider specific concerns such as physical strength, security and protection.

Main Recommendations for Stakeholders

1. Governance and Institutional Arrangements

Develop joint organizational efforts to promote the Law on Disaster Management while focusing on coordination, popular consultation, community participation, local DRR 'culture' development, socialization and commitment building.

Develop comprehensive plans and guidelines to cover EWS in structural and operational detail. While plans are already extensive under InaTEWS, ensure that investments made upstream (technology for monitoring, detection, etc.) are sustainable through decrees and permanent resource allocation and increase focus on downstream plans and implementation (local government and last mile capacity).

Agree on a prioritized plan for EWS capacity development that covers all major hazards and encompasses all member agencies of government, civil society and assistance providers. Develop a mechanism for assigning resources to cover the needed inputs.

- Within this plan concentrate material and human resources at the regional and district levels to provide support and coordination to key actors in the EWS including governors, Bupatis/Mayors, the local/regional parliament (DPRD) and the National Unity and Public Protection Bodies (BADAN KESBANGLINMAS) to reduce disparities and structural gaps.

- Share resources with and integrate early warning efforts of NGOs, media, the private sector, universities and community-based organizations.

1.1 Including women and men in governance and institutions for EWS

Ensure that plans and regulations to implement the Law on Disaster Management and its EWS component emphasize a more active role of women in decision-making. Specifically, ensure that the plan for EWS capacity development encourages participation of women from different sectors (government, civil society, communities, etc.)

Clearly stipulate activities that designate EWS roles of and protective measures for women and men, and girls and boys.

Provide support for gender awareness training to government staff and research to increase knowledge about gender aspects.

2. Risk Knowledge

Promote coordination for risk mapping and data collection/ analysis, and address problems associated with ongoing database development including standardization of methodology across the country and in the region.

- Further promote and strengthen the use of the DiBi tool for the historical analysis and prediction of disasters. Supplement these with new risk assessment undertaken by other technical and scientific agencies.

Promote community-based vulnerability assessments and mapping nationwide, using networks of trained volunteers, community-based organizations and/or NGOs to reach isolated communities and groups requiring urgent protection.

Strengthen risk communication methods and access to risk knowledge to ensure that different target groups understand the risks they face. Use community vulnerability data to integrate and socialize DRR and EWS information.

Focus efforts on updating and enforcing laws and regulations related to building codes, land titling, environmental and natural resources protection, deforestation, and integrated coastal management in light of up-to-date knowledge of risks.

2.1 Strengthening understanding of gender-based vulnerability and capacity

Use existing gender sensitive tools developed nationally to assess the vulnerability of each gender and their access to information regarding trends on hazards and vulnerabilities.

Make effective use of education systems, female politicians and legislators, and organizations and groups with gender-related mandates to further risk knowledge and participation in risk management and EWS, particularly in the least developed provinces.

Provide capacity development support to community groups and networks to help change attitudes and promote empowerment of women through risk knowledge.

Ensure the participation of women in development of building codes, land titling and environmental protection laws and practices, particularly at district/municipality levels.

3. Monitoring and Warning System

Continue to enhance support for BMKG and the wider network of relevant agencies in the development of the InaTEWS forecasting and warning system.

Work on reducing information gaps between BMKG and other organizations monitoring various hazards, including central authorities, local authorities and community groups.

Ensure that resources are available to strengthen community level monitoring and early warning by lobbying with the local or regency/city government (PEMDA) and DPRD (local/regional parliament) to allocate sufficient funds, human resources and support for maintenance of relevant systems.

Involve NGOs such as the Indonesian Red Cross (PMI) and the private sector to push socialization and local capacity development.

Ensure community participation from the beginning to develop trust and ownership of the monitoring and warning system, as well as avoid vandalism of equipment.

3.1 Promoting the potential of women as EWS and DRR actors

Empower women through training and replication of good practices to become actors in community-based DRR and EWS (to strengthen community-based monitoring and early warning in particular).

Involve women in the development of policies to address the human causes of floods, landslides and fires.

4. Dissemination and Communication

Unify the concepts of warning dissemination and communication across organizations through development of a clear strategy/plan and flow-chart supported by cross-organizational SOP. Clarify the roles of information providers and distributors, and ensure that relevant stakeholders understand these roles and how they are linked.

Upgrade technical information and communication systems to international standards to allow information from BMKG to be swiftly disseminated to communities. The communication instruments and system may need to vary with the area, and traditional instruments and systems may need to be revitalized.

Strengthen the community's ability to understand and act upon messages. Obtain consensus in communities and among various levels of authorities on the appropriate local warning system.

Facilitate feedback from the community on and promote circulation of messages in/by the community. Local wisdom and experience should be integrated into the InaTEWS and other EWS.

Develop a cohesive approach for dealing with the impact from false alarms, including those due to the malfunctioning of equipment or hoaxes set to cause panic, and for enhancing public understanding of the need for warnings.

Strengthen public perception of warnings as protective mechanisms. Conduct an intensive and long-term media campaign on the warning messages using examples from successful national and community-based information campaigns.

Support development of media partnerships in EWS, at national and at local levels.

4.1 Ensuring warning messages reach both genders

Prepare actionable warning messages that employ a gender sensitive approach in the context of community disaster preparedness and awareness programmes. Various times of day and the activities that females and males will be engaged in should be considered in terms of how each group can be effectively reached and the reaction time they will need to flee to safety relative to the types of disasters they may face. The protection of children will require extra time for evacuation.

5. Response Capacity

Develop regulations and SOP that mandate the:

- Frequency of evacuation drills in high risk areas;

- Evaluation of drills according to specific indicators of success and feedback from participants;

- Clear identification and realistic mapping of evacuation routes;

- Identification of designated places for evacuation; and

- Development of specific procedures for where to seek shelter and how to reach these safe areas considering the needs of particularly vulnerable groups.

Establish a coordination forum on early warning to allow all actors to vet problems and concerns and to advocate for appropriate resources and capacity development. Involve local governments, NGOs, businesses, education institutions, community-based organizations and networks. Furthermore:

- Develop joint strategies and action plans for expanding the reach of community-based disaster management and capacity development programmes.

- Expand coverage of drills, evacuation information and response planning, particularly in high risk areas and communities.

- Promote well coordinated disaster response plans at district and community levels by strengthening the capacity of BNPB, and regional/provincial/district disaster management agencies.

- Ensure that NGOs and businesses have plans to support the response to warnings.

Undertake lessons learned exercises after evacuation drills or actual warnings, and ensure that a responsible coordinating body captures and analyses results for follow-up and incorporation into preparedness plans and training.

Strengthen optimal use of the Incident Command System[2] by involving local authorities and communities in awareness raising and participation in planning efforts.

5.1 Learning to design EWS that work for women and men

Make optimum use of good practices and lessons learned in previous disasters in Indonesia and other countries to support the critical roles played by women and men in preparedness and response, using national and community-based training programmes as vehicles.

Evacuation drills, routes and procedures should be mapped taking into account gender considerations such as access, security, etc. for women.

---

2 A standardized on-scene emergency management concept specifically designed to allow its user(s) to adopt an integrated organizational structure.

1

Background on UNDP Support to Institutional and Legislative Systems for Early Warning and Disaster Risk Reduction

Between 1984 and 2004, the United Nations Development Programme (UNDP) supported a portfolio of over 50 disaster risk reduction (DRR) programmes in 63 countries, mainly devoted to the strengthening of organizational and institutional capacity. In 2004, the Disaster Reduction Unit of UNDP's Bureau for Crisis Prevention and Recovery conducted a review of UNDP's support to Institutional and Legislative Systems (ILS) for DRR. The review highlighted the importance of establishing linkages between effective and 'good' governance, risk reduction and the mitigation of impacts from recurring disasters. Recent devastating events causing high numbers of casualties, such as the December 2004 Indian Ocean tsunami and the October 2005 earthquake in northern Pakistan reemphasized the urgent need to further strengthen ILS for DRR within a governance framework.

Since the 2004 tsunami, two significant earthquakes in Indonesia as well as severe flooding in Thailand in 2006 have served as stark reminders of the high levels of risk in Asia. These disasters revealed the persistent shortcomings of national warning and response mechanisms, and exposed under-addressed risks of vulnerable populations. There is a need to understand and analyse existing DRR strategies, policies, organizational relationships, mechanisms and processes, laws and regulations, and resources and procedures at all levels of administration. Responding to this need UNDP's Regional Programme on Capacity Building for Sustainable Recovery and Risk Reduction undertook the current study in collaboration with UNDP Country Offices in Indonesia, Sri Lanka and Thailand in 2007. The study focuses on the review of early warning systems (EWS) within the context of national DRR strategies, institutions and legislative systems.

1.1 Background on ILS for Early Warning

Laws and regulations provide the basis for enforcing rules to promote rights and obligations of groups and individuals. However, laws by themselves mean very little, they are a means towards the achievement of policies such as DRR strategies and/or frameworks. Policies have to reflect the social, economic and cultural realities of a given country. Policy makers have to consider to what degree policies can be easily implemented through formal institutions and mechanisms, or whether they require the participation of informal institutions and mechanisms including non-state actors. The latter is particularly relevant for the effectiveness of EWS.

Typically, laws provide incentives (e.g. subsidies) and disincentives (e.g. penalties) to engage in or avoid certain desired or undesired actions. They also frame institutional relationships between agencies and the distribution of roles and responsibilities, including the roles of the wider population. In the context of EWS, laws set objectives, standards and assign mandates and responsibilities to different actors in the monitoring and early warning process. Regulations, standard operating procedures (SOP) and codes describe specific procedures and norms, seeking to encourage certain types of behaviour. The effectiveness of any EWS depends upon political will, the administrative and technical capacity of a given country, and the degree of acceptance and awareness of rules by the population. EWS require a people-centred approach where formal mechanisms such as laws, protocols and standards complement informal mechanisms such as the engagement and participation of communities.

Box 1: Institutional and Legal Systems and Governance

Institutional and legal systems (strategies, policies, laws and regulations, organizational structures, mechanisms and inter-agency processes and resources) form the backbone of a country's **governance framework**. UNDP promotes the following key characteristics of 'good' or democratic governance in all its governance interventions including support to EWS:

- Participation of citizens
- Institutions of accountability
- Impartial mechanisms to enforce the rule of law
- Multiple and transparent flows of information
- Processes and mechanisms that increase the effectiveness of services
- Increased capacity of stakeholders in multiple sectors and at all levels
- Partnerships and a long-term human development
- Pro-poor and gender equality orientation

The public needs to fully understand and be consulted in the design of EWS plans and procedures. The public also needs to be able to monitor EWS performance and hold service providers accountable. If public access to information and to legal systems is weak, and if both local agencies and communities lack appropriate resources to act upon warning messages, it will be difficult to ensure compliance and acceptance of responsibility. EWS become effective and sustainable when citizens start to acknowledge their entitlement to a minimally safe environment, when they can easily access credible information on the performance of EWS, and when they realize their own rights and duties in early warning.

1.2 EWS in the Aftermath of the 2004 Tsunami

Since its creation in 1949, the Pacific Tsunami Warning Center (PTWC) has effectively issued warnings preventing deaths from underwater seismic events in the Pacific Ocean. However the tsunami in 2004 demonstrated the importance of national and local capacity to receive, interpret, disseminate and respond to such warning messages. Many deaths could have been prevented if these capabilities had been in place. The initiative "Building Back Better," supported by the UN Special Envoy for Tsunami Recovery has developed key propositions from lessons learned in the tsunami.[3] While all ten propositions are important for establishing a strong basis for early warning, the following are particularly relevant:

Proposition 3: *Governments* ***must enhance preparedness*** *for future disasters. The recovery period offers the opportunity to enhance relationships among government, the private sector and the international assistance community for preparedness. Governments must act rapidly* ***to reform laws and institutions*** *capitalizing on the availability of new resources for preparedness.*

Proposition 10: *Good recovery must leave communities safer by reducing risks and building resilience.* ***Education and public awareness*** *has been shown to save lives.* ***Legal frameworks*** *must be in place to ensure priority at national and local levels but need to be followed by* ***long-term financial investment*** *and* ***training*** *and* ***mainstreaming of risk reduction*** *in recovery and development strategies.*

The increased attention to EWS in the region since the 2004 tsunami indicates that governments have started to consider preparedness measures within a more comprehensive DRR framework. EWS plans and projects emphasize the need to strengthen connections between vulnerable communities, government warning agencies and international services and actors. In close collaboration with the governments of India, Indonesia, Maldives, Sri Lanka and Thailand a number of bilateral and multilateral organizations have undertaken regional early warning projects. These include the United States Agency for International Development (USAID) Indian Ocean Tsunami Warning System (IOTWS) Program. As part of its engagement, USAID has conducted a study of the DRR capacities in relation to individual national disaster management organizations (implemented by Asian Disaster Preparedness Center – ADPC). UNDP has worked in close collaboration with IOTWS to share information and analysis. The UN International Strategy for Disaster Reduction (UN/ISDR) is working with UNDP and governments to develop Strategic National Action Plans for DRR in tsunami affected countries.

1.3 Guiding Principles for People-centred EWS

"More effective prevention strategies would save not only tens of billions of dollars, but save tens of thousands of lives. Funds currently spent on intervention and relief could be devoted to enhancing equitable and sustainable development instead, which would further reduce the risk for war and disaster. Building a culture of prevention is not easy. While the costs of prevention have to be paid in the present, its benefits lie in a distant future. Moreover, the benefits are not tangible; they are the disasters that did NOT happen."

Kofi Annan, "Facing the Humanitarian Challenge: Towards a Culture of Prevention", UNGA, A/54/1

Most disaster management and contingency plans focus on post disaster response with often only a few lines and/or little energy devoted to EWS. This tendency has so far undermined the potential impact of EWS as a preventive tool for saving lives and avoiding disasters.[4]

The UN/ISDR defines early warning as:

The provision of timely and effective information, through identified institutions, that allows individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response.

---

3   UN Secretary-General's Special Envoy for Tsunami Recovery, William J. Clinton, *Lessons Learned from Tsunami Recovery: Key Propositions for Building Back Better*, December 2006.

4   Including incorporation of early warning in ongoing DRR.

The objective of people-centred EWS is:

…to empower individuals and communities threatened by hazards to act in sufficient time and in an appropriate manner so as to reduce the possibility of personal injury, loss of life and damage to property and the environment and loss of livelihoods.

In March 2006, the Third International Conference on Early Warning sponsored by UN/ISDR and the German Government identified the following areas as critical for establishing a people-centred EWS. These areas provide a structured approach to EWS that this report follows:

1. Governance and Institutional Arrangements – The aim is to develop national institutional, legislative and policy frameworks that support the implementation and maintenance of effective EWS.

2. Risk Knowledge – The aim is to establish a systematic, standardized process to collect and assess data, maps and trends on hazards and vulnerability. This area includes the establishment of organizational arrangements, identification of natural hazards, analysis of community vulnerability, assessment of risk, and storage and accessibility of information.

3. Monitoring and Warning System – The aim is to establish an effective hazard monitoring and warning system with a sound scientific and technological basis.

4. Dissemination and Communication – The aim is to develop systems to ensure local, national and regional coordination and information exchange.

5. Response Capacity – The aim is to strengthen the ability of communities to respond to natural disasters through enhanced education of natural hazard risks, community participation and disaster preparedness.[5]

1.4 Indicators of Good Practice in ILS for EWS

ILS for EWS should be guided by the same basic principles as good or democratic governance (see Box 1). Some indicators of progress that guide the analysis in this review are the following:

---

5   UN/ISDR, *Developing Early Warning Systems: A Checklist*, An outcome of the Third International Conference on Early Warning hosted by the Government of Germany in Bonn, 27–29 March 2006.

Figure 1: EWS and Governance / ILS

Monitoring and Warning System

Risk Knowledge

Governance and Institutional Arrangements

Dissemination and Communication

Response Capacity

1. **Gender equality.** The degree to which countries have been able to influence the way that DRR measures consider the needs of women and men, girls and boys and protect the most vulnerable groups.

2. **Policy priorities and commitment.** National policies assign clear mandates to government and civil society to undertake early warning activities that are underpinned by sufficient commitment and resources. Evidence of commitment may entail the drafting and legalization of an early warning policy and/or the inclusion and resourcing of early warning elements in DRR frameworks and plans. This may include, for example, institutional capacity development, incorporating early warning education and training as part of school curricula, and the continuous maintenance and improvement of early warning assets such as monitoring and warning equipment.

3. **Multi-sector responsibility.** Rather than a separate activity, the EWS is shared across all levels of governance and society and must address all of the hazards that threaten the population. Many actors are likely to be responsible, each supporting a part of the system, and all must ensure that their plans and actions are synchronized. Planning has to include the ministries and departments involved in hazard monitoring, communicating warnings, and responding to warning messages, as well as schools, communities, civil society and the private sector. EWS must be institutionalized and appropriate mechanisms created to promote inter-agency and inter-sectoral cooperation at all levels of administration.

4. **Accountability for warning.** Resources for effective EWS should be adequate and placed by priority in those areas most vulnerable to disaster to address the needs of the most vulnerable groups. Good governance will help to ensure that actors are empowered to undertake their roles in the EWS to help save lives and livelihoods. The government should coordinate the resources of all actors and enlist cooperation from the private sector and civil society to create a greater impact of the EWS. Continuous improvement based on feedback and evaluation of the system is critical.

5. **Resources.** Among the most telling indicators of political commitment for EWS are the level of resources allocated and the efficiency of the use of available resources by governments, civil society and the private sector. Do resources address the most threatening hazards and the most vulnerable populations by priority? Are resources placed on addressing most urgent capacity needs in the system and based on multi-actor assessments? Are actors working together to optimize resource use to cover gaps rather than taking a fragmented or duplicative approach? Are the resources moving effectively to strengthen the impact of the EWS in communities?

6. **Application.** Ideally, the EWS functions as part of a DRR system that is incorporated into longer term development planning and practice. Important components are risk and impact assessments, public awareness, education and training, information management and research, in addition to environmental and natural resource management, sustainable social and economic development practices, physical and technical measures, and preparedness and emergency management. These tools and approaches serve to effect behaviour changes where people recognize their own responsibilities as well as that of the government and participate in EWS, make their own plans to respond to early warning messages, and protect themselves and their families.

7. **Civil society and private sector participation.** While it is recognized that the government bears prime responsibility for early warning, the roles of civil society and the private sector are critical for success. Civil society actors can promote participatory processes to ensure that the needs and priorities of vulnerable and marginalized populations are met. Vulnerable communities can effectively use local knowledge of hazards, vulnerabilities and coping capacities while complemented by technical and scientific solutions. The inclusion of the private sector will ensure discussions to address possible conflicts between public and private interests. Such interactions are important to protect local economic enterprises such as tourism and fisheries, which are safer when effective EWS are in place.

8. **Decentralization of EWS** is an important vehicle for the sharing of responsibilities between central, regional and local levels and for fostering participation. However, it is not an end in itself, but only valuable if it ensures that adequate government interventions in early warning reach communities more effectively. An important indicator is the degree to which resources are decentralized to support early warning activities. Another is the degree to which decision-making is decentralized and local actors have the necessary knowledge and tools to carry out their roles in EWS.

Gender and Institutional and Legislative Systems for Early Warning

Making gender equality a reality is a core commitment of UNDP.[6] As a crosscutting issue, gender must be addressed in everything the organization does. Why? Because equality between women and men is just, fair and right – it is a worthy goal in and of itself, one that lies at the heart of human development and human rights. In addition gender inequality is an obstacle to progress, a roadblock on the path to human development. When development is not 'en-gendered' it is 'endangered'.

> ### Box 2: Key Provisions of CEDAW
>
> The ***Convention on the Elimination of All Forms of Discrimination Against Women,*** commonly referred to as CEDAW, is an international convention that was adopted by the United Nations General Assembly in 1979 and came into force in 1981. The Convention requires States Parties to:
>
> - Pursue a policy of eliminating discrimination against women by all appropriate means and without delay [article 2];
>
> - Reaffirm the equality of human rights for women in society and the family [article 1]; and
>
> - Remove laws, stereotypes, practices and prejudices that impair women's well-being [article 2 (f) and (g), and article 5 (b)].

The international community made strong commitments for women's equality and empowerment at the world summits and global conferences of the 1990s. UNDP helps countries to translate these commitments into practical realities. UNDP contributes in expressing the goals set forth in the CEDAW and the Millennium Development Goals (MDGs) into specific policy reforms and operational programmes that make a difference for women, poor women in particular. The degree to which countries have made progress on the MDGs, particularly MDG 3 (aiming to eliminate gender disparity in primary education by 2005 and in all other levels by 2015) and are realizing the rights accorded through instruments such as the CEDAW and the Convention on the Rights of

the Child, determines to a large extent how countries will incorporate gender concerns in DRR and EWS.

2.1 The Gender Experience of the 2004 Tsunami

Whether natural or human made, the impact of a disaster on people is always influenced by the political, economic and social-cultural contexts. Weaknesses in pre-existing institutional structures and legal protection arrangements will often result in some members of the community paying a higher price than others. Among the most important differences that determine how people are affected by disasters is that of gender.[7] Shortly after the 2004 tsunami, OXFAM issued a briefing note that captured the disproportionate impact of the disaster on women.[8] However, women do not only have specific vulnerabilities but also specific capacities that are often untapped in post crisis situations. The portrayal of women mainly as victims of disaster is still rife in legal language and in organizational practice.

Due to the gender division of labour in daily life, women and men possess specialized skills and strengths to cope with crisis. Yet, women's roles in mitigating and preparing for disasters, and in managing emergencies, go unheralded and unrecognized, even though their skills and contributions both at the household and community levels, are crucial.[9]

---

6   See UNDP Practice Note on Gender, November 2002.

---

7   Gender refers to the social construction of roles of women and men and the resultant role-perceptions about women and men. Gender relations can be described to be unequal power relations between women and men and manifested in the marginalization of women or men in social, economic, political and cultural spheres of life. Women's role in many societies has been restricted to certain tasks and spheres; e.g. household-related duties, reproductive process, child and family care, etc. Opportunities and access to material and non-material resources – land ownership, inheritance, education, training, has been restricted for women in many cases. Gender relations are also affected by other determinants like religion, culture, class, caste or age. (Source: Imelda Abarquez and Zubair Murshed, *Community Based Disaster Risk Management, Field Practitioners Handbook*, ADPC, 2004).

8   The OXFAM Briefing Note, *The tsunami's impact on women*, 2005. This report highlighted the high number of deaths and casualties among females and the possible repercussions on society.

9   Madhavi Ariyabandu, *Women: the risk managers in natural disasters*, Intermediate Technology Development Group South Asia, 2003, page 7.

After the tsunami many agencies have attempted to include women in recovery planning and to study the gender aspects of disaster response, among both women and men. A more active participation of women in EWS is yet to be achieved. The efficacy of EWS will depend on the extent to which people take responsibility to gain access to disaster risk information and warning messages, and can take rapid and appropriate action to protect themselves and their families. This cannot be left to men alone, but requires the active participation of women. Using the EWS as a preventive measure, both women and men can better prepare themselves to lessen the negative impacts of disasters on livelihoods and households.

2.2 Observations on Gender and DRR in the Region

UN/ISDR describes the progress of promoting gender-inclusive DRR as follows:

Successful implementation of the Hyogo Framework for Action requires the full, active and balanced participation of women and men, girls and boys. Yet gender issues have been long overlooked. They have received little attention because of poor understanding of gendered vulnerabilities and risks to disasters. Serious action needs to be taken and more effort needs to be made to promote gender-inclusive disaster risk reduction.[10]

The Asian Forum on Women in Disasters[11] met in December 2006 to review results of a Survey of Women's Human Rights Violations undertaken in the aftermath of the tsunami and the October 2005 earthquake in Pakistan. The review presented a picture of disturbing rights violations that included examples of the following:

- Women's right to adequate housing is violated.

- Women's right to work and employment is restrained by inappropriate assistance for livelihoods that remove women from their traditional occupation.

- Violence against women has been increasing in temporary shelters.

- Women's ownership right to land and property is violated.

- Discrimination based on caste, ethnicity, migrant status, occupation, religion and political affiliation exacerbates sufferings of women tsunami survivors.

- The armed conflict situation in Sri Lanka and (formerly) Aceh exacerbates the sufferings of the tsunami affected communities and inhibits the reconstruction process.

It is clear that the elimination of these violations in future disasters requires coordinated preparedness measures and strong legal bodies to monitor follow-up for the realization of rights. The Asia Pacific Forum on Women, Law and Development has created *Guidelines for Gender Sensitive Disaster Management*. While extremely important, the guidelines are all related to disaster response, or actions to be taken once a disaster has occurred. The reduction of the actual impact of the disasters and thus, a possible reduction in the extent of violations of women's rights could be achieved through effective EWS. EWS should therefore themselves be targeted to reduce these violations.

The Gender Equality and Disaster Risk Reduction Workshop that took place in 2004, in Honolulu, Hawaii issued a call to action that recognized the importance of institutions and institutional structures in providing the framework for policy and action in DRR. The attendees pledged attention to the following recommended follow-up activities:

- Develop legislation ensuring DRR is gender sensitive and addresses social equity.

- Ensure that gender issues and social equity become part of DRR agendas at international and national levels.

- Develop a global legal framework for ensuring that DRR is gender sensitive.

- Improve structural arguments in national governments, local governments and in non-governmental organizations (NGOs) that link gender, social equity, and DRR.

- Institute a Global Fund for Gender-specific Disaster Risk Reduction (GDRR) (in all phases of Disaster Management) with national commitment and membership prerequisites to ensure resource allocation.

- Establish mechanisms for gathering and distributing information related to gender mainstreaming in disaster risk management.

---

10 UN/ISDR, *Gender Perspective: Working Together for Disaster Risk Reduction – Good Practices and Lessons Learned*, June 2007.

11 The Forum is composed of 60 representatives of government, NGOs and aid agencies involved in the tsunami reconstruction efforts from India, Indonesia, Sri Lanka and Thailand.

2.3 UNDP's Eight-point Agenda on Gender Equality in Crisis and EWS

The Hyogo Framework for Action states, as part of the cross-cutting principles, that:

A gender perspective should be integrated into all disaster risk management policies, plans and decision-making processes, including those related to risk assessment, early warning, information management, and education and training.

With the help of a group of world-class experts, UNDP has developed an eight-point agenda to ensure gender equality in crisis prevention and recovery.[12] The following four points are particularly applicable to EWS.

1. Strengthen women's security in crisis

In crisis and post-crisis situations women are often particularly vulnerable to personal and institutional violence. EWS can address the specific security needs of women and girls by improving the gender safety of evacuation routes, centres and shelters, so women are less exposed to the risk of being attacked. The operators of early warning schemes require sensitization to understand the specific needs of women and girls in crisis situations.

2. Support women and men to build back better

Women have unique requirements in the context of natural disasters, which needs to guide the design of EWS. These needs can be addressed by ensuring that women are included in any analyses of disaster risk and in reviews or planning processes that inform the improvement of EWS.

3. Expand women's citizenship, participation and leadership

Women are not only particularly vulnerable to natural disasters but they also have specific capacities to reduce risks from natural disasters. There is ample room to support the representation and participation of women in EWS and to promote them as local leaders in DRR. This can be achieved by building women's skills and confidence, supporting women's representation in the social, political and economic spheres, and developing women's networks and institutions.

4. Transform government to deliver for women

By enhancing capacities and promoting accountability within government institutions in charge of EWS, by engaging women and men to foster gender-equitable relations in DRR, and by ensuring gender sensitive resource mobilization, aid coordination, budgeting and funds allocation, EWS can become a vehicle to promote government that is more responsive to the needs of women.

---

12 See Kathleen Cravero, Address to the Women's Foreign Policy Group: The Critical Role Played by Women in Rebuilding Society after Crises, 1 May 2008.

Country Background [13]

The Republic of Indonesia is the world's largest archipelagic state with more than 17,500 islands, of which 6,000 are inhabited and 1,000 are permanently settled. Indonesia is also the world's fourth most populous nation with over 240 million people.

Indonesia is divided into 33 provinces. [14]The provinces are sub-divided in districts that are in turn split up into sub-districts and municipalities. Indonesia is composed of many ethnic groups: 45 percent Javanese, 14 percent Sundanese, 7.5 percent Madurese, 7.5 percent coastal Malays, and 26 percent other groups. Over 88 percent of the population practices the Muslim religion. Bahasa Indonesia is the language of most written communication. The literacy rate is 90 percent and more than 94 percent of primary school children are enrolled. The infant mortality rate is about 30 deaths per 1,000 live births.

Since the economic crisis and political transformation of 1997–1998, Indonesia has made advances in reducing poverty. In 2005 the per capita income was estimated at $3,600. The number of poor remains high with 110 million (53 percent of the population) living on less than $2 per day. Indonesia is on track to achieve many of the MDGs by 2015. Between 1999 and 2002 the proportion of people living in poverty fell from 23 to 18 percent and improvements were made in adult literacy, infant mortality and child malnutrition. At the end of 2002, 90,000–130,000 people were estimated to be living with HIV/AIDs, perceived by the government to be a serious threat to human development. Empowerment of women has been a priority of the government as shown in the the passing of a law that introduces a 30 percent

quota for women in legislative bodies; but overall, gender disparity remains high.[15]

3.1 Governance in Indonesia

Indonesia is a republic based on the 1945 constitution that provides for a separation of executive, legislative and judicial power. The Dutch began to colonize Indonesia in the early 17th century and finally relinquished power four years after Indonesia declared independence in 1945. Substantial restructuring has occurred since President Suharto's resignation in 1998 and the transitional Habibie administration in 1998 and 1999. The president, elected for a five-year term, is the top government and political figure. On 20 September 2004, the president and the vice-president were for the first time elected by popular vote.

The president, assisted by an appointed cabinet, has the authority to conduct the administration of the government. The People's Consultative Assembly (MPR) has 678 members, consisting of the 550 members of the People's Representative Council (DPR/Lower House) and the 128 members of the Regional Representatives Council (DPRD), which includes four members from each of Indonesia's provinces. With the implementation of decentralization in January 2001, the 430 districts (regencies or cities) became the key administrative units responsible for providing most government services. The military has been a significant political force throughout Indonesian history and although it retains influence, the wide-ranging democratic reforms instituted since 1999 ended the armed forces' formal involvement in government administration.

As a reaction to Suharto's centralization of power and reflecting historically independent sentiment, the Free Aceh Movement (GAM) was established in 1976. Some 15,000 died in military conflict in Aceh over the following three decades and many hundreds of thousands of people were displaced. A peace agreement between GAM and the Government of Indonesia (GoI) that provided wide-ranging autonomy for the Aceh Special Region (NAD) was signed in August 2005. By December 2005, GAM had disbanded its military wing and the GoI had withdrawn the bulk of its security forces. On

---

13 Derived mainly from the Government of Indonesia/UNDP Country Programme Action Plan, 2006–2010; ADPC and ADRC Indonesia Country Reports; World Conference on Disaster Reduction Indonesia Report 2006; Wikipedia; CIA World Factbook; and US State Department Country Briefs.

14 Four of the provinces have special status: 1) Nanggroe Aceh Darussalam (formerly Aceh Special Region), according to a Memorandum of Understanding of 2005 has its own Islamic syari'ah law (only for Muslim citizens), flag and song of province, and local political parties are allowed; 2) In the Yogyakarta Special Region, the governor is not elected, but automatically served by the Sultan of Yogyakarta who has ruled for centuries; 3) Papua (formerly Irian Jaya), since 2000 has greater role of local government, and allowed to own flag and song of province; and 4) Jakarta Special Capital Region is a place of all national government bodies. It is proposed that Jakarta area will be extended to part of neighbouring provinces.

---

15 According to the UNDP Human Development Indices: A statistical update 2008, Indonesia ranked 93 out of 157 on the Gender-related Development Index.

11 December 2006, democratic gubernatorial and district administrative elections were held in NAD, the first in over half a century.

Decentralization in Indonesia was legitimated by Laws No. 22 and No. 25 of 1999 and 2001 respectively that defined Regional Autonomy and Fiscal Decentralization. These laws devolved most of the government services and functions to local authorities – apart from defence and national security, foreign affairs, fiscal policy and religion. Since 2001, decentralization in Indonesia has been entering a new phase of consolidation where actors are working to gather lessons learned and replicate best practices. However, local institutions in many areas still lack the capacity to fulfill their new mandates effectively. In 2004, Law No. 32 set out regulations to support regional revenue for disaster management and gave the power to the regions to draft and execute regional policies.

Understanding of the complexities of Indonesian decentralized governance is critical to implement an effective EWS. Each province has its own legislative body, called Dewan Perwakilan Rakyat Daerah (DPRD, literally meaning Regional People's Representatives Assembly) and the governor and members of the DPRD are elected by popular vote for a five year term. Each province is divided into districts i.e. regencies (Kabupaten) and cities (Kota) that govern public schools and public health facilities. Both regency and city have their own local government and legislative bodies; however, they differ in demographics, size and economy. Generally the regency occupies a larger territory than city, and cities have non-agricultural economic activities. The regency is headed by a regent (Bupati) and the city is headed by a mayor (Walikota), both elected for a five-year term.

Each regency or city is divided into sub-districts (Kecamatan) headed by the Camat, who is a civil servant, responsible to the regent (for a regency) or to the mayor (for a city). Each sub-district is divided into Desa or Kelurahan. Although Desa and Kelurahan are part of a sub-district, the Kelurahan has less power than a Desa. A Kelurahan is headed by a Lurah, who is a civil servant, and directly responsible to the Camat. The Kelurahan is part of the Regency/City government bureaucracy. The table below indicates the large proportion of Bupatis and regencies.[16]

Type	Head of Administration	Indonesian Title	Number
Province	Governor	Gubernur	33
Regency	Regent	Bupati	349
City	Mayor	Walikota	91

16 Wikipedia.

The local/regional and national institutions involved in the public order and safety sector are also major actors in DRR and EWS. These organizations are tasked with creating an EWS to mitigate security and conflict incidences, and this system may apply to disaster warning as well. Relevant local institutions include the Municipal Police, the National Unity and Public Protection Body (BADAN KESBANGLINMAS), and the Regional Intelligence Body. The national institutions include the National Defence Force and the Police Department, both of which have bureaucratic structures that reach from the national to the sub-district level.

Almost all regions allocate funds for public order and safety in their Regional Administrative Budget for the Municipal Police, BADAN KESBANGLINMAS, and the Police Department. In general, the funding is reported to be insufficient. However, it is important to note that while local government finances police and military security activities; neither of these security institutions is accountable to local government. Also, funding is generally authorized by the head of region, meaning there is no accountability either to the DPRD or to the public at large.[17] These relationships are key areas of concern for EWS.

3.2 Judicial and Legal Systems

The legal system is based on Roman-Dutch law, but has been substantially modified by indigenous concepts, new criminal procedures and new election codes. The justices of the Supreme Court are appointed by the president after candidates are approved by the legislature. Since 2004, the Supreme Court has assumed administrative and financial responsibility for the lower court system. In 2003, the president invested a separate Constitutional Court. Indonesia has not accepted compulsory International Court of Justice[18] jurisdiction.

The Indonesian justice system has suffered from severe and widespread deficiencies for decades and the GoI has declared a commitment to uphold the rule of law, affirming the importance of legal reform. Important steps have already been taken to try to address popular demands for a better functioning legal and judicial system. In October 2005, after many years, the Indonesian House of Representatives finally ratified the UN Covenant on Civil and Political Rights and the Covenant on Economic, Social and Cultural Rights. Yet, despite the passage of regulations and the establishment of new institutions, the implementation of the agenda for reform has been mixed. The justice sector is often suspected as corrupt and of protecting the private interests of elite

17 Indonesia Rapid Decentralization Appraisal (IRDA) – Fourth Report, Asia Foundation, page 61.

18 The International Court of Justice is the primary judicial organ of the United Nations. It is based in the Peace Palace in The Hague, Netherlands.

groups rather than providing public service, especially to the poor, the conflict-affected and other vulnerable groups.[19]

3.3 Natural and Human-made Hazards in Indonesia

Due to its unique geography and geology, Indonesia is highly prone to natural disasters and the incidences of natural disasters increase each year. Environmental degradation caused by human activity has further increased the variety and numbers of deadly hazards.
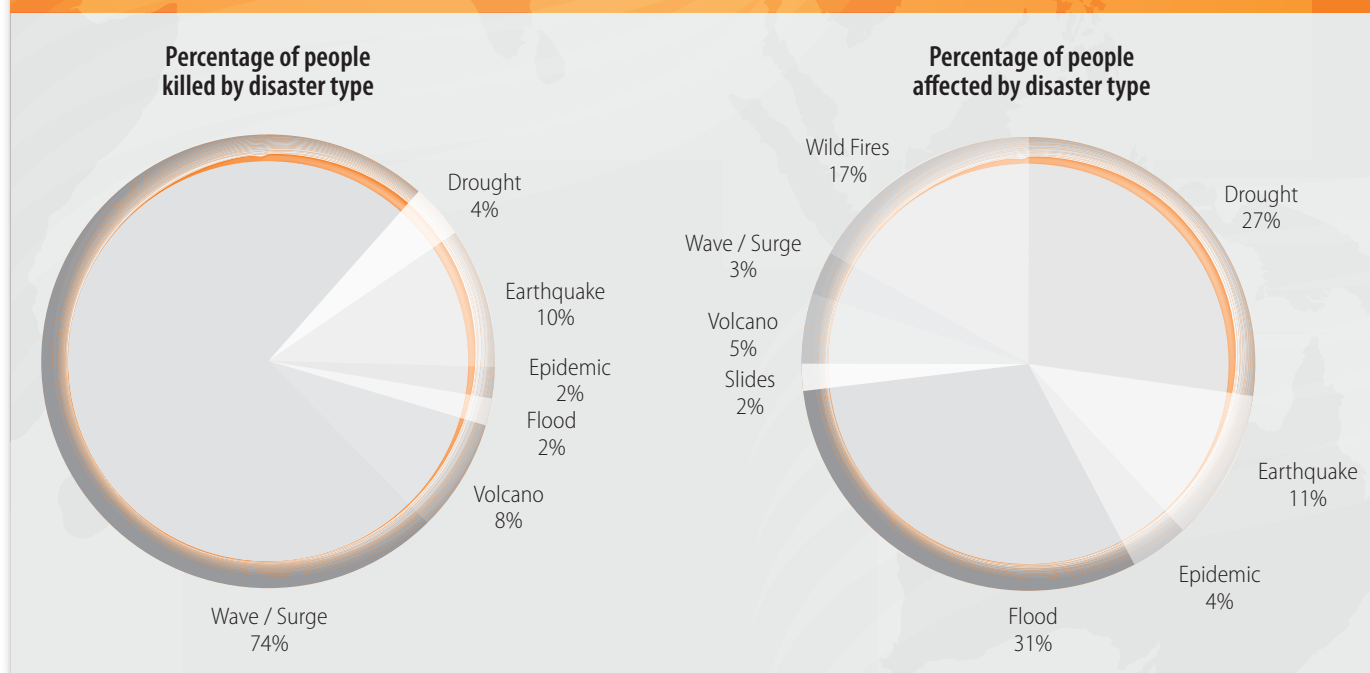
The southern and western islands, such as Java and Sumatra, are exposed to the largest number of hazards and have high risk levels for droughts, earthquakes, floods, landslides and volcanic activity. Geophysical hazards are confined to the mountainous regions of Java and Sumatra while droughts and floods affect larger areas. On other islands, droughts are the most widespread hazard, although landslides, floods and earthquakes affect selected regions. When measured against their proportionate impact on GDP and mortality, floods constitute the largest risk in Indonesia.[20]

Floods and Landslides. Indonesia receives massive amounts of rain within short time periods, contributing to floods and landslides. Areas affected by deforestation and urbanization are especially vulnerable. Floods comprised 34.1 percent of the total disasters between 2003 and 2005 and landslides 16 percent. During the last ten days of December 2006, heavy rains in Indonesia's NAD province produced severe flooding that displaced 127,000 people. There were 126 deaths on Sumatra island, with 76 of the fatalities occurring in NAD province. Floods affecting Jakarta in January 2007 killed 29 people. As many as 800 landslides have occurred over the past decade, killing at least 735 people. Two days of heavy rain prompted a landslide in Solok regency, West Sumatra on 16 December 2006, causing 18 deaths.

Earthquakes and Tsunamis. The country's location near the great Indo-Australian tectonic plate, where the India Plate is moving deeper and deeper beneath the Burma Plate, subjects it to frequent and powerful seismic activity. Earthquakes, tsunamis and volcanic eruptions only comprise 6.4 percent of the total environmental hazards but cause disproportionate losses.[22] Indonesia was the hardest hit by the Indian Ocean tsunami in 2004, and human losses and widespread damage to livelihood, infrastructure, private and public property, and economic and social activities were recorded in more than 20 districts in NAD with total damage equaling 97 percent of NAD's GDP. Furthermore, coastal damage occurred to coral reefs, wetlands and wildlife habitats. The population and land have not yet recovered and they are highly vulnerable to future disasters.

Figure 2: Natural Disaster from 1907–2005[21]

Percentage of people killed by disaster type

Drought 4%
Earthquake 10%
Epidemic 2%
Flood 2%
Volcano 8%
Wave / Surge 74%

Percentage of people affected by disaster type

Wild Fires 17%
Wave / Surge 3%
Volcano 5%
Slides 2%
Drought 27%
Earthquake 11%
Epidemic 4%
Flood 31%

19 Government of Indonesia/UNDP, Country Programme Action Plan 2006–2010.

20 Center For Hazards and Risk Research at Columbia University, 2005.

21 Information provided by "ISDR Hazards."

22 National Action Plan for Disaster Reduction 2006–2009.

Box 3: The Indian Ocean Tsunami Disaster in Indonesia[23]

On 26 December 2004, an earthquake measuring 9.1–9.3 on the Richter scale[24] occurred 150 miles off the coast of Sumatra. The tsunami generated struck Aceh and North Sumatra at around 8am. The provincial capital, Banda Aceh, and the west coast were the worst affected. A total of 128,645 people were killed and 37,063 are missing and presumed dead. More than 400,000 people were displaced and 750,000 suffered a partial or total loss of their livelihoods. The social and economic costs are substantial and difficult to estimate. Government capacity was severely affected – approximately half of the civil service members in Aceh were casualties or left the area.

Most tsunami survivors describe feeling the massive earthquake and then running to higher ground. The water swept inland as far as 4 kilometres in some areas and scoured the hillsides. Many could not reach the safety of the hills in the 20–45 minutes that transpired between the earthquake and the tsunami landfall. Most inhabitants were unprepared for such a disaster and lacked evacuation plans and routes. Some wasted time securing personal belongings. People describe being swept away in the water, struggling to swim or holding on to trees, and many felt their survival was simply fateful. Many deaths in Banda Aceh and larger towns such as Meulaboh and Calang occurred from impact of debris from demolished houses and other objects.

The impact of the disaster was not fully realized by people in Jakarta for nearly 24 hours. Staff of World Vision's National Office and United Nations Children's Fund (UNICEF) heard about the devastation first on the British Broadcasting Corporation (BBC) or the Cable News Network (CNN) rather than through local media. Many NGOs first sent their response teams to Sri Lanka believing that the impact on Indonesia was less critical. As the government began to issue reports, the severity was comprehended. The current GoI had been in office for only two months at the time of the disaster. The Coordinating Ministry for People's Welfare had a standing Council of Disasters, and its Secretariat, BAKORNAS, took immediate control of the situation. A second earthquake occurred along the same fault on 28 March 2007 of 8.7 magnitude and caused a smaller tsunami (4 metres) that affected fewer areas but caused significant damage on Simeuleu Island and on Nias Island.

Droughts. Droughts generally occur during the dry season, impact the country's power supply and destroy crops. Droughts also promote the spreading of tropical diseases, such as malaria and dengue fever. High incidences of malnutrition indicate that some communities and groups are very vulnerable to food shortages due to drought. Annual variations in Indonesia's climate are largely determined by the El Niño Southern Oscillation (ENSO) system.[25] The frequency and duration of droughts in Indonesia is likely to increase with global warming.

Volcanic Activity. Volcanic eruptions are an important cause of human and environmental losses; active volcanoes in Indonesia, totaling 129, represent 15 percent of all active volcanoes in the world.[26] Between 1972 and 1991, 29 volcanic eruptions were recorded in the country, mostly on Java. Since May 2006, for example, a mud volcano has been emitting 'hot mud' in the East Java Province resulting in hundreds of displaced persons. An active volcano, Mt. Merapi, emitted smoke in April 2006 and lava flows necessitated the evacuation of 20,000 people in May.

Forest Fires. The effects of forest fires increasingly threaten humans and the environment. The 1997–1998 forest fires were among the most destructive and damaged 9.8 million hectares of forests, of which 5.2 million hectares were located in East Kalimantan, where the ground is largely composed of peat. In 2001, assessments indicated that affected communities were still recovering from the fires.[27] Enduring fires have intensified in recent years because of conflicts, lack of law enforcement, and poor natural resource

---

23 Compiled from CARE and World Vision, *Multi-agency Evaluation of Tsunami Response: Thailand and Indonesia*, August 2005; and UNICEF, *Evaluation of UNICEF Tsunami Response: Indonesia*, 2006.

24 The magnitude of the earthquake was originally recorded as 9.0 on the Richter scale, but has been upgraded to between 9.1 and 9.3. At this magnitude, it is the second largest earthquake ever recorded on a seismograph and is reported to be the longest duration of faulting ever observed, lasting between 500 and 600 seconds (8.3 to 10 minutes) (Source: Wikipedia).

25 The ENSO is warming of surface water off the coast of Central and South America, near Ecuador, Peru and sometimes Chile and has a warm phase (El Niño) and cold phase (La Niña). The ENSO changes the ocean-atmosphere system affecting weather in approximately 75 percent of the earth.

26 Center of Volcanology and Geological Hazard Mitigation, Ministry of Energy and Mineral Resources.

27 Johan Kieft and Aspian Nur, *Community-based disaster management: A response to increased risks to disaster with emphasis on forest fires*, CARE Indonesia, 2001.

management. According to the World Bank[28] almost all of the burning is related to human activities, such as clearing land for agriculture. The spread of the fire and the smoke and haze was aggravated by drying effects of the ENSO. The World Bank estimated that only 1 percent of fires are due to natural causes. Choking pollution from fires in Indonesia sometimes spreads as far as Australia, China and India, while the fires release massive amounts of carbon dioxide.

In addition to fires, Indonesia is vulnerable to many other **human-made hazards**. The country's vulnerability to conflict is exacerbated by gaping economic disparities, high unemployment, ethnic and religious tensions, and low levels of education. Indonesia continues to face a low intensity separatist guerilla movement in Papua. There have been terrorist attacks, some in Bali aimed at tourists. While the incidence of violent conflict has declined markedly over the last five years, past conflicts have had a significant impact on human development in affected areas, affecting women disproportionately.[29] The GoI no longer issues a comprehensive figure on internal displacement but an update in mid-2006[30] suggests that the number of internally displaced persons could range from 150,000 to 250,000.

The country suffers from deforestation, water pollution from industrial wastes and sewage, and air pollution in urban areas. Transportation accidents have had a significant impact. Communicable diseases continue to be a major cause of morbidity and mortality. Tuberculosis claims 175,000 lives a year, and malaria and dengue fever occur yearly in epidemic proportions.[31] Indonesia is waging an uneven battle against the highly pathogenic H5N1 avian influenza (HPAI); out of 81 cases there have been 63 deaths (as of May, 2007).[32]

Indonesia is party to the following international conventions and instruments: Biodiversity, Climate Change, Climate Change-Kyoto Protocol, Desertification, Endangered Species, Hazardous Wastes, Law of the Sea, Marine Life Conservation, Ozone Layer Protection, Ship Pollution, Tropical Timber 83, Tropical Timber 94, and Wetlands. Indonesia's use of natural resources remains unsustainable in many parts of the country.

---

28 World Bank, *Indonesia: Environment and natural resource management in a time of transition*, 2001.

29 For example, the Progress Report on the MDGs (2004) shows that the share of women in wage employment in the non-agricultural sector in the conflict-afflicted North Maluku Province, accounting for 19.8 percent, is significantly lower than the national average of 28.3 percent.

30 Internal Displacement Monitoring Center's breakdown by province using a variety of sources – Aceh: 30,000–150,000 (including North Sumatra); Papua: at least 1,200; West Timor: 10,000–40,000; Central Sulawesi: 15,000; North Maluku: 15,000; Maluku: 35,000; Central Kalimantan: 50,000–100,000.

31 WHO website.

32 International Society for Infectious Diseases website, ProMed mail, 7 May 2007.

3.4 National DRR Institutions

Brief descriptions of key government organizations relevant to EWS and DRR are given below with more analysis of institutional capacity for EWS following in the remaining sections of this report. Key actors work in approximately 15 ministries.

Under the provisions of the Law on Disaster Management, **BNPB**, the National Disaster Management Agency, was established on 26 January 2008 to provide leadership in comprehensive DRR. BNPB is the reformed BAKORNAS PB (National Coordinating Agency for Disaster Management); while BAKORNAS PB was a non-structured (ad-hoc) agency, BNPB is a permanent and structured organization with direct control of its funding. BNPB is led by a ministerial-level Chief, and supported by the Executive Body (for operational tasks) and a steering committee consisting of government officials from 10 ministries and professionals from various development sectors. BNPB has four divisions: 1) prevention and preparedness; 2) emergency response; 3) rehabilitation and reconstruction; and 4) logistics and equipment. These four divisions are coordinated by Deputy Directors, and early warning is a sub-division under the prevention and preparedness division. BNPB is also the focal point for establishing a National Platform for DRR that is in line with the Hyogo Framework for Action. At the provincial and district/municipality level, the establishment of local disaster management agencies will soon be underway once the *Guidelines for the Establishment of Local Disaster Management Agency* are released.

The main functions of **BAPPENAS**, the National Development Planning Board, are set out in the Presidential Decree No.138 of 1999. These include macro-economic development, infrastructure development including tourism, human and natural resource development, budget control, the development of the five pillars (law, information, politics, defence and security, and state administration), capacity development through the Center for Building the Training and Education of Development Planning, and a data and information library. BAPPENAS prepares the national development programme and houses the National Spatial Planning Coordinating Agency (BKTRN). Together with BAKOSURTANAL, BAPPENAS has assumed a lead role in coordinating the preparation of damage and loss assessments and post-disaster recovery strategic action plans. BAPPENAS has established a Coordination Team for planning and disaster management under the BAPPENAS Ministerial Decree No. 18 of 2007. At the provincial and city levels, the Regional Development Planning Board (BAPPEDA) is in charge of development planning and its decision-making power supersedes that of BAPPENAS. BAPPENAS has allocated funds from the national budget for relevant agencies to integrate DRR into development planning.

BAKOSURTANAL is the National Coordinating Board for Survey and Charting Development, first established in 1969 and then renewed in 1998 by Presidential Decree No. 87. BAKOSURTANAL assists the President in the development, management, maintenance and coordination of surveys and mapping, and also the maintenance of the national geographic data and information. BAKOSURTANAL collects and stores data for surveys and mapping such as terrestrial photos, high resolution satellite imagery, maps and geographical names. The agency is remapping Aceh after the tsunami disaster changed its landscape to support evacuation, rehabilitation and reconstruction. BAKOSURTANAL is also accessing disaster assessment and geospatial information derived from remote sensing data for Aceh rehabilitation and reconstruction activities to support the Indonesia Tsunami Early Warning System (InaTEWS).

BMKG, the Meteorological, Climatological and Geophysical Agency, is a non-departmental government agency. Formerly the Meteorological and Geophysical Agency (BMG), it was first established as a formal government institution in 1866 by the Dutch East Indies government. A Presidential Decree No. 61 was issued on 2 September 2008, adding to the agency the climatology function and changing its name to BMKG. BMKG has been designated the focal agency for monitoring, analysing and disseminating tsunami early warning. BMKG hosts InaTEWS and operates 116 units of broadband seismographs, 90 units of tide gauges and 2 units of the Deep-Ocean Assessment and Reporting of Tsunamis (DART)[33] buoys for seismic observation and monitoring.[34] In addition, there is the Indonesian Database of Pre-calculated Tsunami Models, Decision Support System and Information Dissemination System that allow BMKG to issue warning in less than 5 minutes. In addition, in 2009, BMKG will be considered as a Regional Tsunami Watch Provider (RTWP) to support other RTWPs of the Indian Ocean in providing data and information related to tsunamis.

BRR, the Aceh-Nias Rehabilitation and Reconstruction Agency, was a temporary government agency established on 16 April 2005 by Presidential Decree No. 2 of 2005 with a four-year mandate to coordinate all post-tsunami rehabilitation and reconstruction efforts in Aceh and Nias. BRR officially closed on 16 April 2009. Over the four years, BRR implemented over 5,000 reconstruction projects, coordinated more than 12,500 other projects involving over 60 bilateral donors and multilateral agencies, as well

as around 700 NGOs. BRR was given full authority to manage all aspects of the tsunami recovery in Aceh and Nias on behalf of the central government, which allowed for a much smoother coordination process, devoid of any potential inter-ministry politics and bureaucracy. Significantly, BRR Headquarters was located in the capital of Aceh, and not in Jakarta, a model that worked extremely well and ought to be considered as a model for other complex disaster contexts.[35] Under the management of BRR, significant resources were allocated by all involved actors to address recovery in Aceh and Nias, but most resources were devoted to reconstruction and little interest was shown in DRR or EWS. Only in Nias were there some DRR programmes. UNDP worked with BRR to produce a policy statement that included DRR. The Presidential Decree to end the four-year term of BRR stipulates that state ministries and local authorities in Aceh and Nias will oversee the ongoing reconstruction projects started by BRR, and a new reconstruction agency for Aceh and Nias will be established and led by the Aceh and North Sumatra governors.[36] This presents a good opportunity to incorporate DRR and EWS in strategies and plans for the new agency.

BPPT, the Agency for the Assessment and Application of Technology, is a non-departmental government agency reporting to the Ministry of Research and Technology. About 2,000 people work at BPPT, of which nearly 600 are researchers on science and technology. BPPT focuses on assessing and formulating national policies in the field of technology assessment and its application; monitoring, developing and providing services to government bodies and private sectors in the field of science and technology; promoting and diffusing innovation and technology transfer; and capacity development.

DESDM, the Ministry of Energy and Mineral Resources, is in charge of managing Indonesia's oil reserves and has done considerable work in searching for alternative sustainable energy resources. DESDM houses the Directorate of Volcanology and Geological Hazard Mitigation (DVGHM) and the Center of Volcanology and Geological Hazard Mitigation (CVGHM) that monitor seismic activity and Indonesia's 129 volcanoes. CVGHM is a government institution offering services on a complete range of telemetry of various parameters, GIS and image processing, remote sensing, geology, geodetic, geothermal exploration, geophysical data acquisition, hazard and environmental assessment, and interpretive technologies and techniques.

DKP, the Ministry of Marine Affairs and Fisheries, manages the marine research in Indonesia. In 2001 the government

---

33 The DART system monitors seismic activity on the seafloor, sending signals to a buoy floating on the surface. The buoy then uses satellite communication to pass on the information to tsunami warning centres around the Indian Ocean. In the event of an earthquake it is designed to detect whether a tsunami will occur and pinpoint its height, location and when it will make landfall. Indonesia reported its plans (at ICG/IOTWS-IV in 2007) to develop an Indonesian tsunameter drawing on existing surface buoy components, and using technology transfer to be delivered under a pending agreement with the USA.

34 BMKG, *Press Release InaTEWS*, 11 November 2008.

---

35 Tsunami Global Lessons Learned Project, *The Tsunami Legacy: Innovations, Breakthroughs and Change*, 2009.

36 Erwida Maulia, "New body to continue Aceh projects," *The Jakarta Post*, 14 February 2009.

created the Agency for Marine and Fisheries Research (BRKP) under DKP that provides research support and scientific input to the management and development of the marine and fisheries sector, and also in harmonizing marine and fisheries policy. DKP works in close collaboration with the provincial Fisheries Department and with the district Fisheries Bureau to rehabilitate fisheries, one of the major sources of livelihood in the tsunami affected coastal areas.

KOMINFO, the Ministry of Communication and Information, has authority over all mass media and telecommunications providers, so its role is very important for warning dissemination through television, news media, radio, etc.; and for promoting public awareness on disasters through public dialogue and interaction to enhance overall preparedness. KOMINFO works through provincial and regional offices for information and communication, under the Governors, Mayors and Bupatis. KOMINFO also issues and regulates licenses for the media that are independent from government (television stations formerly controlled by government are now privately owned).

LAPAN, the National Institute of Aeronautics and Space established in 1964, undertakes research and development in: remote sensing technology and application; atmosphere, climate and space sciences; and aerospace technology, as well as assessment and development of aerospace policies and programmes. LAPAN has offices and space centres spread around the archipelago, and since 2003, has been developing a micro-satellite system with remote sensing technology to prepare geospatial maps that can be used to identify evacuation routes in communities vulnerable to earthquakes and tsunamis. The technology also facilitates the mapping of fire affected areas, flood susceptibility, cyclone tracking and rainfall, and El Niño prediction. LAPAN produces a regular bulletin with the World Food Programme (WFP) called the *Early Warning Bulletin on Natural Hazards*. LAPAN's ground station in Pare-pare, South Sulawesi, records data from earth observation satellite such as Landsat, Spot, ERS-1, and JERS-1. The ground stations in Pekayon, Jakarta and Biak record and process data from the National Oceanic and Atmospheric Administration (NOAA) weather satellite 24 times a day.

LIPI, the Indonesian Institute of Sciences founded in 1986, is a non-departmental institution that reports directly to the President. LIPI consists of 47 research centres in the country working in various areas in the social and natural sciences. LIPI's role in DRR focuses on community preparedness and public awareness, and carries out this work with funds from its own network. LIPI has conducted several activities to inform the local government and the community of earthquake and tsunami risks. The institute is also responsible for conducting geo-science research, including studies on the nature of tsunamis.

RISTEK, the State Ministry of Research and Technology established in 1962, has the responsibility to assist the President in formulating national policies and coordinating research in science and technology. RISTEK focuses on six areas – food and agriculture, sustainable energy, transportation, information and communication technology (ICT), pharmaceutical products, and defence technology. RISTEK has the overall mandate to coordinate the development of InaTEWS in association with line agencies, such as BMKG and LIPI.

The **Institute of Technology Bandung (ITB) Centre for Disaster Mitigation (PMB)** was established in 2003 in order to respond to the country's need to reduce disaster impact through sustainable research and development activities. Its programme includes risk assessment, development of DRR technology, policy studies, dissemination of disaster risk information and public awareness campaigns, and advocacy for DRR. Additionally, ITB is responsible for developing a tsunami database to be installed at the Situation Center in BMKG. The establishment of the centre is supported by the institute's track record on DRR research for over twenty years. As a university, ITB is also responsible for the preparation and enhancement of human resources.

Other important actors in the DRR system include **DEPDAGRI** (Ministry of Home Affairs) that coordinates local governments, and programmes for public education, public awareness and preparedness. **DEPLU** (Ministry of Foreign Affairs) is responsible for all foreign affairs and diplomacy. Other actors include **KLH** (Ministry of Environment), **DEPKES** (Ministry of Health) and **MENKO KESRA** (Coordinating Ministry for People's Welfare).

Indonesia's disaster response system has been shaped by the former strong influence of the military. Both the military and police are members of BNPB. The **Indonesia National Defence Force (TNI)** totals approximately 350,000 members, including the army, navy, marines and air force. The army is the largest branch with about 280,000 active-duty personnel. Defence spending in the national budget accounts for 1.8 percent of GDP, but is supplemented by revenue from many military businesses and foundations. Over 40,000 members of TNI responded to the 2004 tsunami disaster in Aceh and Sumatra, and their resources were critical to search and rescue and clean-up operations. TNI benefits from joint trainings and drills with the armed forces of Australia, Malaysia and Singapore, and bilateral agreements are in place for shared military assistance in disasters.

The **Indonesian National Police (POLRI)** were a branch of the armed forces for many years until they were formally separated in April 1999, a process that was completed in July 2000. With only 250,000 personnel the police represent a much smaller portion of the population than in most nations.

3.5 National Disaster Management Legislation

Indonesia has been developing the legal basis for its disaster management system for decades.[37] Various actors cite numerous laws and decrees in relation to DRR, in fact, at least 120 different pieces of legislation are thought to be important. The Constitution of Indonesia (1945) stresses the role of the government in protecting lives and livelihoods. The Presidential Decree No. 54 of 1961 was a forerunner of disaster management legislation in the region and was followed by the establishment of an Advisory Board for Natural Disaster Management in 1966 that focused primarily on response.

In 1979 the Presidential Decree No. 28 established BAKORNAS PB. Several subsequent decrees expanded the definitions and scope of activities associated with disaster management to include human-made disasters, environmental disasters and industrial accidents. The identity of BAKORNAS PB as a non-structural body to work out, coordinate, guide, monitor and standardize the national approach for disaster management was solidified under the Decentralization Laws No. 22 (1999) and No. 25 (2001), and the Presidential Decrees No. 3 and No. 111 of 2001. These 2001 decrees extended the BAKORNAS PB's roles to include complex emergencies and situations involving internally displaced people. Following the 2004 tsunami, the Presidential Decree No. 83 of 2005 adjusted the duties, functions, membership and organizational structure of BAKORNAS PB.

At the end of March 2007 after a lengthy process of consultation and review, the Parliament passed the long-awaited Disaster Management Bill, and BNPB was established, replacing BAKORNAS PB, to provide leadership in comprehensive DRR, including emergency response, both through routine sectoral programmes and specially earmarked funds in national, provincial and district budgets.

To many people, the passage of law symbolizes a new policy environment that will reduce the need for ad hoc presidential decrees. The law is based on the premise that protection from hazards is part of the basic rights of the population, and confirms the role of government as the duty bearer to ensure such protection. The provisions also highlight the need for integration of DRR into national development programming, and the allocation of sufficient funds for that purpose. The law covers natural and human-made disasters including social conflict, technological, modernization, epidemics and outbreaks. When a state of disaster is declared, BNPB

will exercise special authority to lead and coordinate the response, including undertaking early recovery, leading to rehabilitation and reconstruction. The head of the new agency will be a cabinet member.

A National Action Plan for Disaster Reduction 2006–2009 cooperatively produced by BAPPENAS and BAKORNAS PB in January 2007 supplements the Medium Term Development Plan 2005–2009. The latter plan was formulated after the elections and reflects the agenda of the President. It promotes a greater focus on policy and institution building, and on social and political agendas with an emphasis on the role of civil society. The Action Plan has been socialized in Jakarta, Makassar, Medan and Yogyakarta by engaging various stakeholders including academics and the civil society.

As described in the Annual Government Work plan for 2007 (passed into law as Decree No. 19 of 2006) and 2008 (Decree No. 18 of 2007), disaster mitigation and management is now a main priority for national development. The work plan supports the Hyogo Framework for Action 2005–2015 as well as its follow-up in the Beijing Action Plan for Asia, and confirms the paradigm shift from emergency response to preventive measures.

3.6 Regional DRR Cooperation

Indonesia's foreign policy includes support for the Association of Southeast Asian Nations (ASEAN) in the interest of regional stability and it has developed increasingly close ties with other ASEAN members – Brunei Darussalam, Cambodia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam – whose foreign and economic ministers hold annual meetings. Some of these relationships are pivotal to sharing early warning data with neighbours vulnerable to similar disasters. Regional cooperation is progressing in economic, trade, banking, political and cultural matters.

Indonesia is party to the ASEAN Agreement on Disaster Management and Emergency Response (AADMER) signed in July 2005. The aim of the agreement is to provide effective mechanisms for joint response and it sets out the principles for cooperation as well as for disaster risk identification, preparedness (including early warning information systems), assessment and monitoring, response, rehabilitation, and research. The ASEAN experienced a number of challenges in the development of AADMER notably the different perspectives on legal issues, terminology and definitions among the countries. While the agreement has not yet entered into force, it was tested in the wake of the Yogyakarta earthquake and efforts are ongoing to operationalize the components of the agreement. ASEAN members set out a strategy for disaster capacity development in December 2006.

---

37 Draws on IFRC International Disaster Response Law Study, *Indonesia – Laws, Policies, Planning and Practices on International Disaster Response*, July 2005; and USAID/Asia, *US Indian Ocean Tsunami Warning System Program: Review of Policies and Institutional Capacity for Early Warning and Disaster Management in Indonesia*, January 2007.

The ASEAN Agreement on Transboundary Haze Pollution lacks enforceable mandatory provisions; however, it is a useful vehicle for international pressure and regional cooperation to eliminate trans-boundary pollution.[38] A 2006 study explores initiatives in Indonesia, Malaysia and Singapore to eliminate trans-boundary haze in South-East Asia and the fires in Indonesia that are its major cause. It outlines reforms and technical programmes to improve fire management and reduce smoke pollution, and examines the scope for cooperation and conflict among the relevant parties. The study analyses how changing administrative structures affect success of fire management and pollution control programmes, and explains how developing effective fire management in Indonesia necessary to eliminate trans-boundary haze will depend on a combination of political will, legal reform and administrative coordination. Indonesia has not yet ratified the agreement.[39]

3.6.1 Multi-donor Voluntary Trust Fund on Tsunami Early Warning Arrangements in the Indian Ocean and South-East Asia

The United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) set up a regional Trust Fund in late 2005 to build and enhance tsunami early warning capabilities. The Fund is demand-driven and supports projects led by governments, inter-governmental and non-governmental organizations in their areas of priority. As of the end of 2008, the Fund had conducted five rounds of funding and received 51 proposals from various regional, subregional and national organizations. Eleven projects had been approved, one of which is to be implemented by GoI and UNDP Indonesia.

---

38 Alan Khee-Jin Tan, *The ASEAN Agreement on Transboundary Haze Pollution: Prospects for Compliance and Effectiveness in Post-Suharto Indonesia*, October 2005.

39 Judith Mayer, "Transboundary Perspectives in Managing Indonesia's Fires," *Journal of Environment and Development*, Vol. 15, No. 2, 2006.

The GoI has demonstrated its commitment to the development of an integrated EWS to protect inhabitants and the 5 million tourists (2005 estimate) who visit each year. Financial and social impact analyses[40] of the effects of the tsunami disaster illustrated the need for EWS to protect lives and assets. Disasters in 2005–2007 have resulted in deaths of more than 300,000 people, and damages and losses of approximately $9.2 billion.[41] The earthquake and tsunami events in 2006 in Yogyakarta and Central Java and the floods in NAD in December 2006 and in Jakarta in January 2007 have re-emphasized the need for people-centred EWS. Attention has also been brought to the fact that liabilities may result from failure to establish or properly utilize EWS, in terms of responsibility to warn tourists and other countries when a potentially disastrous event is forecasted.[42]

Several issues have been identified that will affect the functioning of the EWS. These are:

- Numerous relevant laws and regulations, plans and activities that are not united in a policy framework, and lack of a specific policy for EWS

- Overlap and duplication of roles and resources among actors

- Unclear roles and responsibilities in DRR and EWS

- Legal and structural focus on emergency response without sufficient attention to preventive measures

- The insufficient inclusion of DRR and EWS in development planning

4.1 Legal and Policy Frameworks to Support Early Warning

Several pieces of legislation form the foundation for EWS, however, the EWS does not figure prominently or proportionate to its significance in legislation and policy. The Decision III of 2000 of the People's Consultative Assembly vests power with the Supreme Court and other authorities to make regulations or decisions to implement existing

legislation. Under Decision III, a Minister has the authority to issue a Ministerial Decision to implement an Act or government regulation but the ministerial decision must be ordered by a higher legislation. The legislation hierarchy in Indonesia is stated in regulation No.10 of 2004 as follows:[43]

1. 1945 Constitution

2. Law/Government Regulation

3. Governmental Regulation

4. Presidential Regulation or by an institution that is equivalent to the Presidential level, e.g. Head of Supreme Audit Agency, Great Council Regulation, Ministerial Regulation, Judicial Regulation, and Constitutional Council Regulations, as long as it is clearly ordered or delegated by the higher level legislation

5. Regional Regulation

6. Governor Regulation

7. County Regulation

8. Regulation of Head of County

9. Village Regulation

The Constitution of Indonesia (1945) stresses the importance of protecting lives and livelihoods and indicates that the "President shall declare a state of danger." The Presidential Decree No. 83 of 2005 that adjusted the duties, functions, membership and organizational structure of BAKORNAS PB, mentions disaster preparedness but does not elaborate on early warning as a specific responsibility of the organization.

A Ministerial Decree of September 2006 set out the institutional arrangements for InaTEWS, designating RISTEK as the coordinating focal point with accountability to MENKO KESRA. The related Decrees of MENKO KESRA ensures that resources and supporting mechanisms are available for implementation of InaTEWS. The State Minister acts as chair to the InaTEWS Team Steering Committee with three deputies assigned: 1) Head of BMKG, 2) Deputy for Social

---

40   IOC/UNESCO.

41   UNDP Indonesia website.

42   Customary international law includes the duty to alert another nation of an identified threat. William C. Nicholson, *Legal Issues: Warning Systems, in Early Warning Systems – A Public Risk Institute Symposium*, 2005, pages 1 and 2.

43   Not all legal experts agree on the hierarchy and several examples are mentioned in Anthony D. M. Sihaan, *Legal Framework for Disaster Management Particularly in the Field of Early Warning*, GTZ, December 2006.

Welfare and 3) Deputy for Utilization and Dissemination of Science and Technology.

The Law on Disaster Management of March 2007 mentions EWS under the topic of preparedness. Of the 79 articles, some refer to risk assessment, monitoring and mitigation but few connections are made between these components and the readiness of the end-to-end people centred multi-hazard EWS.[44] The EWS will therefore require more elaboration and legal underpinnings to set out responsibilities. A critical feature of the law is the inclusion of community participation in disaster management (Article 26). Importantly, the law assigns roles to regional branches of BNPB and stresses the legal implications for parties who may contribute to disasters.

The law defines early warning as a "series of activities warning the public at a most immediate stage on possibility of disaster at specific location by authorized agency." Article 45 describes the following constituent components of preparedness: repairing and testing a disaster emergency mitigation plan; organizing, installing, and testing an EWS; provisioning and preparing supplies to meet basic needs; organizing, assisting in, training, and performing drills of emergency response mechanism; preparing evacuation sites; preparing accurate data, information, and updating SOP for emergency response; and provisioning and preparing material, goods, and equipment to fulfil recovery of infrastructure and facilities.

In Article 46, the purpose of early warning is described as rapid and targeted action to reduce disaster risk and to prepare for emergency response. Early warning involves: a) observing disaster indication; b) analysing observation results; c) decision-making by authorized party; d) disseminating information on disaster warning; and, e) action taken by the public.

The German Technical Cooperation Agency (GTZ) undertook a comprehensive study of national legislation as well as a review of the draft Law on Disaster Management to determine whether existing legislation formed the needed support for InaTEWS.[45] The report notes that the definitions for EWS in the legislation do not match UN definitions for the end-to-end system and do not include or are not sufficiently interrelated with the five key components: governance and institutional arrangements, risk knowledge, monitoring and warning, dissemination and communication, and response. Roles and relationships are not clearly defined in regard to, for example, delivery of information and the role of the

community in taking immediate action. The Law on Disaster Management does not systematically formulate provisions for the EWS. The report recommends the development of regional level regulations for the EWS, an activity that is legal under Law No. 32 of 2004.

4.2 EWS in National Planning

The **National Action Plan for Disaster Reduction 2006–2009** offers a broad picture of the institutional, legal, societal and technical requirements for an end-to-end multi-hazard EWS. It mentions EWS among the five key priorities that must be addressed:

1. Ensure that DRR is a national and a local priority with a strong institutional basis for implementation;

2. Identify, assess and monitor disaster risks and **enhance early warning**;

3. Use knowledge, innovation and education to build a culture of safety and resilience at all levels;

4. Reduce underlying risk factors; and

5. Strengthen disaster preparedness for effective response at all levels.

The lengthy annexes to the Action Plan list ongoing and future activities along with the involved organizations and projected timeframes for completion of the activities. The Action Plan maps planned programmes of various stakeholders for the purposes of coordination but does not analyse whether the projects and activities mentioned cover the needs. It is also unclear as to what degree progress has been made as per the projected timeframe. Thus, the Action Plan stops short of being a dynamic tool to match needs with coverage and bring gaps to the attention of stakeholders. Key elements support prioritization of the following general activities:

- Developing EWS that are people-centred, in particular systems that produce timely warnings understandable to those at risk

- Establishing, periodically reviewing and maintaining information systems as part of EWS

- Establishing institutional capacities to ensure that EWS are well integrated into governmental policy and decision-making processes

- Strengthening of coordination and cooperation among all relevant sectors and actors in the early warning chain in order to achieve fully effective EWS

- Creating and strengthening effective EWS on smaller islands

Following the 2004 tsunami, some regional and local governments sought a comprehensive approach to

---

44 The objective of people-centred early warning systems is to empower individuals and communities threatened by hazards to act in sufficient time and in an appropriate manner so as to reduce the possibility of personal injury, loss of life and damage to property and the environment, and loss of livelihoods.

45 Anthony D. M. Sihaan, *Legal Framework for Disaster Management Particularly in the Field of Early Warning*, GTZ, December 2006.

DRR, and some have used the Action Plan as a basis for the development of local plans. For example, Padang has strengthened the Provincial Coordinating Unit for Disaster Management (SATKORLAK PB) and prepared SOP for disaster response. Few provincial governments, with the exception of Central Java and Jakarta, have expanded the concept of disaster management to include preventive measures. Recent workshops to develop SOP in Bali, West Sumatra and NAD (see more details below) have made progress with tsunami and hazard warning SOP involving district actors.

The extent to which EWS will be capacitated through development and recovery strategies remains to be seen. BAPPENAS has included DRR as one of the nine priority areas in the national budget, however, sectoral contributions to EWS are undefined. The Country Programme Action Plan (CPAP) is a five-year plan that outlines how respective UN agencies and the GoI will work together in achieving Indonesia's medium-term development priorities. The Mainstreaming Disaster Risk Reduction into Development (MDRRD) Programme is one of five focus areas in UNDP's CPAP and the number of early warning projects is used as an indicator but how these will be implemented and with what effect on the end-to-end EWS is unclear.

Overall, the laws and plans focus more on action for response rather than preventive measures through EWS and, as it is, response remains somewhat reflexive in most districts. Although the trend toward decentralization offers an opportunity to strengthen EWS closer to communities, the shift of power from the central government to the regions has not been completely followed-up by the transfer of responsibility for the provision of services and protection to the people. The devolution of tasks, authorities and resources for managing disasters should serve to make the systems more relevant to the local situation, but in some cases, decentralization was used as a means to transfer resources rather than highlight disaster management responsibilities. Consequently when action was required, local authorities and central government both saw the responsibility resting with the other party. The situation became even more complex when disaster occurred in more than one locale. The weak coordination between different government agencies ultimately hindered the implementation of an effective response.[46]

The EWS requires a more prominent position in an overall DRR policy, which has not yet been developed. A policy section on EWS would serve to allay the confusion caused by the numerous laws and regulations, various plans and disparate DRR activities, unifying them into a cohesive approach. The section would need to set out clear roles and responsibilities to enhance public acceptance of authority for EWS, connecting and differentiating roles for tsunamis and other hazards.

4.3 Roles and Responsibilities of Actors in the EWS

The passing of the Law on Disaster Management represents a significant step forward in promoting effective EWS; however, many challenges remain with its implementation. The law must be underpinned with regulations that require drafting and approval. Significant time will be required to establish a new lead agency, and create and capacitate its provincial and district level equivalents. Substantial human and material resources will be needed to ensure that the provisions of the law are widely disseminated to responsible government officials and the general public. While these arrangements are put into place, EWS must still function and its capacity built. At this critical juncture, it is important that all actors coordinate to strengthen the EWS, and that the language and concepts of EWS are firmly positioned within the DRR dialogue.

Overlap and duplication of resources and programmes have been a subject of criticism in various evaluations of tsunami response. Meanwhile, in other areas of the country, resources are inadequate to prevent disasters. There are increasing but still scattered efforts to support communities resulting from the absence of a comprehensive policy framework and a systematic integrated plan for capacity development. A significant number of people in Indonesia are living outside of communications loops or may lack the resources to prepare themselves adequately. A combined and synchronized effort of the actors is therefore critical for supporting communities with the appropriate breadth and depth of preparedness activities and for warning them in a timely and effective manner.

4.3.1 Government and Administration Actors

As a step towards clarifying roles and responsibilities for an effective EWS, RISTEK and MENKO KESRA issued decrees that detail the roles and responsibilities of 20 institutions for InaTEWS (68/M/KP/V/2008 & SK No. 21/KEP/MENKO/KESRA/IX/2006). They include:

1. MENKO KESRA responsible for overall coordination and the legal aspects.

2. RISTEK for technology transfer, capacity development, and organization of tsunami drills and simulations, and related conferences, workshops and seminars.

3. BMKG for seismic monitoring, analysis and dissemination of tsunami warning.

---

46   MPBI, *A Briefing Paper on Legislative Reform*, 2005.

Figure 3: Institutional Roles and Responsibilities in the Indonesian EWS

Risk Knowledge

BAPPENAS, BNPB, BAKOSURTANAL, BPPT, BMKG, BPN, DEPAGRI, DEPDIKNAS, DKP, DEPKES, DESDM, KLH, ITB/PMB, KOMINFO, LAPAN, LIPI, Dept PU, RISTEK, Ministry of Forestry, Ministry of Culture and Tourism, TNI, Police, Media, Universities, NGOs, MPBI, WALHI, Indonesia Red Cross, Provincial/District Agencies

Monitoring and Warning System

BNPB, SATKORLAK, SATLAK, POSKO, BAKOSURTANAL, BPPT, BMKG, DEPDAGRI, DEPKES, Dept PU, DKP, DESDM, KLH, ITB, KOMINFO, LAPAN, LIPI, Ministry of Forestry, RISTEK, IAHRI, TNI, Police, Media, Universities, Provincial/District Agencies

Governance and Institutional Arrangements

Response Capacity

BNPB, DEPKES, DEPSOS, Dept PU, SATKORLAK, SATLAK, POSKO, BASARNAS, LIPI, TNI, Police, Provincial/District Agencies, Indonesia Red Cross, NGOs, Private Sector

Dissemination and Communication

BNPB, SATKORLAK, SATLAK, BAKOSURTANAL, BASARNAS, BPPT, BMKG, DEPDAGRI, DEPKOMINFO, DKP, DESM, KLH, ITB, KOMINFO, LAPAN, LIPI, RISTEK, TNI, President, Cabinet, Provincial/District Agencies, Police, Media, Mobile Services

4. LIPI for research and development of geosciences, and community awareness and preparedness.

5. KOMINFO for media relations and media campaigning on InaTEWS.

6. BAKOSURTANAL for installation and operation of tide gauges and global positioning system (GPS) networks so that near-real time data can be made available to BMKG for enhancing warning accuracy.

7. BPPT for deployment and operation of buoys (that transmit data back to the agency and to BMKG), oceanographic monitoring, and earthquake and tsunami run-up modelling.

8. BNPB for disseminating early warnings to public through crisis/emergency operation centres.

9. LAPAN for providing geospatial, remote sensing data to InaTEWS operational stakeholders.

10. ITB for developing the tsunami database that is installed at BMKG, and develop human resources needed to sustain InaTEWS.

11. DEPDAGRI coordinates local government, and programmes for public education, public awareness and preparedness are implemented through this ministry.

12. BAPPENAS for supporting RISTEK on coordination and human resource development, LIPI on research and development of geosciences, and MOHA on public education.

13. DESDM for supporting InaTEWS stakeholders in geological disaster management.

14. DKP for assisting InaTEWS stakeholders in all issues relevant to marine and coastal affairs.

15. DEPLU for assisting RISTEK in international stakeholder coordination.

16. KLH for providing RISTEK and InaTEWS stakeholders with relevant environmental information and planning.

17. DEPDIKNAS for assisting DEPDAGRI and InaTEWS stakeholders in public education, awareness and preparedness.

18. DEPBUDPAR for assisting InaTEWS stakeholder in issues related to (coastal) tourism, awareness and preparedness.

19. POLRI for network communication from headquarter to the regional police (Polda) as well as the resort police.

20. TNI for providing security to InaTEWS infrastructure.

On early warning in general, **BNPB's** roles include: 1) Providing policies and guidelines related to national multi-hazard DRR;[47] 2) Integrating warning systems from related institutions into the National Emergency Operations Centre; 3) Deciding on appropriate actions to take based on the

---

47 BNPB has published a number of guidelines related to: 1) standards for risk assessment; 2) risk analysis for major development projects/ infrastructure; 3) rehabilitation management; 4) flood management; 5) urban disaster mitigation policies; 6) disasters and internally displaced persons; and 7) foreign aid for emergency relief.

warning issued; 4) Disseminating early warning messages to the public through the provincial, district and municipal Emergency Operation Centres; and 4) Coordinating preparedness and emergency response activities. However, these roles are often not clear to outsiders, and additional human and technical capacity is required. The budget has been increased significantly but time will be required to put a new structure into place. The CEO will be supported by deputies in preparedness and mitigation, emergency response, and recovery and rehabilitation. However, it is not clear if, how and where authority for the EWS will be incorporated into these responsibilities.

The SATKORLAK PB and SATLAK PB (Regency or District Coordinating Unit for Disaster Management) may lack resources, authority, and technical capacity to coordinate activities of various sectoral ministries and they are generally not functioning 24/7, which has led to weak public confidence. Furthermore, the overlap of mandates among the sectoral agencies affects the functioning of the secretariat and complicates coordination.

BMKG hosts InaTEWS and is the focal agency for earthquake monitoring and tsunami early warning. It processes seismic and geophysical data and disseminates analysis. BMKG is developing its capacity for warning in many areas and it is working with a variety of partners that are providing technical and financial support including donor countries (China, France, Germany, Japan and USA), UN agencies (UNDP and UNESCO, etc.) and technical agencies (JMA, ICG/IOTWS, ITIC, JTIC, etc.). InaTEWS is also being developed in line with overall UN plans, strategies and standards of global and regional EWS i.e. IOC/UNESCO, ICGs and the Global Earth Observing System of Systems (GEOSS). However, BMKG lacks strategic plans for working with partners and using its own expertise effectively. BMKG also requires more dedicated human resources to support the National Operations Center that houses the seismic monitoring system.[48]

BAPPENAS is directing its efforts considerably toward incorporating DRR into development planning. Five new priority areas include accelerating Aceh reconstruction, accelerating rehabilitation and reconstruction of Yogyakarta, Pandarang and South Sulawesi, and capacity development of local government and community in preparedness and reduction of disaster risk through community empowerment. With these goals, BAPPENAS is well poised to incorporate the concepts of EWS in its work. BAPPENAS in partnership with BNPB, DEPDAGRI and UNDP is implementing the Safer Communities Through Disaster Risk Reduction (SC-

DRR) Programme,[49] and is in discussion with BMKG on developing a joint strategic framework and action plan for strengthening InaTEWS. BAPPENAS also expects to make special budgetary allocations for InaTEWS equipment, and promote the development of SOP for EWS at national and local levels.

4.3.2 Partners for EWS Outside Government and Administration

Community members constitute the critical audience for early warning and each one of them essentially requires his/her own personal and family plans for response to early warning messages. Community-based organizations and networks are important actors in strengthening the EWS. The Law on Disaster Management describes citizens' entitlement (Article 26) to participate in and be trained in disaster management. There are considerable regional disparities in terms of development – many provinces lag behind the national averages in income and education. Communities, especially in rural areas and remote islands, may lack basic information on local hazards and disaster preparedness and may live in exceptionally high risk areas. Considerable work is underway to reach vulnerable communities but it may be years before this is accomplished even in Aceh and Nias where a large number of recovery resources are concentrated. Countrywide resources devoted to supporting community preparedness are however small and insufficient compared to those dedicated to technical components of EWS and central planning. Geographical coverage is therefore inadequate and there is no agreed upon method for measuring community preparedness (although LIPI is working on developing a means of measurement).

The Law on Disaster Management sets out the role of **business organizations** as participants in disaster management. In Article 29, businesses are required to comply with disaster management organization policy, submit reports to the government, and practice transparency in providing information to the public, as well as support humanitarian activities economically. The private sector has significant resources to contribute, such as the communication networks and private radio operators for the dissemination of early warning messages. For example, a private telecommunications company sponsored the December 2006 evacuation drill in Bali and also provided siren towers.

The **media** in Indonesia grew considerably after the end of President Suharto's rule, during which the now-defunct Ministry of Information monitored and controlled domestic

---

48 Stuart Weinstein, David Oppenheimer and Harley Benz, *Mission #3: Assessment and recommendations*, PTWC and USGS, December 2006.

49 The SC-DRR Programme aims to promote the integration of DRR in development planning and support the implementation of the Law on Disaster Management and the National Action Plan for Disaster Risk Reduction 2006–2009. For more information on the programme, please visit http://sc-drr.org/.

media and restricted foreign media. The number of printed publications has increased significantly since 1998. There are hundreds of new magazines, newspapers and tabloids. The television market has expanded to include some 10 national commercial networks that compete with the public TV station. Some provinces also operate their own stations. Private radio stations carry their own news bulletins and foreign broadcasters can supply programmes. The radio dial is crowded, with scores of stations on the air in Jakarta alone. In 2003 the authorities reported that more than 2,000 illegal TV and radio stations were broadcasting across the country. The government urged them to apply for licenses or face closure. The current trends are digital multimedia and 'news on demand' from online news portal.[50] Some large newspapers also use digital printing to solve the distribution problems in remote areas in Indonesia.

BMKG has been collaborating with 11 private TV stations to disseminate tsunami early warning through running text and/or display 'headline news' for several minutes as well as activate sound warning signals. BMKG has prepared specific warning signals that media will use to warn the public, and media agencies have established SOP for disseminating these warning signals to the public. This mechanism is supported and regulated by the Department of Communication and Information (DEPKOMINFO).

Indonesia has an extensive network of international and national NGOs that have many resources to share for DRR and EWS. Following the tsunami, more than 400 organizations were operating in Aceh, most of them NGOs. There are hundreds of national NGOs in Indonesia – about 120 identified themselves in the 2004 tsunami response. There are also numerous national civil society coalitions including the: Coalition on Human Rights, Coalition on Civil Violence, Forum on the Environment/Indonesian Friends of the Earth (WALHI), National Alliance for Indigenous People and Aceh NGO Forum.

The **Indonesian Red Cross** (PMI) has 33 chapter offices and 379 district branches. PMI, with assistance from IFRC and the Red Cross and Red Crescent Movement, is developing capacity of its network of volunteers and communication systems to better support local level DRR activities. The Indonesian Society for Disaster Management (MPBI) facilitated civil society participation in development of the draft disaster management bill. MPBI is also playing an active role in the integration of disaster management in all government departments through BAPPENAS and with Oxfam GB and CARE.

4.3.3 UN, Donors and Regional Partners

The United Nations Technical Working Group for Disaster Risk Reduction (UNTWG-DRR) was formed in 2002 and revitalized in June 2005. The UNTWG-DRR works with the GoI in collaboration with donors, Red Cross and Crescent Societies, and NGOs to enhance the capacity of government institutions and communities in DRR. The Working Group consists of designated focal persons from FAO, OCHA, UNDP, UNESCO, UNFPA, UNHCR, UNICEF, WFP and WHO, is chaired by UNDP and meets once a month. Its objectives include producing a UN Disaster Risk Reduction Strategy based on the International Strategy for Disaster Reduction (Hyogo Framework of Action, etc.), contributing to the Consolidated Appeal Process and the United Nations Development Assistance Framework,[51] pursuing the MDGs, and collecting best practices from Indonesia and other countries or situations.

The UNTWG-DRR can be instrumental in promoting the objectives of EWS and is creating a foundation for DRR among its own organizations. A global review of UNDP's DRR programmes conducted in 2004[52] found that for UNDP, as well as for the governments it assists, DRR, particularly mitigation and preparedness, was considered lower priority and was not adequately recognized as intrinsic to the success and sustainability of development programmes. Based on recommendations from this review, DRR is being mainstreamed within its divisions and in its approach to working with other UN agencies.[53]

Support for EWS and DRR by regional programmes such as USAID's IOTWS, IOC/UNESCO, and UNDP's Regional Programme for Capacity Building, and by UN/ISDR, GTZ, ADPC and the Asian Disaster Reduction Center (ADRC), among others, have helped to promote progress by generating results such as action plans, assessments, guidelines, manuals, coaching and skill transfer. These activities have served to clarify government roles and capacity needs and build community preparedness. Donors, regional actors and NGOs, while not intending to work at cross purposes, often pursue similar objectives independently, thus limiting the potential of funds invested. The abundance of post-tsunami funding has increased competition to find channels for the use of resources including those dedicated to EWS. Some donors and NGOs acknowledge difficulties in developing their programmes due to cultural differences between

---

50 Wikepedia.

51 While making these cohesive with the Cluster Approach. Clusters in Indonesia are Health and Nutrition, Shelter and Camp Management, Water and Sanitation, Child Protection and Education, Information and Telecommunication, Logistics, Early Recovery, Food, and Agriculture.

52 UNDP, *A Global Review: UNDP Support for Institutional and Legislative Systems for Disaster Risk Management: Executive Summary*, 2004; See also the introduction to this series of UNDP ILS EWS reports listing the specific objectives of DRR that reflect principles of good governance.

53 UNDP Regional Disaster Risk Reduction Workshop, Bangkok, Thailand, June 2006.

foreigners and Indonesians and between various parts of the country. Often many meetings are required to allow actors to do the groundwork for the start of joint and realistic programmes.

Many of the larger international and regional actors remain centrally located and have few representatives in provinces and communities, particularly in the non-tsunami areas. As a consequence, understanding of EWS issues is fragmented. Cooperation is improving, particularly for workshops, as organizations see the benefits of joint information sharing with government and communities through multi-actor forums. An example is the series of workshops for the development of SOP, sponsored by UNDP, USAID/Asia, IFRC/PMI and GTZ. The workshops have taken place in Bali, Jakarta, Padang and Aceh and have involved local institutions such as the SATKORLAK PB and SATLAK PB, mayors, and the armed forces and police, among others. These workshops provide opportunities to discuss the roles of institutions and their responsibilities in detail.

4.4 Assessment and Enhancement of Institutional Capacities

Considerable work has been done by UNDP and other organizations to extract lessons from recent responses to disasters in Indonesia. Numerous evaluations, some multi-organizational, were conducted of tsunami response programmes in Aceh, Nias and Yogyakarta, and some are underway for recovery programmes. Many of these evaluations have been shared on the Tsunami Evaluation Coalition and Active Learning Network for Accountability and Performance websites. However, it is unclear how effective these evaluations will be in fine tuning programmes and contributing to enhanced preparedness for DRR and EWS.

The following post-tsunami assessments and studies on institutional capacity for DRR and EWS have been carried out:

- IOC/UNESCO multi-country assessment (including Indonesia) of the preparedness, assessment and warning capacity for tsunamis, published in 2005.

- USAID/Asia IOTWS *Review of Policies and Institutional Capacity for Early Warning and Disaster Management in Indonesia*, January 2007 that included 'Development Stage Indicators' for various components of disaster management.

- The United States Geological Survey (USGS) and PTWC running assessment of capacity to establish an operational seismic monitoring and tsunami warning centre focusing on BMKG capacity.

- The German–Indonesian Cooperation for Tsunami Early Warning System baseline study, *Capacity Building in Local Communities, Early Warning Experiences for Flood, Volcano and Forest Fire in Indonesia and Tsunami in the Pacific Region*, December 2006.

4.4.1 Coordination for Coverage of EWS Activities

A checklist developed by The Third International Conference on Early Warning sponsored by UN/ISDR and the German Government identified numerous components and processes that are critical for establishing a people-centred EWS (see checklist in Annex 3). This checklist was used to determine the state of EWS development in NAD. The participants at the Workshop for Developing SOP for TEWS for NAD Province (April 2007) found that most EWS activities had just been started or were ongoing with very few near completion or completed. The latter included tsunami hazard mapping and use of various kinds of communication media for warning dissemination.

In the Kota Padang, West Sumatra Workshop on Capacity Building for Development of Local SOP for TEWS (November 2006), participants expressed the need for a mechanism that clarifies the linkages between central and local actors, and a legal framework that clearly defines roles and responsibilities. The participants concluded that communities need access to existing hazard information, such as maps and models particularly at the district level, as well as a clear design and coordination mechanisms for the dissemination process between central and district levels, or alternatively a direct link from central BMKG to the local level. The participants defined a need for a National Training Center for Local Level Disaster Management. The discussion in the first SOP workshop held in Bali in October 2006 revealed that the districts are at very different stages of development of their SOP and that no standardized method for developing SOP had been formerly used.

The National Action Plan for Disaster Reduction 2006–2009 mentions the following activities as priorities in legislative and institutional development for DRR (the status of these activities is unclear and whether ongoing projects meet these needs remains to be seen):

- Setting up and strengthening an integrated DRR mechanism including drafting SOP and integrating DRR into good governance activities

- Integrating DRR into development policies and planning, including incorporating DRR into the Medium Term Plan, creating new national guidelines for DRR, and promoting training in DRR for executive and legislative branches at provincial, district, and municipal levels

- Adopting or modifying statutory regulations to support DRR including studying legal umbrellas for conflict

management and collecting information on insurance underwriting and calculating disaster risks

- Identifying local disaster risks and decentralizing DRR authority including regional DRR planning, promoting implementation based on disaster assessments and technical recommendations, and district, sub-district and village disaster risk mapping

- Conducting human resource capacity assessments including preparing national capacity development guidelines, preparing training programmes in various areas covering the design and management of participatory community-based DRR

- Allocating resources to implement policies and programmes

- Strengthening local DRR institutions including the SATKORLAKS PB and SATLAKS PB

- Promoting public participation in DRR by producing guidelines and training for community-based DRR and improving dissemination of DRR awareness materials

Summary of Main Points

1. The GoI has stated its commitment to the development of integrated multi-hazard EWS. Commitment was clearly demonstrated through the passing of the Law on Disaster Management.

2. Among the numerous laws underpinning DRR, several pieces of legislation form the foundation for EWS. Overall, however, the EWS does not figure prominently or proportionate to its significance in legislation and policy. Although RISTEK has been assigned as the focal point for InaTEWS, lead agencies for other hazards have not been determined.

3. The Law on Disaster Management mentions EWS under the topic of preparedness; further elaboration will be required to set out clear responsibilities. A critical feature of the law is the inclusion of community participation in disaster management (Article 26).

4. The National Action Plan for Disaster Reduction 2006–2009 offers a broad picture of the institutional, legal, societal and technical requirements for an end-to-end multi-hazard EWS. It mentions EWS among the five key priorities that must be addressed as well as activities to support EWS capacity development.

5. Most laws and plans focus greater attention on response, rather than on prevention and preparedness. Recent workshops to develop SOP have made progress with drafting tsunami and hazard warning SOP that involve district actors.

6. Resources are unevenly spread relative to vulnerability in the country and efforts to support communities are scattered. A number of changes need to be implemented, such as those underpinning the Disaster Management Law with regulations and disseminating the law. It is critical at this stage that all actors coordinate to strengthen the EWS.

7. Under the provisions of the Law on Disaster Management, a new BNPB was established, replacing BAKORNAS PB, to provide leadership in comprehensive DRR. BNPB is one of the key stakeholders of InaTEWS, particularly in disseminating early warnings to public through crisis/emergency operation centres. However, BNPB's roles are often not clear to outsiders as it is relatively new (established in 2008) and requires additional human and technical capacity.

8. BMKG bears a large responsibility for monitoring and dissemination and is developing its capacity with numerous partners, but lacks strategic plans and adequate human resources. LIPI's work is important to bridge the gaps between research and communities but its efforts are under-resourced and its expertise underutilized.

9. BAPPENAS is well poised to incorporate the concepts of EWS in its work. BAPPENAS is leading the SC-DRR Programme that aims to integrate DRR in national development planning, and is in discussion with BMKG on developing a joint strategic framework and action plan for strengthening InaTEWS.

10. Community members constitute the critical audience for early warning but resources devoted to supporting community preparedness are generally insufficient. The private sector and the media, which have expanded exponentially in recent years, have significant resources to contribute to EWS.

11. The extensive network of NGOs with resources for EWS includes national coalitions, the PMI and MPBI. The UN Technical Working Group for DRR can be instrumental in promoting the objectives of EWS among its members. Cooperation is improving such as for a recent series of local workshops for the development of SOP, sponsored by UNDP, USAID's IOTWS and GTZ.

12. Considerable work has been done to extract lessons from recent responses to disasters in Indonesia and several assessments have been conducted of institutional capacity for DRR and EWS. The participants at the Workshop for Developing SOP for TEWS for NAD Province (April 2007) found that most EWS activities had just been started or were ongoing with very few near completion or completed.

13. Some needs expressed by local EWS stakeholders in West Sumatra include clear descriptions of linkages between central and local actors and community access to hazard maps and models. The National Action Plan for Disaster

Reduction 2006–2009 mentions priorities for legislative and institutional development including conducting human resource capacity assessments and creating capacity development guidelines.

Recommendations for Stakeholders[54]

- Develop joint organizational efforts to promote the Law on Disaster Management while focusing on coordination, popular consultation, community participation, local DRR 'culture' development, socialization and commitment building.

- Develop comprehensive plans and guidelines to cover EWS in structural and operational detail. While plans are already extensive under InaTEWS, ensure that investments made upstream (technology for monitoring, detection, etc.) are sustainable through decrees and permanent resource allocation and increase focus on downstream plans and implementation (local government and last mile capacity).

- Agree on a prioritized plan for EWS capacity development that covers all major hazards and encompasses all member agencies of government, civil society and assistance providers. Develop a mechanism for assigning resources to cover the needed inputs.

  ◦ Within this plan concentrate material and human resources at the regional and district levels to provide support and coordination to key actors in the EWS including governors, Bupatis/Mayors, the local/regional parliament (DPRD) and the National Unity and Public Protection Bodies (BADAN KESBANGLINMAS) to reduce disparities and structural gaps.

  ◦ Share resources with and integrate early warning efforts of NGOs, media, the private sector, universities and community-based organizations.

---

54 These recommendations are a synthesis of those made by interviewees in the UNDP ILS EWS process as well as those mentioned in the National Workshop Report for Tsunami Early Warning Systems in Indonesia, jointly organized by RISTEK and UNDP in September 2007.

Risk Knowledge

The organizations responsible for DRR in Indonesia are putting considerable efforts into strengthening risk knowledge and disseminating this information through training and education. The 2004 tsunami drew global attention to vulnerability in the coastal areas and has resulted in heightened disaster risk awareness. However, the degree of sharing, integration and dissemination of data analysis and its application to EWS countrywide, at the community and at the regional level are unclear.

Major issues identified in risk knowledge for EWS include the following:

- National capacity requires strengthening for the systematic collection, sharing and assessment of hazard and vulnerability data, and for standardization with regional neighbours.

- Practical applications of risk knowledge require strengthening. It is unclear whether training and awareness raising efforts are reaching all of the public and how much duplication exists. There is a need to update and harmonize relevant legislation.

- Enforcement of building codes, land titling and environmental protection laws are constrained by unclear and contradictory roles between central, provincial and district/municipality levels, and weak administrative capacity.

This chapter focuses on institutional arrangements for hazard, vulnerability and risk identification, storage and analysis of data, the dissemination of risk knowledge to the public, and enforcement of risk reduction regulations and measures. The **Law on Disaster Management** (Articles 36 to 42) stipulates the following activities to support risk knowledge: 1) identification and monitoring disaster risk; 2) disaster management participatory planning; 3) promotion of a culture of disaster awareness; 4) strengthening commitment to disaster management actors; 5) implementation of physical and non-physical activities; and 6) regulation of disaster management.

5.1 Assessment of Risks and Vulnerability

Mapping of risk and vulnerability that contributes to risk assessment is proceeding through various methods in Indonesia and supported by different actors. It is estimated that more than 15 different risk mapping projects are underway. Tsunami hazard mapping is being undertaken by various actors including DESDM (that maps major faults and trenches), ITB, BMKG and BAKOSURTANAL. The degree of coverage, compatibility, sharing and overlap among these various initiatives is unclear. BNPB and BAKOSURTANAL are developing guidelines to standardize disaster risk mapping. The ability of current mapping programmes to help in early warning has yet to reach its potential, particularly at the community level; integrated risk mapping has been carried out to some degree.

Examples of mapping efforts include the following:

- The **Sangihe District Government** is producing Sangihe-North Sulawesi Hazard Risk Areas maps and is mapping 2007 disaster locations.

- **CVGHM** is producing earthquake and tsunami hazard maps, mass movement and landslide hazard zone maps, vulnerability maps for high density settlements, as well as guidelines for mapping of areas prone to volcanic disasters (in collaboration with PEMDA i.e. local government).

- **BAKOSURTANAL** is producing landslide maps, flood hazard maps and tsunami hazard maps.

- **BMKG** prepares hazard maps for floods, drought, forest and estate fires, and seismic activity.

- The **Public Works Department** engages in various types of mapping including mapping of volcanic activity and mapping of disaster impact from 2005–2006.

- **DKP** has completed some maritime baseline and thematic surveys on coastal hazards, and tsunami risk mapping for several coastal cities.

- The **Ministry of People's Welfare** with WFP, the Central Bureau of Statistics Indonesia (BPS) and the Australian Government Overseas Aid Program (AusAid), have carried out nutrition mapping using 'small area estimation' that follows progress toward the achievement of the MDGs in terms of infant mortality, energy intake and nutritional status of children.

- The **United Nations Office of the Recovery Coordinator for Aceh and Nias** keeps an extensive database of maps, including geographic and thematic maps that can be searched by district and by sector.

- International mapping organizations such as the Earth Institute at **Columbia University** have produced multi-hazard maps for Indonesia.

5.1.1 Database Development

There are numerous data collection methodologies used for historical analyses and prediction. An overview of various national, regional and global data collection, storage and analysis methods was presented in a workshop in 2006,[55] which included the Centre for Research on the Epidemiology of Disasters (CRED) and the Global Unique Disaster Identifier Number Initiative. The discussion revealed the wide range of tools used in the region.

There are several initiatives aiming to establish disaster risk indexes (OXFAM, UPN), indicators (LAPAN) and models (BGR/GTZ Georisk Project and DESDM). **BNPB** is working with UNDP to utilize the **DesInventar** methodology, which is also being used by other countries in the region, to build a disaster loss database – DiBi (Data and Informasi Bencana Indonesia). DiBi was officially launched on 29 July 2008 with records of disaster losses from 2002 to 2007. BNPB is in the process of collecting historical disaster data for the past 30 years from six provinces. BNPB has also been leading the process of collecting and validating disaster data through the Communications Forum that meets regularly to discuss, consult and decide on issues related with DiBi. At the same time, BNPB has also organized a series of training and socialization events on DiBi.

DiBi supports collection of homogeneous data on disasters of all scales, with the information being compiled, processed and referenced to a relatively small geographic unit. DesInventar methodological aspects highlight the dependent relationship between small and large disasters in so far as small disasters can indicate where large disasters will occur. There is a need to compile data on recurring small disasters to assess their accumulated impact, which, in some cases, can be of the same magnitude or even exceed that of single large disasters.

Flood event data is mainly stored in the Department of Public Works' National Water Resources Data Center and is derived largely from the Piram Jasa Tirta I and II (the largest river basin organizations) and about 50 Water Resources Management Centres (BPSDAs) in Java, Sumatera and Sulawesi. However access to the data is not standardized, and use for flood prediction and risk assessment will require considerable work for collection and processing.[56]

General problems identified with database development and sharing in Indonesia include: varying sources of data with different formats and contents, poor reliability of media sources, imprecise estimates of disaster losses, inaccurate information leading to improper action, and difficulty in obtaining reliable information from small districts that have limited communication facilities. As a result of these problems, geo-data has not been effectively used as a DRR tool.[57] The development of a sustainable database requires:[58]

- A comprehensive disaster management information system addressing issues of Indonesia's intricate geography

- Data compatibility between systems

- Competent and motivated human resources to manage the system

- User friendly applications

- Strong interfaces between relevant institutions and sections

The National Action Plan for Disaster Reduction 2006–2009 identified extensive numbers of projects for mapping, modelling and database development to strengthen risk knowledge. The Action Plan ties these activities to spatial planning, regional planning, coastal pollution management planning, and inputs to the Perda (local regulations), among others. Some activities underway include the following:

- Production of maps of disaster prone regions (volcanic, landslide, erosion and ground movement hazard) and those having dense populations and high activity and/or vital and strategic buildings, with recommendations for the Perda (DESDM, BGR/GTZ Georisk Project;[59] Yayasan PIKUL – Eastern Indonesian NGO working in Papua).

- Management of geospatial data to support Aceh and Nias reconstruction, and multi-hazard mapping by various government institutions (BAKOSURTANAL, BRR, Ministry of Public Works or PU) for incorporation into regional planning.

- Preparation of geological risk assessments (Central Java, West and East Nusa Tenggara) that will serve as input to local governments and assist local government in preparing local maps (DESDM, BGR/GTZ Georisk Project).

55 Workshop to Improve the Compilation of Reliable Data on Disaster Occurrence and Impact, jointly organized by CRED and UNDP Regional Centre in Bangkok on 2–4 April 2006. The workshop was an important step in the preparation of a Global Risk Identification Program.

56 Dr. Sutardi, *Action Report toward Flood Disasters Reduction: Indonesian case*, Indonesian Water Partnership, 2005, page 5.

57 Rizqi Abdulharis, D. M. Hakim, Akhmad Riqqi and Siyka Zlatanova, *Geo-information as Disaster Management Tools in Aceh and Nias, Indonesia: A Post-disaster Area*, 2005.

58 Presentation by B. Wisnu Widjaja made at the Workshop to Improve the Compilation of Reliable Data on Disaster Occurrence and Impact, Bangkok, Thailand, April 2006.

59 The Georisk Project is part of the GTZ Urban Quality Project and focuses on five cities/districts.

5.2 Risk Communication and Public Awareness

Legal instruments and institutional changes aiming at the enhancement of risk knowledge, while essential, are not sufficient to effect changes in public behaviour and increase safety. The efficacy of EWS is deeply rooted in communities' own knowledge and understanding of their vulnerability and their capacity to engage in public discourse on ways to protect themselves and their livelihoods. To this effect, some activities in Indonesia aim to produce behavioural changes in communities but coverage is limited. Some examples of community-based participatory planning and risk reduction initiatives are mentioned below.

The National Action Plan for Disaster Reduction 2006–2009 identifies numerous institutions that are producing brochures, pamphlets, books, posters and other disaster risk materials for distribution to the public, especially in disaster prone areas. These include BNPB, DEPDAGRI, DEPKES, PU supported by the BGR/GTZ Georisk Project, the ITB/PMB with the Ministry of National Education (DEPDIKNAS), as well as DESDM and BMKG. Many organizations participate in training, education and capacity development, however, coverage and impact of these collective actions is uncertain.
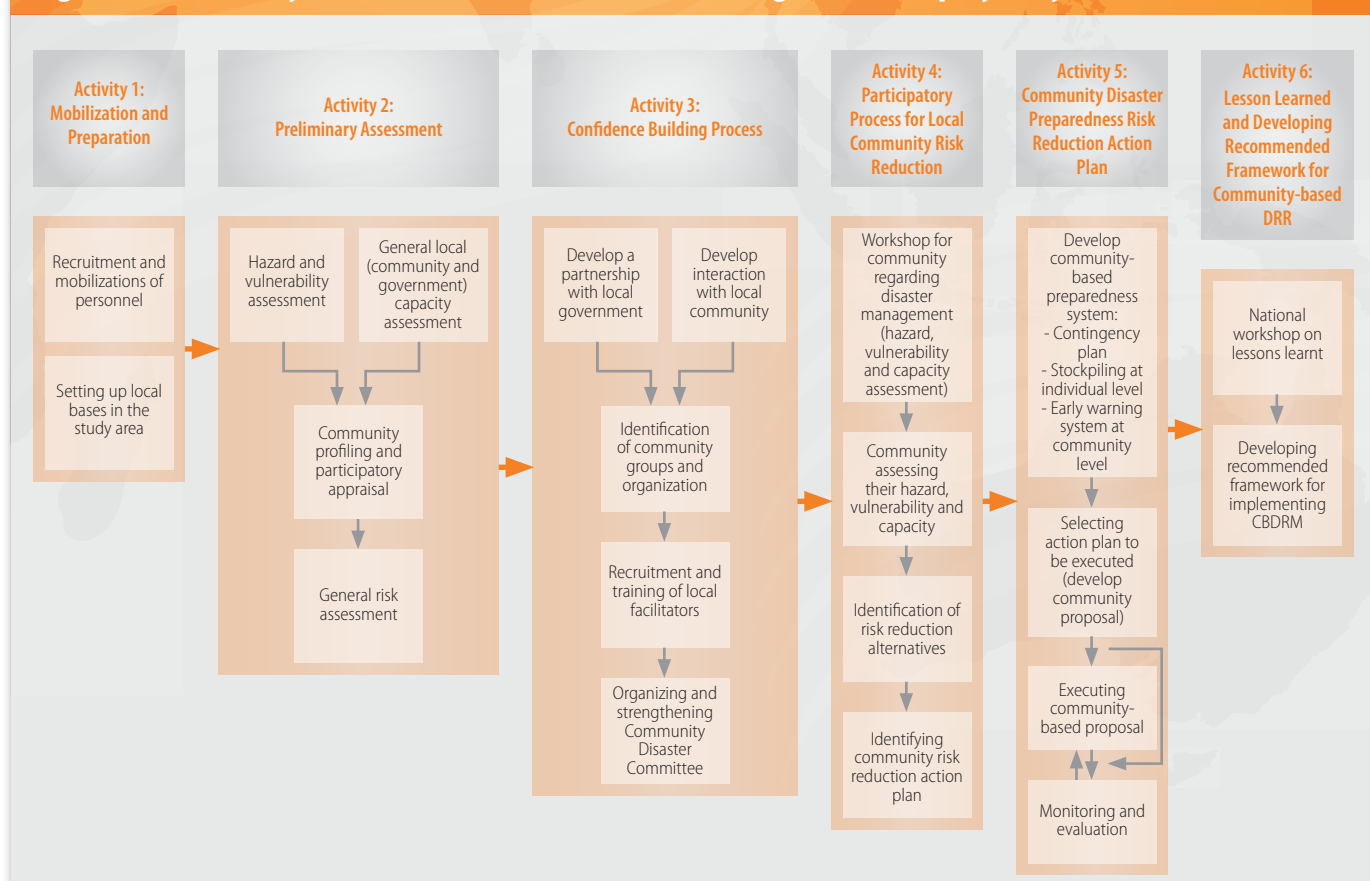
5.2.1 Community-based DRR Planning

The Earthquake Disaster Mitigation Research Center (EDM) and the National Research Institute for Earth Science and Disaster Prevention (NIED) with the support of UNDP and the GoI are undertaking a project to strengthen local capacity and resilience to disasters, promoting the paradigm shift to a bottom-up process in DRR. The areas of project implementation are four Kecamatans in Aceh Province, including Johan Pahlawan-Aceh Barat, SamaTiga-Aceh Barat, Kuala-Nagan Raya and Teunom-Aceh Jaya, and one Kecamatan in West Sumatra Province, Pariaman Selatan. The process of mapping and community involvement is shown in the diagram below. The collection of information in a participatory manner, based upon participatory rural appraisal techniques, uses local risk knowledge to identify local solutions and promote the mobilization of local resources for the protection of the most vulnerable.

5.2.2 Building Coastal Resilience

The IOTWS undertakes pilot activities to build coastal community resilience by encouraging communities to develop standards and awareness in order to reduce their vulnerability to coastal hazards. In September 2006 IOTWS conducted a workshop in collaboration with MBPI

Figure 4: Community Risk Assessment and Action Planning Process Employed by EDM/NIED

Activity 1: Mobilization and Preparation
- Recruitment and mobilizations of personnel
- Setting up local bases in the study area

Activity 2: Preliminary Assessment
- Hazard and vulnerability assessment
- General local (community and government) capacity assessment
- Community profiling and participatory appraisal
- General risk assessment

Activity 3: Confidence Building Process
- Develop a partnership with local government
- Develop interaction with local community
- Identification of community groups and organization
- Recruitment and training of local facilitators
- Organizing and strengthening Community Disaster Committee

Activity 4: Participatory Process for Local Community Risk Reduction
- Workshop for community regarding disaster management (hazard, vulnerability and capacity assessment)
- Community assessing their hazard, vulnerability and capacity
- Identification of risk reduction alternatives
- Identifying community risk reduction action plan

Activity 5: Community Disaster Preparedness Risk Reduction Action Plan
- Develop community-based preparedness system:
  - Contingency plan
  - Stockpiling at individual level
  - Early warning system at community level
- Selecting action plan to be executed (develop community proposal)
- Executing community-based proposal
- Monitoring and evaluation

Activity 6: Lesson Learned and Developing Recommended Framework for Community-based DRR
- National workshop on lessons learnt
- Developing recommended framework for implementing CBDRM

and IFRC/PMI, and created a training guide that would be used throughout the country. LIPI has taken up tsunami geology to assess risk and boost awareness under Indonesia's community preparedness programme. Recent field work in Java and Sumatra co-led by scientists from LIPI and the USGS, and supported in part by US IOTWS, provided training to government researchers and to university students and lecturers. The team found clues to help determine the return periods for tsunamis in the region affected by Java's 2006 tsunami. The team also developed criteria for using coral boulders in the area to estimate the strength of the 1883 Krakatau tsunami in the Sunda Strait, which followed one of the most powerful volcanic explosions in recorded history.

5.2.3 Avian Flu Risk Reduction

As a member of the government's national committee, the PMI has been involved in formulating a proactive strategy against the avian flu virus. With the support of IFRC, PMI volunteers have conducted a massive public awareness campaign that included the distribution of information and education materials to thousands of people in the communities. Some 2,460 volunteers from 82 Red Cross branches were mobilized to reach 10 provinces identified as being most at-risk from outbreaks, including Aceh. Volunteers conduct door to door visits to monitor backyard poultry raising activities and explain the importance of maintaining cleanliness, as well as proper handling of meat. They also check on the health situation of high-risk families and educate them on the signs of the disease, as well as on what to do if symptoms appear.

5.2.4 Communicating Risks in Schools

DEPDIKNAS is working on incorporating disaster risk knowledge into primary through tertiary school curricula. This may pose challenges since primary and secondary school curricula are already very comprehensive. Some extracurricular activities for learning about disaster risk are being developed such as a game created by a professor from the University of Brawijaya that includes a set of folding pictures and simulation exercises on a variety of natural disasters. The Asia-Pacific Cultural Centre for UNESCO is developing materials in collaboration with community groups under the Japanese-funded project "Education for Natural Disaster Preparedness in Asia-Pacific within the context of Education for Sustainable Development." The Save the Children Alliance is undertaking a programme in Nias modelled after a successful programme in Cuba that enables children to act as leaders in their communities in raising awareness of potential disasters and of appropriate preparedness measures. This is done through integrating DRR into the local curriculum, and conducting hazard mapping of communities and educational campaigns.

5.2.5 Communicating Risks to Tourists

The Ministry of Culture and Tourism website has a hyperlink to news stories that inform tourists of the ongoing threats and hazards related to traveling around the country. Tourists are also warned through their own national consular sections that often provide detailed information on protection from disasters, both natural and human-made. In general, it is necessary for tourists to become proactive in gathering information about hazards in Indonesia. There are no regulations that compel hotel owners to provide public awareness materials to visitors; however, the Law on Disaster Management requires businesses to practice transparency in providing information to the public.

5.3 Utilization of Risk Knowledge for Housing, Building and Land Use Codes and Regulations

The population of Indonesia is very unevenly distributed with over 100 million people living in Java, which accounts for only 7 percent of the total land area. Extreme population pressures on the built environment and natural resources in some areas and underdevelopment in rural areas, signal the need for heightened vigilance to updating and enforcing laws and regulations and promoting public education on risks. Article 42 of the Law on Disaster Management promotes enforcement of spatial planning regulations, safety standards and imposition of sanctions against violators. Government is tasked with monitoring and evaluating compliance with standards on a routine basis.

5.3.1 Building Codes

Building standards in the form of laws, regulations and guidelines are administered by PU while government standards are administered by the National Standardization Agency (BSN). Additional local government regulations are issued and enforced locally.

The first Indonesian provisions for seismic building design were incorporated in the 1970 Indonesian Loading Code (NI-18) that also introduced the first official seismic zoning map. In 1976 when severe earthquakes caused heavy loss of life and material damage in some areas that had been presumed low-risk before, the government developed a new seismic design code and adapted seismic zoning. The Indonesian Seismic Code for Building Design was issued in 1987, based on the New Zealand Code, and was ratified in 1989 as one of the Indonesian National Standards (SNI) and registered as SNI 1726-1989-F. The SNI requires the lateral-resisting system of the building to be flexible and sets out mandatory requirements for design and detailing. The current seismic code in Indonesia (2002) is based on the international Uniform Building Code of 1997. ITB/PMB, RISTEK

**Box 4:   Disaster Risk Reduction and Rebuilding in the Tsunami Affected Areas –
Indications for Early Warning**

Some scientists and engineers studying the effects of the 2004 and 2005 earthquakes and tsunami in Aceh and Nias, and utilizing tools such as numerical modelling, may agree that saving lives in the next local disaster will depend on the efficacy of the EWS.[60] The following points are keys to this reasoning:

1. Seven earthquakes north and west of Aceh in the last 170 years have triggered tsunamis; in 1833 the destruction was similar to 2004, thus planning for reconstruction has to consider the high degree of vulnerability.

2. The height of the tsunami at the coastline was 9 -10m at Banda Aceh, about 10m at Calang and about 13m at Lhoknga where the run-up was up to 35m. The first 500m in all areas were nearly totally destroyed irrespective of tsunami height; only few well-engineered structures, such as mosques, remained standing.

3. The earthquake lasted 15 minutes and the time interval from the start of the earthquake to the arrival of the first wave front of the tsunami was about 35 minutes in Banda Aceh, 25 minutes in Calang and 50 minutes in Meulaboh.

4. Survivors stated that it was difficult to move very far during the earthquake particularly for families with young children and the elderly – they could only run after the tremors stopped. In Calang, this meant that there were only 10 minutes left to run after the earthquake stopped and before the first wave arrived.

5. In some areas, access to the hills was restricted by housing and the low number of roads connecting settlements and hills.

6. Even concrete framed brick housing that meets the Indonesian Earthquake Design Code can only withstand wave levels up to 2.5m if the house is correctly positioned.

Some facets of spatial planning in Aceh and Nias are not aligned with the potential for another major tsunami in the next 30 years. For instance, the new access road has been situated closer to the coast than originally planned, and development along the road including housing and other infrastructure will be vulnerable. Some recommendations for DRR and EWS are as follows:

•   For people living close to a potential tsunami origin or on low coastal land, plans for construction and early warning should assume that people need to reach a safe zone within 10 minutes and that the earthquake itself will trigger the evacuation.

•   The accesses must allow for rapid evacuation of a large number of people and there should be wide cleared paths that do not have open trenches or drains. Access easements to the hills are essential.

•   People should be very well acquainted with signs of earthquakes and tsunamis and early warning procedures, including messages and evacuation routes.

and the Department of Public Works are incorporating results of hazard analysis in Sumatra to improve the seismic code.

Despite the presence of the SNI and codes, un-reinforced clay brick masonry housing is often found in rural areas consisting of single story buildings made with traditional construction methods. Buildings of this type typically experience severe damage or collapse in earthquakes.[61] In May 2006, a 6.3-magnitude quake on Java Island near Yogyakarta killed 6,234 people and injured more than 30,000; reducing more than 135,000 houses to piles of brick, tile and wood in less than a minute[62] (the current seismic code ranks Yogyakarta as a seismic zone 3 among 6 seismic zones).

The six districts affected by the May 2006 earthquake were among the most densely populated in the country and the shallow epicentre of the earthquake contributed to widespread casualties and structural damage. The damage to buildings is associated with lack of adherence to safe building standards for both private homes and public buildings; many structures such as schools were built in the 1970s and 1980s with special grant funds.[63] Small and relatively inexpensive reinforcements can be made to strengthen older buildings but it must become a government or public priority that requires the provision of guidance to the public.

60   Frank Wilkinson, Final Report: Coastal Design and Tsunami Mitigation, for UNHCR, August 2005; Red R PowerPoint presentation, April 2006; and Rizqi Abdulharis, D. M. Hakim, Akhmad Riqqi and Siyka Zlatanova, *Geo-information as Disaster Management Tools in Aceh and Nias, Indonesia: A Post-disaster Area*, 2005.

61   Earthquake Engineering Research Institute, *World Housing Encyclopedia Report*, 2003.

62   *Washington Week* "Indonesia reeling from deadly earthquake," 1 May 2006.

63   BAPPENAS and provincial governments, *Preliminary loss and damage assessment: Yogyakarta and Central Java natural disaster*, June 2006.

Reconstruction in the tsunami and earthquake affected areas is proceeding with greater attention to building codes. For example, more than 300 new permanent schools are being built by UNICEF in Aceh and Nias and will be more earthquake-resistant.

5.3.2 Land Management Policy

Indonesia's Basic Agrarian Law of 1960 was among the most progressive of any country for its time, however to date only about 30 percent of Indonesia's non-forested land[64] is titled, compared to 90 percent in Thailand and 80 percent in the Philippines. Administered by the National Land Agency (BPN), the land law has been less than effective in supporting land rights. The World Bank and bilateral aid programmes have expended considerable resources to assist the GoI to reform its land law and bureaucracy, for example though the Land Administration Projects (LAP) I and II, with the goal of registering all land in Indonesia by 2020. LAP I (1994–2000) registered nearly 2 million parcels of land.[65] Through LAP II, BPN distributed 365,000 titles.

Over $6 billion has been allocated to reconstruction in Aceh and Nias but the efforts to secure land rights fell short of expectations. The multi-donor funded Reconstruction of Aceh Land Administration Project aimed to help BPN create land records destroyed in the disasters and title 600,000 land parcels (less than 20 percent of land in Aceh had been titled prior to the tsunami). Land titles enable citizens to use land as collateral, which can be particularly helpful for the poor. The project includes community driven adjudication processes that establish land boundaries through community mapping with a community review process, and storing all information in a database. As of December 2006 only 7,700 titles had been distributed while 20,000 were stuck in the system due to administrative bottlenecks.[66]

5.3.3 Water Management Policy[67]

Indonesia's Water Resources Law No. 7 of 2004 (superseding the 1974 law) was created to address modern water issues and covers authority, duties and responsibilities of different levels of government (in coordination with communities) in relation to planning, utilization and emergency aspects of water resources. In addition, it addresses information management, participation of the private sector and, importantly, bases water and flood management on a 'whole river basin' approach. The Water Resources Law is seen to

have a clear strategy for disaster management and includes mechanisms to prevent, mitigate, respond and recover from disaster.[68]

The GoI's operational policy on flood mitigation is based on five principles: 1) land use planning; 2) integrated water resources management; 3) provision of adequate urban infrastructure; 4) provision of low-priced housing to resettle those living in particularly vulnerable areas; and 5) empowerment of society for early warning and hazard mapping. While the policy contains these critical and adequate components, the implementation of the policy cannot keep pace with the increased population pressures and the rapid acceleration of watershed degradation, especially in Java. Flooding in early 2007 in Jakarta has been blamed on excessive development, issuing of too many building permits, and construction of too many large buildings, as well as environmental degradation upstream in Bogor.[69]

Other problems include the lack of detailed spatial plans that would factor in area-specific flood risks, and the weakness of regulations to ensure that developers provide flood protection. Even strong measures undertaken to fight the degradation, such as the National Movement for Rehabilitation of Forest and Soil Conservation implemented by the Ministry of Forestry is not expected to make the necessary impact.

PU coordinates development and management of water resources and has four director generals including the Directorate of Water Resources. All 30 provincial governments have the authority to manage rivers crossing district boundaries, but master plans for some of the water basins are not yet prepared. The five provincial governments in Java set up 20 BPSDAs responsible for river and flood management but some are faced with inadequate budgets and understaffing.

The GoI is formulating a National Flood Management Policy through a coordination committee chaired by BAPPENAS. The National Forestry Department is largely responsible for upper watershed conservation that is implemented through the public corporation for forestry. The districts are responsible for implementation of the activities aimed at conservation of water resources and reducing erosion (see below for more details). The GoI is also developing an Integrated Flood Management Plan that focuses mainly on social and institutional measures. Thus, the GoI has recognized the need for reform and is promoting a 'living with floods' approach to flood plain management. The World

---

64 Approximately 70 percent of land is designated as 'forest land' directly under state control.

65 Craig C. Thorburn, *A Long Row to Hoe, Decentralization, Reformasi and Land Management Policy in Indonesia*, Monash University, Australia, 2004.

66 *Jakarta Post*, "Land titles in Aceh – so much hope but more action needed," 2 December 2006.

67 Draws primarily from Dr. Sutardi, *Action Report toward Flood Disasters Reduction: Indonesian case*, Indonesia Water Partnership, 2005.

68 Anthony D. M. Sihaan, *Legal Framework for Disaster Management Particularly in the Field of Early Warning*, GTZ, December 2006.

69 *Jakarta Post*, "After the Flooding, the blame game begins," 4 February 2007.

Water Day each year has been effectively used by the GoI to publicize new programmes and heighten awareness.

5.3.4 Environmental Protection

A broad array of environmental and natural resource legislation was enacted between 1980 and 2001 when Indonesia experienced rapid growth. However, laws were not rigorously enforced and significant environmental degradation occurred during the 1980s and 1990s. The Asian financial crisis of 1997–1998 caused a more relaxed approach to the enforcement of environmental regulations and industrial standards allowing damaging production and harvesting methods to be used. This situation was exacerbated by a lack of clear authority among Indonesia's central, regional and local governments, and weak regulatory institutions. In 2002, the Environmental Impact Management Agency (BAPEDAL) was dissolved without clear delineation of which body would take over its role and authority. The Office of the State Minister for the Environment assumed the duties but lacks enforcement powers.[70]

Unfortunately, the natural environment continues to deteriorate, significantly contributing to disasters. One of the largest problems is illegal logging of forests, which has global implications as Indonesia contains 10 percent of the world's forest cover and has the third largest tropical rain forest.[71] Locally, the deforestation that results from unregulated logging is closely linked with floods and landslides, air pollution and industrial runoff that pollutes the water supply.

In the regulation of logging, contradictions are cited between instruments such as Law No. 22 of 1999 on Regional Autonomy that accords the regional governments' primary authority over natural resource matters, and Forestry Law No. 41 of 1999 and its implementing instrument, Government Regulation No. 34 of 2002 on the Management, Exploitation and Use of Forest Areas. These two laws serve to maintain central power particularly in the granting of lucrative timber concessions. Thus two disparate sets of political forces are at work, one according power to local government while the other retains centralized control. The result is that local leaders may ignore central government edicts and issue their own concessions pursuant to regional autonomy.[72]

Air pollution is serious and also deadly – linked to inflammation of the respiratory tract, the sixth leading cause of death. Motor vehicles are one of the chief sources of air pollution in Indonesia. The Asian Development Bank (ADB) conducted a study on urban air quality management, finding that some improvement had occurred but more air quality monitoring (AQM) was required. BAPPENAS has drafted a national action plan on AQM, and BAPPEDA is in charge of regional planning for transport systems and integrating this with land use planning. The roles of central, provincial and district/municipal level authorities in relation to AQM remain unclear.[73]

Forest fires contribute to air pollution and the cost of the 1997–1998 fires (when 10 million hectares burned and affected all of South-East Asia) were said to exceed legal liabilities of both the Exxon Valdez oil spill and the Bhopal chemical disaster.[74] In many rural areas, a combination of lawlessness and local government complicity makes bans on burning unworkable and places the burden on the poor. A study by CARE has recommended a more promising approach by fostering the development of local institutions for controlling the use of fire and participatory management in communities.[75]

A draft Natural Resources Management Law was prepared in 2004 but has been criticized by environmentalists. There are doubts whether such a law can be effectively implemented since it may be difficult to gather sufficient evidence for prosecution and judges must be well-trained in environmental law. Nevertheless, WALHI, a major national advocate for environmental protection has advised that discussions on the draft law be urgently conducted. In addition to this, WALHI advises stricter regulation of the degradation caused by the mining sector and replacing Decree No. 11 of 1967 with new legislation.

A number of initiatives contribute to environmental protection. Among others, UNDP with Yayasan Bina Usaha Lingkungan (NGO) is helping to provide alternative sustainable livelihoods to communities in 15 provinces that may otherwise be overexploiting their natural resources. The Hans Seidel Foundation[76] supports BPPT through training for government officials in the fields of environmental management and water resources management, in association with prominent Indonesian universities, such as the University of Trisakti in Jakarta, and the local governments of Jakarta, Bogor, Tangerang, Bekasi Industrial Estate and Jasa Tirta in Malang.

---

70 US Energy Information Administration, *Indonesia Environmental Issues*, 2004.

71 Indonesia's huge forests function as one of the world's main 'carbon sinks' (natural means of sequestering world carbon emissions) that help mitigate climate change.

72 Alan Khee-Jin Tan, "Environmental Laws and Institutions in Southeast Asia: A Review of Recent Developments" *Singapore Yearbook of International Law*, 2004, Vol. VIII, pages 177–192.

73 ADB, *Country Synthesis Report on Urban Air Quality Management*, December 2006

74 World Bank, *Indonesia Environment Monitor 2003*.

75 Johan Kieft and Aspian Nur, *Community-based disaster management: A response to increased risks to disaster with emphasis on forest fires*, CARE Indonesia, 2001.

76 The Munich-based Hans Seidel Foundation has worked in Indonesia since 1993.

Given heavy dependence on coastal and marine resources, Indonesia faces serious challenges in the protection of its coastlines. The GoI/USAID Coastal Resources Management Project that aimed to strengthen participatory and decentralized coastal management, was evaluated in 2003 after six years. It was found that the project was largely successful but could barely keep pace with the increase in unsustainable use.[77] The GoI has promoted Integrated Coastal Zone Management (ICZM)[78] and a bill on coastal zone management was initiated in 2001. Guidelines to support coastal zone management were developed by DKP. However, coastal zone management continues to be constrained by ambiguity regarding laws and jurisdiction. There are approximately 22 laws affecting the coastal zone that need to be harmonized so as to prevent ineffective management and conflict among sectors. Further, the lack of clear mandates for designated institutions and the need for greater administrative capacity both centrally and locally have been constraining factors.[79]

Summary of Main Points

1. Mapping of risk and vulnerability is proceeding through various methods. Tsunami hazard mapping is undertaken by numerous actors including DESDM, ITB, BMKG and BAKOSURTANAL. The National Action Plan for Disaster Reduction 2006–2009 ties database and mapping activities to spatial planning, regional planning, coastal pollution management planning, and inputs to the Perda (local regulations), among others.

2. Numerous data collection methodologies are used for historical analyses and prediction, both nationally and regionally. BNPB is converting historical data of disaster losses to the regionally used DesInventar methodology to build DiBi. DiBi was officially launched on 29 July 2008 with records of disaster losses from 2002 to 2007. BNPB is in the process of collecting historical disaster data for the past 30 years from six provinces. Problems identified with database development include: varying sources of data with different formats, poor reliability of media sources, imprecise estimates of disaster losses, inaccurate information leading to improper action, and general difficulty in obtaining reliable information from small districts.

3. Community-based participatory planning is undertaken by EDM and NIED in Sumatra, PMI and OXFAM, among others, but is limited in coverage.

4. The National Action Plan for Disaster Reduction 2006–2009 identifies numerous institutions that are producing public awareness materials and many organizations participate in training, education and capacity development, however the collective coverage and impact of these activities is uncertain.

5. DEPDIKNAS is incorporating disaster risk knowledge into school curricula and some extracurricular activities on DRR are being developed. The Save the Children Alliance is undertaking a programme in Nias that enables children to be leaders in raising awareness of potential disasters. The Ministry of Culture and Tourism website has a hyperlink to news stories that will inform tourists of the ongoing threats and hazards related to traveling around the country.

6. Extreme population pressures on the built environment and underdevelopment in rural areas signals the need for heightened vigilance to updating and enforcing laws. The current seismic code in Indonesia (2002) is based on the international Uniform Building Code of 1997. The May 2006 Yogyakarta earthquake reduced more than 135,000 houses to rubble, damage that was associated with lack of adherence to safe building standards. Building and land use in Aceh and Nias reconstruction does not always consider modelling and geo-data that indicate extreme vulnerability for near-coast dwellers, which results in reliance on early warning and evacuation.

7. Only about 30 percent of Indonesia's non-forested land[80] is titled, although the LAP registered nearly 2 million parcels of land and distributed 365,000 titles. The Reconstruction of Aceh Land Administration Project has fallen short of expectations distributing only 7,700 titles by December 2006 while 20,000 were stuck in the system.

8. A broad array of environmental and natural resource legislation was enacted between 1980 and 2001 but was not rigorously enforced and significant environmental degradation has occurred. The Office of the State Minister for the Environment was not given law enforcement powers.

9. The deforestation that results from unregulated logging is closely linked with floods and landslides, air pollution and industrial runoff polluting the water supply. Two disparate sets of political forces are at work, one according power to local government while the other retains centralized control. Air pollution is serious and BAPPENAS has drafted a national action plan on AQM while BAPPEDA is in charge of regional planning for transport systems. Forest fires contribute to air pollution but local lawlessness makes bans on burning unworkable.

77   University of Rhode Island, *Evaluation of the CRMP*, 2003.

78   ICZM is a system that manages the resources of the coastal zone through the collaborative participation of all affected economic sectors, government agencies and NGOs. It is based on the physical, socio-economic and political connections that make up the coastal zone.

79   Hendra Yusran Siry, *Making Decentralized Coastal Zone Management Work for the Southeast Asian Region: Comparative Perspectives*, 2007, page 46.

80   Approximately 70 percent of land is designated as 'forest land' directly under state control.

10. A draft Natural Resources Management Law was prepared in 2004 but there are doubts whether such a law can be effectively implemented. A number of initiatives contribute to environmental protection, in particular those by WALHI, UNDP with Bina Usaha Lingkungan, and the Hans Seidel Foundation.

11. The GoI has promoted ICZM; however, coastal management continues to be constrained by ambiguity regarding laws and jurisdiction. Further, the lack of clear mandates for designated institutions, and the need for greater administrative capacity both centrally and locally have been constraining factors.

Recommendations for Stakeholders[81]

- Promote coordination for risk mapping and data collection/analysis, and address problems associated with ongoing database development, including standardization of methodology across the country and in the region.

  ○ Further promote and strengthen the use of the DiBi tool for the historical analysis and prediction of disasters. Supplement these with new risk assessment undertaken by other technical and scientific agencies.

- Promote community-based vulnerability assessments and mapping nationwide, using networks of trained volunteers, community-based organizations and/or NGOs to reach isolated communities and groups requiring urgent protection.

- Strengthen risk communication methods and access to risk knowledge to ensure that different target groups understand the risks they face. Use community vulnerability data to integrate and socialize DRR and EWS information.

- Focus efforts on updating and enforcing laws and regulations related to building codes, land titling, environmental and natural resources protection, deforestation, and integrated coastal management in light of up-to-date knowledge of risks.

---

81 These recommendations are a synthesis of those made by interviewees in the UNDP ILS EWS process as well as those mentioned in National Workshop Report for Tsunami Early Warning Systems in Indonesia, jointly organized by RISTEK and UNDP in September 2007.

Monitoring and Warning System

Of the five elements considered to be important to EWS (see introduction) monitoring and warning services is an element that is quite well developed in Indonesia.[82] Responsible organizations have upgraded computer systems and communication technologies in recent years in order to improve the quality and lead time of warnings, and improve access to real time data. Communications between central authorities and regional and international monitoring and warning systems are also getting better but the systems are less effective inside the country, particularly in reaching vulnerable people. This section of the report examines the institutional, scientific and technical mechanisms for monitoring and forecasting, and the inter-institutional relationships for issuing warnings.

The following issues emerge as important for monitoring and warning systems:

- Monitoring information and warning for various hazards does not consistently reach the vulnerable public with actionable messages.

- BMKG as a main receiver/provider of data and data analysis for InaTEWS requires more capacity in the processing of input information to speed up warning time. Due to an increase in natural and human-made disasters and their area-specific impacts, communities need to be capacitated as soon as possible to strengthen community monitoring and early warning.

- The pace of development and environmental degradation is threatening to overtake the capacity to predict and warn, particularly for floods and landslides. Policies are needed to address the causes of floods, landslides and fires.

In response, BMKG has installed state-of-the-art equipment in its new building, including a decision support system and an information dissemination system, which is developed to ensure integration with UN plans and strategies for the establishment of regional and global EWS, coordinated by IOC/UNESCO. The systems of InaTEWS have contributed to the successful issuance of a warning in less than five minutes during the Bengkulu earthquake on 12 September 2007. Nevertheless, capacity development on end to end EWS

within BMKG and for local governments is still required to consistently reach the vulnerable public with actionable messages.

Hazards most often affecting Indonesia are floods and landslides, droughts, earthquakes and tsunamis, landslides, and volcanic activity. Indonesia is vulnerable to human-made hazards such as fires, deforestation, water pollution from industrial wastes and sewage, air pollution in urban areas, transportation accidents, and communicable diseases, such as tuberculosis, HPAI and HIV-AIDS. The Intergovernmental Panel on Climate Change has cautioned that the incidence of extreme events such as droughts and high rainfall will increase globally, and emphasizes the importance of early warning for hydro-meteorological hazards to protect lives and livelihoods.

6.1 Institutional Mechanisms for Monitoring and Warning

Various scientific foundations and technological systems are required for monitoring the major hazards and some systems have different target populations. One multi-hazard monitoring and warning service is SIMBA developed by LAPAN that provides warning for most weather- and climate-related hazards such as flood, drought, extreme weather and forest fires. Other agencies have developed similar systems for specific hazards such as the Ministry of Forestry for forest fires, and BMKG for floods and forest fires.

6.1.1 Floods[83]

Major floods are increasing in Indonesia with heavy losses to the economy. In what was called the worst flooding in recent memory, much of Jakarta was affected in January to February 2007, displacing 430,000 from their homes. Most flooding in Indonesia is due to overtopping of river banks and inundation of adjacent lowland areas. Velocity of overflowing water depends on the terrain and the height of accumulated water on the river, but can result in inundation of urban areas, commercial districts and agricultural land for hours and days. There are three major determinants: the intensity and duration of rainfall, the condition of river channels and the existence of lowland areas. Human settlements have

---

82 German Indonesian Cooperation for Tsunami Early Warning System, *Capacity Building in Local Communities Early Warning Experiences for Flood, Volcano & Forest Fire in Indonesia and Tsunami in Pacific Region*, Working Document No.7 Baseline-Study, December 2006.

83 Draws on Dr. Sutardi, *Action Report toward Flood Disasters Reduction: Indonesian case*, Indonesian Water Partnership, 2005.

experienced significant impact; many of the aquifers in Java's urban centres have suffered from over-extraction resulting in salt-water intrusion and increasing land subsidence.

Floods normally occur during the rainy season when precipitation timing and intensity varies from island to island. Flash floods have proved to be deadly for people living on flood plains (in 2003, 151 people died in 30 minutes in Bukit Lawang village in Northern Sumatra). There are generally three zones of rainfall intensity:

- Rainfall intensity > 400 mm/month covering west–middle–southern part of West Java, central and northern part of East Java, South Sumatera, Jambi, South Sulawesi and Central Flores

- Rainfall intensity of 300–400 mm/month covering southern part of Central and East Java

- Rainfall intensity of 200–300 mm/month covering Aceh area

Earlier flood management plans focused mainly on the improvement of flood mitigation infrastructure but the need to cover the 600 rivers with the biggest historical flood impact records (out of 5,860) in itself is overwhelming. Thus, a 'living with floods' approach is being promoted by the GoI. The Water Resources Law No. 7 of 2004 covers authorities and duties and promotes a 'whole river basin' management concept. Monitoring is undertaken by PU, which keeps hydrological data, and BMKG.

However, EWS based on telemetry have a high failure rate due to inadequate budgets, lack of proper maintenance and inadequate staff. An ADB-funded project (1996–2004) to support flood control in North Java included a flood warning pilot project to test methods for district-led preparedness and included a radio system to transfer rainfall data. The system fell into disuse due to a lack of capacity to plan operations and maintenance, and consult with beneficiaries. In general communities and developers were not aware of flood risks and the flood warning systems did not always reach communities effectively. It was found that NGOs were more successful in facilitating consultations and capacity development initiatives with communities. The small investment in 'soft' components, such as consultation and capacity development, compared to the structural components, was considered to be cost effective in moving government and communities from a flood control to a flood management approach.[84]

The tasks and roles of the SATKORLAK (province), SATLAK (district or river basin level) and POSKO (coordinating post at sub-district level) in monitoring hazards and risks are as follows:

- Observation and patrolling of flood control measures such as dykes, river junctions, pumping stations and flood retention areas

- Monitoring of flood water levels every three hours and every one hour if there is a sharp increase to predetermined levels

- Transmission of flood warning every three hours and every hour if needed

- Implementation of flood fighting actions and response measures

6.1.2 Landslides

Landslides frequently occur in the rainy season, causing significant damage and casualties. According to *The State of the Indonesian Environment 2005*, decline in forested areas has occurred almost uniformly in all of the forest zones in Indonesia. The rate of decline in forest cover during the period 1997–2000 was 3,510,030 hectares per year, with the largest rate of decline in Sumatra (1,154,460 ha per year), Kalimantan (1,212,630 ha per year), Sulawesi (692,090 ha per year), Maluku (294,170 ha per year) and Papua (156,680 ha per year). Indirectly, the rate of land alteration has given rise to various other types of land degradation and as a result, floods and landslides assail the lives and possessions of people who dwell close to the forest zone with increasing frequency.[85]
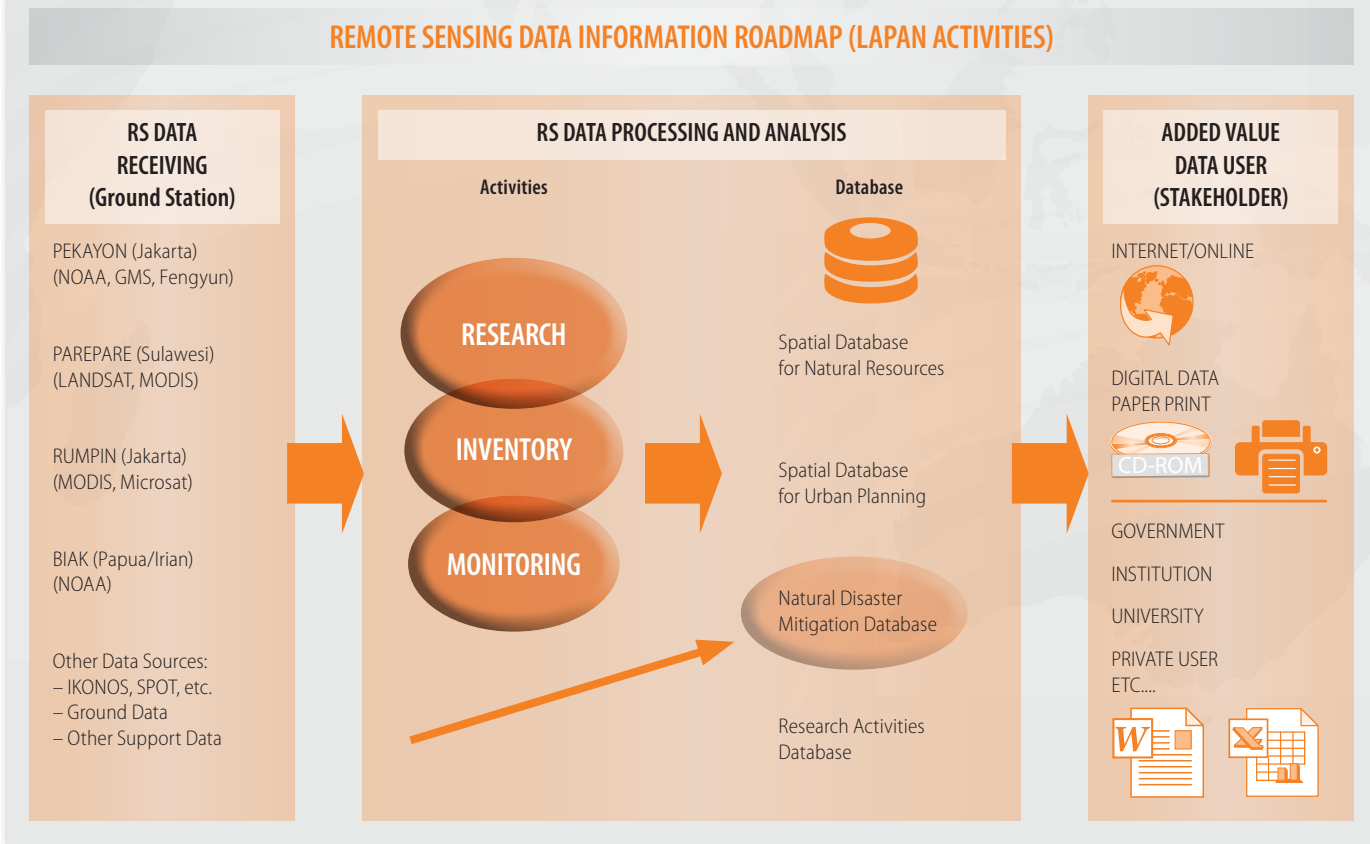
The *State of the Indonesian Environment Report 2005* provides several clues as to why landslides happen. Floods, as in the case of Jakarta and other flood-prone towns, are generally associated with heavy rainfall in areas where denuded forests or barren hills have rendered water catchments useless. Landslides are also caused by the disintegration of the roots of harvested trees losing their ability to hold soil in place. Various studies have found a much higher frequency of landslides in clear-cut areas than in uncut forests, and that slides in cut areas tend to be more intense. The failure of reforestation programmes over decades has been blamed for an increase in catastrophic landslides; however, some are due to exceptionally long and heavy rainfall that saturates the forest soil. The Center for International Forestry Research attributes the major cause of the landslides in Sijeruk village in late December 2005 and early January 2006 to heavy rainfall rather than logging. But logging has come under the spotlight for the tragedy around the East Java village of Kemiri, where at least 77 died after floods and landslides swept through the area.[86]

---

84   ADB, *Indonesia: North Java Flood Control Sector Project – Completion Report*, December 2006.

85   WALHI website.

86   *Jakarta Post*, "Nature hits back," 29 June 2006; Reuters, Indonesia Red Cross fears big landslide death toll," 5 January 2006.

Figure 5: LAPAN Remote Sensing Data Information Processes

REMOTE SENSING DATA INFORMATION ROADMAP (LAPAN ACTIVITIES)

RS DATA RECEIVING (Ground Station)

PEKAYON (Jakarta)
(NOAA, GMS, Fengyun)

PAREPARE (Sulawesi)
(LANDSAT, MODIS)

RUMPIN (Jakarta)
(MODIS, Microsat)

BIAK (Papua/Irian)
(NOAA)

Other Data Sources:
– IKONOS, SPOT, etc.
– Ground Data
– Other Support Data

RS DATA PROCESSING AND ANALYSIS

Activities

RESEARCH

INVENTORY

MONITORING

Database

Spatial Database
for Natural Resources

Spatial Database
for Urban Planning

Natural Disaster
Mitigation Database

Research Activities
Database

ADDED VALUE DATA USER (STAKEHOLDER)

INTERNET/ONLINE

DIGITAL DATA
PAPER PRINT

CD-ROM

GOVERNMENT

INSTITUTION

UNIVERSITY

PRIVATE USER
ETC....

Box 5: Lessons Learned from Landslide Early Warning in the Rainy Season of 2002–2003[87]

Following the disastrous landslide events in the District of Purworejo in 2001, an expert multi-disciplinary team that included members from BMKG and LAPAN was formed to provide technical assistance to strengthen prediction, early warning and preparedness. The team focused on prediction of rainfall intensity and distribution for the rainy season from October 2002 to April 2003.

In order to forecast the landslide events, the team agreed upon a rainfall intensity scenario based on different predictions from BMKG and LAPAN. A map of landslide susceptibility was then prepared using a map produced by the Directorate of Environmental Geology in 1996 that indicated four categories of susceptibility and overlaying it with the rainfall intensity prediction. The landslide prediction map was intensively reviewed and in mid-December 2002 a press conference was conducted with various media, including printed as well as television and radio. The media were informed of the landslide forecast and given suggestions for mitigation to relay to the public.

During the period of October 2002 – April 2003, 44 landslides occurred in Java and Flores Islands resulting in 108 deaths. Most of the landslide events occurred in the most vulnerable areas mapped by the team. The team reviewed the events questioning why casualties were so high when early warning had been given. The team concluded that the landslide forecast is a valuable activity for disaster mitigation and that the forecast was reasonably accurate. The impact of the early warning can be improved by:

• Timely dissemination of the warning; the early warning was a little too late and should be issued prior to or at the onset of the rainy season.

• Ensuring that the early warning reaches the community in the form of a non-scientific practical message.

• Strengthening of the end to end system including the global network, the national and regional network, and the local network with early warning equipment installed in the vulnerable areas.

87 BMKG and LAPAN, Asep Effendi, 2004.

LAPAN uses satellite data and remote sensing applications, and has developed several systems such as the 'potential flooded area monitoring system' that also covers landslides.[88] One method used to monitor the landslide hazard is repeated GPS surveys. The Department of Geodetic Monitoring of ITB has conducted several studies to improve the use of GPS for landslide monitoring.[89]

6.1.3 Droughts

Environmental degradation, such as deforestation, contributes to drought in Indonesia and when combined with variations in the monsoon rains caused mainly by the ENSO phenomenon, this can lead to drought conditions affecting millions of people. Although 93 percent of drought years (1877–1997) in Indonesia are associated with El Niño, there are regional and seasonal discernable differences. The great drought of 1997–1998 necessitated the import of over 5 million MT of rice and is thought to have contributed to the disastrous forest fires of the same years, the most severe for the previous two decades. Forecasts of the El Niño event were available in late 1996 and were communicated by BMKG to provincial levels, however, there was weak response to the early warning; no major interventions were taken to minimize crop losses and few fire prevention measures were taken.[90] The lessons learned from these disasters are still reverberating.

BMKG is the main agency responsible for producing climate forecasts and has formed a National Seasonal Forecasting Working Group with BPPT, LAPAN, the Agriculture Research Institute and the Water Resources Management Research Institute. Forecast guidance includes seasonal monsoon onset, monthly rainfall forecast and seasonal cumulative rainfall for 102 meteorological regions.

LAPAN with WFP produces an Early Warning Bulletin that contains remote sensing-based climate prediction information for Indonesia and its potential impacts on the environment including floods, drought, forest fires and food security. Indonesia benefits from FAO's Advanced Real Time Environmental Monitoring Information system (ARTEMIS) that supplies information to its Global Information and Early Warning System to monitor drought worldwide. The Humanitarian Early Warning Service posts situation reports of overall food supply on the Internet.

Since 2003, the Indonesian Agro-climate and Hydrology Research Institute (IAHRI) has been developing a drought monitoring system including a meteorological database, drought index, application of remote sensing for drought monitoring, and online spatial drought information delivery. Based on the number of dry and wet months, the country is divided into 14 agro-climatic zones, of which 11 are considered sensitive to extreme climate variability since rainfall fluctuations can upset established cropping patterns.[91]

6.1.4 Earthquakes and Tsunamis

InaTEWS was inaugurated on 22 November 2008 and its full operation is expected by early 2010. It has three major components: 1) operational monitoring, processing, warning, issuance and dissemination; 2) capacity building for modelling and human resource development, including training; and 3) emergency response and reconstruction including public awareness and preparedness.[92] The involved institutions are listed in the September 2006 Decree of MENKO KESRA (see section 4.3.1).

BMKG is responsible for the seismic monitoring system and prior to the 2004 tsunami had already been operating 30 geophysical stations and 5 regional centres equipped with 27 remote seismic sensors. BMKG hosts the National Operations Center, which collects and processes all seismic data, determines earthquake epicentres, analyses whether the earthquake is tsunamigenic, issues earthquake information and tsunami warnings, and integrates other observation data for confirmation or cancellation of the warning. The US IOTWS support has included the installation of two coastal sea level stations, the upgrade of a third station, and their integration into the IOC/UNESCO Global Sea Level Observing System (GLOSS) network. The GLOSS network provides real time monitoring of water levels for tsunami detection and warning purposes throughout the region. BMKG is using PTWC, USGS and other seismic data sources in the region to calibrate its seismic detection systems.

A December 2006 assessment of BMKG's capacity to implement a new seismic monitoring system indicated that significant improvements were needed to optimize performance. These included software upgrades that would allow greater speed in reviewing incoming data from the automated system and archiving data that triggered an official action by BMKG. BMKG's ambitious plans for deployment of more than 100 digital seismic systems to be integrated at national and regional levels will require well-defined deployment and management procedures. BMKG staff members need to develop their capacity to use instrumentation and software provided by China, Germany

88 Hidayat Gunawan and Islam Widia Bagja, *Global Precipitation Measurement (GPM) Data Use in Indonesia*, Center of Remote Sensing Application and Technology Development, LAPAN, 2005.

89 Hasanuddin Z. Abidin, H. Andreas, M. Gamal, Surono and M. Hendrasto, *Studying Landslide Displacements in Megamendung (Indonesia) Using GPS Survey Method*, Department of Geodetic Engineering, ITB, 2006.

90 ADPC, *Indonesia Country Study*, 2000.

91 Eleanor Runtunuwu, *Utilization of Satellite Imagery for Vegetation Drought Monitoring in Indonesia*, Indonesian Agroclimate and Hydrology Research Institute, 2005.

92 Indonesia Report presented at the Fourth Session of the ICG/IOTWS, Mombasa, Kenya, 28 February – 2 March 2007.

and Japan in order to provide high quality and reliable information on earthquake locations and magnitudes. Furthermore, to allow the National Operations Center to process real time information, specially trained and dedicated staff are needed to ensure electronic and physical security of the data collection and ICT systems.[93]

The Situation Center at the BMKG Operations Center has already set up a number of processing facilities from China, France, Germany and Japan. The operations system is the German System SiscomP that provides real time automatic processing with satisfactory results thus far.

BMKG staff have benefited from various training activities. One course sponsored by BMKG, USAID, IOC/UNESCO and USGS, focuses on seismology and tsunami warnings designed to improve understanding of the science of earthquake seismology and tsunami warning system operations. This course targets new employees who will be responsible for the day-to-day operations at BMKG's regional centres across Indonesia. Before the course all participants undergo several weeks of induction training with BMKG.

In addition, BMKG and UNDP organized a Regional Workshop on Strengthening Tsunami Warning and Emergency

---

93   Stuart Weinstein, David Oppenheimer and Harley Benz, *Mission #3: Assessment and recommendations*, PTWC and USGS, December 2006.

Responses: Regional SOP Training on End to End Tsunami Early Warning System for Indonesia, Maldives, Sri Lanka and Thailand.

6.1.5 Volcanic Activity

The estimates of active volcanoes in Indonesia range from 35–220 because there is no standard definition for volcanoes. A volcano can be defined as individual vents, volcanic edifices or volcanic fields. An indication of an active volcano is determined by its historical records, radiocarbon dating or geothermal activities. DVGHM and CVGHM have been monitoring volcanic activity for decades and classify volcanic activity based on historical records:

- Type A – no magmatic (molten rock) or phreatic (steam driven) eruptions since 1600 AD.

- Type B – no magmatic or phreatic eruptions since 1600 AD, but have fumarolic (emitting steam and gas) and solfataric (emitting sulfurous gases) activity.

- Type C – no activities evident except slight or minor fumarolic and solfataric activity.

According to this classification, 80 of the 129 volcanoes defined as active are considered to be Type A and are dotted across Sumatra (12 volcanoes), Java (21), Bali (2), Nusatenggara (20), Banda Sea (9), North Sulawesi (6), Sangihe (5) and Halmahera (5). Volcanoes play a major

---

Box 6: Capacity Built for Seismic and Tsunami Warnings

BMKG's capacity for seismic detection and earthquake and tsunami warning has improved in practice. Following the 27 May 2006 earthquake that occurred in the Indian Ocean 25 kilometres south of Yogyakarta killing 5,782 people, a tsunami warning was issued but later recalled as the tsunami did not materialize.

Following the 17 July 2006 earthquake that occurred off the coast of Java, a tsunami killed more than 600 people. The PTWC had issued a warning 12 minutes after the earthquake and more than 20 minutes ahead of the tsunami. However the warning was not transmitted to the communities in time. People on the coast reported having little or no local warning, and that any given warning messages were confusing.

The BBC reported that InaTEWS was not ready to effectively warn inhabitants and BMKG acknowledged that it was taking scientists 60 minutes to receive and analyse the data from 30 seismological stations and send out a warning. With only a 20-minute interval between the magnitude 7.7 undersea earthquake and the arrival of the waves

on shore, there was insufficient time to warn people. While the global monitoring information effectively reached the government, the authorities have to ensure that messages make the final mile to the people on the coast. The system still had big gaps particularly in using public communication systems, although officials were making use of the Short Message Service (SMS) to contact communities at risk.

On 24 May 2007, an earthquake in the province of Nusa Tenggara occurred at 9:06 a.m., triggering a tsunami alert from BMKG. The earthquake, which BMKG measured at 6.5 and the USGS at 5.5, resulted in no casualties or major damage. BMKG responded rapidly by sending out a message at 9:12 a.m. warning of a potential tsunami to local communities around Sumba Island, but the warning was cancelled shortly afterwards upon confirmation that there was little actual risk of a tsunami.

On 12 September 2007, BMKG had performed competently at Bengkulu earthquake where BMKG issued a warning in less than 5 minutes.

role in soil development and enrichment, and there is a strong relationship between agricultural development, density of population and location of volcanoes. Of the 80 volcanoes that have a recent history of eruption, the greatest concentration (22) is on Java. The greatest population densities occur in the region south and east of Mount Merapi in central Java, where the soil is enriched by volcanic ash and debris. The same pattern occurs in Bali and in northern Sumatra, where the rich soils are directly related to flows from volcanic eruptions, although in central and southern Sumatra the ash and lava are largely acidic, and the resulting soils are relatively poor.

In Indonesia, lahars[94] (mudflows) have killed tens of thousands of people particularly when they were triggered by crater lake outbursts during an eruption (e.g. Kelut, 1919, 1951 and 1966). Lahar monitoring aims at understanding lahar behaviour, which helps to design more effective countermeasures and more useful warning systems. Low-cost lahar monitoring consists of field measurements of flow velocity and discharge at Merapi and Semeru, calculation of sediment concentration, and discharge at the debris flow front and peak flow.[95]

Institutionalized monitoring of volcanic activity has been ongoing since 1920 with the establishment of the Volcanological Survey of Indonesia. By 1984, 81 hazard maps had been developed and by 1995, 65 observation posts had been established – there are now over 70 observation posts. DVGHM is in charge of issuing evacuation alerts, and monitors lahar occurrence in addition to volcanic and seismic activity at several hazardous volcanoes. PU monitors rainfall parameters that trigger lahars; for example, the Sabo Technical Center (Yogyakarta) can issue evacuation alerts based on monitoring a critical lahar-triggering threshold in rainfall intensity and duration, acquired by telemetered rain gauges and radar at Merapi.[96]

6.1.6 Human-made Volcanic Activity

Exploratory drilling in May 2006 by a local gas company pierced an underground chamber of hydrogen sulfide, forcing hot mud to the surface in East Java's Sidoarjo. The sea of mud inundated hundreds of hectares of land and made 15,000 people homeless. It also threatened to swamp a key railway, which was rerouted away from the danger zone.

Attempts were made to stem the mudflow using concrete balls to fill the crater.[97]

6.1.7 Fire

The ENSO is blamed for the dry weather from 1997 to 1998 when millions of acres of forest and agricultural land burned on the islands of Borneo and Sumatra. A team of scientists studied eight affected areas to find out the causes of the fires, preparing maps using satellite imagery.[98] They found that the most important contributing factors were predictable in advance of the fires including weather patterns, previous deforestation, increased human access to forest areas, and, above all, an unsettled land tenure system. In areas where social structures and property ownership are stable, forests were actively protected from large, destructive fires. In areas of unstable land tenure, fires typically burned out of control. The study concluded that the GoI should continue to work on policies to mitigate the underlying problems. Key changes might include establishing fair, impartial, and transparent legal proceedings to resolve property disputes; eliminating perverse incentives for forest conversion to other uses, such as oil palm plantations; developing a better fire protection and management infrastructure; and strengthening the protection of national parklands.

LAPAN's remote sensing applications extend to fire detection, warning and response including 'Smoke Dispersion Modelling'. The BMKG has developed a Fire Danger Rating System (FDRS) and produces daily maps based on real time weather observations from BMKG's synoptic network. BMKG distributes the FDRS maps to resource management agencies and to the public via the Internet and they are used to trigger prevention and preparedness measures during periods of extreme haze risk.

6.1.8 Epidemics

Indonesia faces regional and global issues concerning the spread of a number of infectious diseases, particularly the avian flu. Control of the disease is particularly complex in a country where poultry is kept in more than 30 million backyards. In December 2005, the Ministry of Agriculture endorsed a national Strategic Plan for the Progressive Control of HPAI[99] that includes disease control activities, systematic surveillance and implementation of poultry vaccination. The FAO identified issues in monitoring and warning, including lack of public awareness of the disease, lack of resources for

---

94 Lahar is an Indonesian term that describes a hot or cold mixture of water and rock fragments flowing down the slopes of a volcano or river valley. When moving, a lahar looks like a mass of wet concrete that carries rock debris ranging in size from clay to boulders more than 10 metres in diameter.

95 F. Lavigne, J.-C. Thouret , H. Suwa, and B. Sukatja, *Lahar monitoring and warning systems in Indonesia*, 2006.

96 Ibid.

97 *Terra Daily News About Planet Earth*, "Indonesian mud volcano woe could widen as concrete ball plugs fail," 28 February 2007.

98 Grahame Applegate, Unna Chokkalinggam, and Suyanto, *The underlying causes and impacts of fires in Southeast Asia*, Center for International Forestry Research and Indonesia and International Centre for Research in Agroforestry (ICRAF), 2001.

99 The highly pathogenic avian influenza is the deadliest form of the disease that is responsible for fatal outbreaks in Asia, Europe and Africa.

small holders to change their husbandry practices and for vaccinations, and inappropriate monitoring systems that fail to report effectively and control the movement of sick birds. The FAO is supporting a community-based programme to educate community members and local veterinarians to carry out monitoring.[100]

Good practice in monitoring infectious disease occurred after the 2004 tsunami when the Ministry of Health and partners acted quickly to establish the Early Warning and Response Network (EWARN) system that kept epidemics at a minimum. A tuberculosis epidemic was avoided by documentation of new cases and medicines, and educating the population about how to recognize symptoms. Sources of EWARN information were health facilities, and clinical and public health laboratories in affected districts. Diseases with epidemic potential were targeted (acute watery diarrhoea, bloody diarrhoea, dengue, fever of unknown origin, acute jaundice, measles, meningitis, and malaria), as well as acute respiratory infections and tetanus. Data collected on morbidity and mortality were compiled on a weekly basis complemented by an immediate alert system based on daily telephone calls, text messages and email reporting of suspected cases. Any alert led to verification, investigation and response, jointly carried out by the Provincial Health Offices.[101]

Summary of Main Points

1. Monitoring and warning services are relatively well developed in Indonesia. However, monitoring information and warning does not consistently reach the vulnerable public. BMKG requires more capacity to speed up warning time, communities need to be capacitated to strengthen community monitoring and early warning, and policies are needed to address the social, economic and environmental causes of floods, landslides and fires.

2. One multi-hazard monitoring and warning service is SIMBA developed by LAPAN that provides warning for most weather- and climate-related hazards such as flood, drought, extreme weather and forest fires. Other systems include the Forest Fire and Flood Warning System.

3. Major determinants of floods include the intensity and duration of rainfall, the condition of river channels, and the existence of lowland areas and human settlements. The Water Resources Law No. 7 of 2004 promotes a 'whole river basin' management concept. Monitoring is undertaken by the PU and BMKG. EWS based on telemetry

have a high failure rate due to inadequate budgets, lack of proper maintenance and inadequate staff.

4. Landslides frequently occur in the rainy season during heavy rainfall, particularly in areas with denuded forests. LAPAN uses satellite data and remote sensing applications, and has developed the 'potential flooded area monitoring system' that includes landslides. Landslide prediction is reasonably accurate but must be communicated in advance of the rainy season and in practical terms that can be understood by the community.

5. Environmental degradation, such as deforestation, contributes to drought along with the ENSO. The great drought of 1997–1998 necessitated the import of over 5 million MT of rice. BMKG is the main agency responsible for producing climate forecasts and manages a National Seasonal Forecasting Working Group. LAPAN and WFP produce an Early Warning Bulletin.

6. InaTEWS was inaugurated on 22 November 2008 and its full operation is expected by early 2010. MENKO KESRA issued decrees that detail the roles and responsibilities of 20 institutions for InaTEWS (see section 4.3.1).

7. BMKG is responsible for the seismic monitoring system and hosts the National Operations Center. It requires improvements to optimize performance, use inputs provided by donors and process real time information. The performance of BMKG in prediction and warning is improving.

8. DVGHM classifies volcanic activity based on historical records with 80 of 129 volcanoes having a recent history of eruption. The great population density around Mount Merapi in central Java signifies elevated risk. Institutionalized monitoring of volcanic activity including for lahars is well established, and the DVGHM is in charge of issuing evacuation alerts.

9. Fires have been attributed to weather patterns, previous deforestation, increased human access to forest areas, and, above all, an unsettled land tenure system. LAPAN's remote sensing applications extend to fire detection, warning and response including 'Smoke Dispersion Modelling'. BMKG has developed a FDRS and produces daily maps based on real time weather observations.

10. In 2005, the Ministry of Agriculture endorsed a National Strategic Plan for the Progressive Control of HPAI that includes disease control activities, systematic surveillance and implementation of poultry vaccination. The FAO identified lack of public awareness and inappropriate monitoring systems as constraints. The EWARN system kept epidemics at a minimum after the 2004 tsunami.

---

100 A. Finzi, E. Guerne Bleich and A. Rhissa, *The control of avian influenza in Indonesia: A community based approach*, April 2006.

101 "Epidemic-prone disease surveillance and response after the tsunami in Aceh Province, Indonesia," *Weekly Epidemiological Record*, Vol. 80 (18), 2005, pages 160–164.

Recommendations for Stakeholders[102]

- Strengthen capacity of BMKG (engaged in monitoring and warning, among others) and the communities to disseminate monitoring information and early warning messages. Work on reducing information gaps between BMKG and other organizations monitoring various hazards, including central authorities, local authorities and community groups.

- Ensure that resources are available for monitoring and warning by lobbying with the local government (PEMDA) and DPRD (local/regional parliament) to allocate sufficient funds, human resources and support for maintenance of monitoring systems.

- Continue to enhance support for BMKG and the wider network of relevant agencies for development of the InaTEWS forecasting and warning system.

- Involve NGOs such as the PMI and the private sector to push socialization and local capacity development.

- Ensure community participation from the beginning to develop trust and ownership of the monitoring and warning system, as well as avoid vandalism of equipment.

---

102 These recommendations are a synthesis of those made by interviewees in the UNDP ILS EWS process as well as those mentioned in the National Workshop Report for Tsunami Early Warning Systems in Indonesia, jointly organized by RISTEK and UNDP in September 2007.

7 Dissemination and Communication

The aim of dissemination and communication for EWS is to develop systems that ensure local, national and regional coordination and information exchange. This chapter discusses issues affecting institutional decision-making for warning, communication, social networks and technical systems used to generate warnings and the various warning messages. Significant effort is required to do the groundwork that would facilitate efficient and effective multi-hazard warning dissemination and communication to all of Indonesia.

The following issues in dissemination and communication have been identified:

- There are separate systems for dissemination of warnings and communication for different hazards.

- SOP require formalization for government information exchange among government staff, with media and civil society, and for coordination of responsibilities to inform the general public.

- Central and provincial authorities express fear of issuing false alarms due to potential negative legal effects and/ or public outrage. They worry about the margin of error in analysis but false alarms can be triggered by several factors.

- Technical information and communication systems are not up to international standards for effective exchange of data.

Dissemination and communication mechanisms must be continuously operational, effective and tailored to the needs of different user communities. Accepted good practices offer indications of direction for the development of effective dissemination and communication systems:[103]

- Dissemination must be based on clear protocols and procedures and supported by an adequate telecommunications structure.

- Systems for communication with internal and external actors should be based on internationally agreed standards and they should all work smoothly together.

- National warnings must reach remote areas using non-technical social networks if needed, and be based on a clear chain of command to ensure that all those in need receive the message.

7.1 Institutional Roles in Warning Dissemination and Communication

The roles and lines of communication for warning dissemination are generally set out in institutional frameworks and flow charts. Indonesia's decentralized system of governance, interfaced with the decentralized system for DRR, offers the potential for timely and effective warning dissemination and communication, and reaching the last mile. However, for people vulnerable to more than one hazard, which may include many Indonesians, there may be potential for confusion due to a variety of authorities and sources of messages. In a discussion paper entitled *Status of Tsunami Warning Chain on the Community Level* prepared by GTZ in September 2007 based on experiences in three pilot areas, the following issues were identified:

- There are only a few official authorities who operate 24/7 to receive direct warning from BMKG, there are no SOP for police and military, and it is unclear how the public will be informed.

- SOP to guide evacuations ordered by local decision makers are not in place.

- Communication systems are subject to power outages and failure, so alternatives such as sirens and mosque loudspeakers are important.

- Most local stakeholders involved in warning dissemination are unfamiliar with the actual general warning format from BMKG.

The designation of responsibility for information collected as a basis for early warning is as follows:[104]

- Alert from BMKG (earthquake, tsunami, heavy rain, flood, and drought)

- Spatial Information from BAKOSURTANAL (hazard map, landslide, coastal data)

- Alert from LAPAN (hot spot for forest fire, climate forecasting)

---

103 UN Global Survey of Early Warning Systems, March 2006.

104 BAKORNAS PB presentation, 2005.

- Alert from DESDM (volcanic eruption, landslides)

- Alert from Ministry of Forestry (forest fire)

- Information from PU (floods, landslides)

- Information from Ministry of Agriculture (drought)

- Information from local government (all hazards)

The actual warning message to the public will come from:

- Earthquake/tsunami – BMKG, DESDM

- Forest fire – LAPAN, Ministry of Forestry

- Flood – PU

- Drought – Ministry of Agriculture

- Volcanic eruption – DESDM

- Oceanic disaster – LIPI, BPPT, DKP, BMKG

The authority for warning is spread among the organizations mentioned above and not vested in one unified institution. Most relevant legislation is unclear on who has the ultimate authority. The President is clearly vested with authority to declare an emergency but his role with regard to warning ahead of a disaster is unclear. The Government Regulation in the form of Law Substitution No. 23 of 1959 is the closest to giving the President authority to announce a dangerous situation.[105]

Two regulations are important for the dissemination of warnings but each has weaknesses. The Government Regulation No. 50 of 2005 concerning the Performance of the Private Broadcasting Institutions gives broadcasters the responsibility to widely disseminate early warning information originating from GoI official sources and provide information to help the affected society deal with the disaster situation. However, it does not stipulate timing for effective dissemination and does not describe the issuing government institutions.[106]

The Regulation of the Minister for Communication and Information No. 20/P/M.Kominfo/8/2006 "Concerning Early Warning for Tsunamis or Other Disasters Through Nationwide Broadcasting Services" states that radio and television stations have the responsibility to stop an ongoing broadcast to transmit warnings. When warning information is received from BMKG, it must be transmitted as soon as possible followed by a high tone alarm for 30 seconds. The regulation also imposes penalties for violations; however, it differs from Regulation No. 50, a higher level legislation.[107]

Regulation No. 50 pertains to all disasters while No. 20 largely pertains to earthquake and tsunami warnings via BMKG.

There is a fear of triggering false alarms, particularly for earthquakes and tsunamis. For instance, prior to the July 2006 earthquake, tsunami warnings were not issued to the public, which resulted in over 600 deaths and many casualties perhaps because all data had not yet been received and analysed, and authorities feared that unnecessary panic might occur. As the InaTEWS monitoring system develops capacity to receive and analyse real time data, the potential for false alarms can be expected to diminish. Since Indonesia is extremely disaster-prone, many communities are prepared to evacuate, for example, in order to escape potential floods and volcanic activity. On the other hand, recent events indicate that the government and public need to prepare for different types of false alarms such as those due to the malfunctioning of equipment or even hoaxes intended to cause panic.

Floods and landslides. All developed river basins in Java (11), Sumatra (3) and Sulawesi (2) have emergency plans and EWS. Water level measurements are telemetrically centralized and sent to provincial authorities in respective Crisis Centers and other officials such as the Lurah (civil servants responsible to the Camat). The SATKORLAK (province), SATLAK (district or river basin level) and POSKO (sub-district) transmit flood warnings every three hours and one hour if needed based on monitoring information they collect, and prepare to implement flood fighting actions and response measures. There are four alert levels for floods. The weakness of the flood EWS is the link to the affected communities who are frequently the last to be alerted. Community-based flood preparedness, community access to flood hazard maps, and training and access to communications is therefore critical.[108]

Earthquakes and tsunamis. The regional IOTWS and the InaTEWS have contributed to enhancing national and international communications and identifying gaps in technical and societal systems. Information on the development of InaTEWS is now available to stakeholders who can access it on the Internet through the Jakarta Tsunami Information Centre (JTIC) working under the IOC in the UNESCO Jakarta office.[109] The JTIC website, available in Bahasa and English, provides updates and explanations of the technical development of InaTEWS (upstream, see below) and community preparedness for tsunami threat (downstream), tsunami education and promotional materials on tsunami preparedness, pertinent activities, news and articles, and a discussion forum on, for example, the establishment of SOP.

---

105 Anthony D. M. Sihaan, *Legal Framework for Disaster Management Particularly in the Field of Early Warning*, GTZ, December 2006.

106 Ibid.

107 A government as opposed to a ministry regulation – see hierarchy of legislation in Chapter 2.

---

108 Dr. Sutardi, *Action Report toward Flood Disasters Reduction: Indonesian case*, Indonesian Water Partnership, 2005.

109 Funded by the Canadian International Development Agency.

Box 7: Community-based Flood Monitoring and Warning in Jakarta

The Action Contre la Faim (ACF), with funds from DIPECHO, has been implementing a Community-based Disaster Risk Management Programme (CBDRM) for vulnerable people living in slum areas exposed to and affected by floods since 2003. This project is seen as part of the end to end EWS. ACF is currently working in three flood prone low-income areas of the special capital district (PEMDA DKI) of Jakarta – Kampung Melayu, Cipinang Besar Utara and Penjaringan – aiming to strengthen local capacities on integrated disaster risk management, raising public awareness, leading to better response capacity to flood and other extreme events, and reinforcing integrated and people-centred EWS. Problems identified in the EWS point to lack of systematic dissemination of flood warnings. Furthermore, warnings are not always trusted or acted upon.[110]

Indicators for flood warning in Jakarta are water levels in the rivers, mean sea level readings and rainfall depth. Water levels are observed in seven stations and Jakarta has 93 water gates to regulate water depth that are distributed in 33 locations. The water level stations and water gates are managed by PU and PEMDA DKI Jakarta. Rainfall is measured in a number of rainfall stations managed by BMKG. Communities in vulnerable areas are active in observing water levels. All relevant data is sent to the Provincial Public Works Office (DPU) of DKI Jakarta and also to the Crisis Centre of SATKORLAK PB, and translated into warnings by DPU DKI Jakarta to issue flood information to decision makers.[111]

The flood warning is communicated to the community using radio, walky talky, SMS, phone (fixed-line and mobile), facsimile, TV running text and the Internet. The Lurahs have mobile phones and a hotline to the Crisis Centre. The DPU DKI communicates flood warnings to some community leaders using the phone, but this practice is not yet widespread. The community may communicate its own readings and ask the DPU DKI for flood warning information. DPU DKI has set up a communication system for flood warning so all responsible persons will receive real time information on water levels as well as the status of the flood alert through their mobile phones.[112]

The effectiveness of the warning is hampered by the shortage of staff at the Kelurahan level and limited facilities for announcing the warning, such as loud speakers or sirens. In addition, flood warning information does not specify flood height and duration. People may therefore assume that a normal flood level is expected when it may be more serious. When an extreme flood is expected to occur, dissemination of warnings should be more intensive so that local governments and communities can prepare.[113]

Earlier experience from the 2003–2004 phase of the ACF project in Kampung Melayu has provided lessons and good practices for ACF and the community in disaster preparedness for floods. During this period baseline surveys and studies were conducted, awareness raising campaigns were organized, and coordination mechanisms were established including the development of a contingency plan. Hazard Vulnerability and Capacity Assessments and Damage, Needs and Capacity Assessments were among the tools used in the community.

Some of the challenges included the need to address underlying causes of urban community vulnerability such as the political and social tensions among crowded communities, the weak experience on the part of youth in making decisions (rather having an inclination to follow) and the tendency to avoid responsibility for keeping a clean environment. Although many women contribute significantly to their families' livelihoods, women's capacities to support CBDRM require special attention and strengthening in a male dominated society. The strategy for effective CBDRM in poor urban communities needs to include policy and legal advocacy to urge government to provide equitable public services, and appropriate infrastructure and equipment to help communities deal with prolonged flooding.

---

110 Edward Turvill, "Supporting End to End Flood Early Warning Systems in South East Asia: ACF's Experience," presentation made at the Third International Conference on Early Warning: From concept to action, Bonn, Germany, 27–29 March 2006.

111 German Indonesian Cooperation for Tsunami Early Warning System, *Capacity Building in Local Communities Early Warning Experiences for Flood, Volcano & Forest Fire in Indonesia and Tsunami in Pacific Region*, Working Document No.7 Baseline-Study, December 2006.

112 Ibid.

113 Op. cit.

A series of four SOP workshops[114] that took place between October 2006 and May 2007 focused on warning and information dissemination including the development of a dissemination strategy that includes interconnecting policies between national and local levels, tools and equipment for warning dissemination, SOP for warning dissemination at the local level, and appropriate phrasing of warning messages that can be understood by the community. The participants at the Workshop for Developing SOP for TEWS for NAD Province (April 2007) identified the following aspects of dissemination and communication that require significant development. Work in these areas had just been started or was about to start at the time.

- Warning communication technology reaches all parts of the community, including temporary or isolated parts of the community

- Consistent systems for multi-hazard warnings

- Two way communications to enable verification by the authorities that communities have understood the messages

---

114 The series of workshops for the development of SOP is sponsored by UNDP, USAID/IOTWS, GTZ and PMI/IFRC. These workshops have taken place in Bali (October), Padang (November), Jakarta (January) and Aceh (April). The main objective is to strengthen capacities in local communities to develop SOP for TEWS by supporting a learning process for three regional teams who will act as outreach agents in their communities.
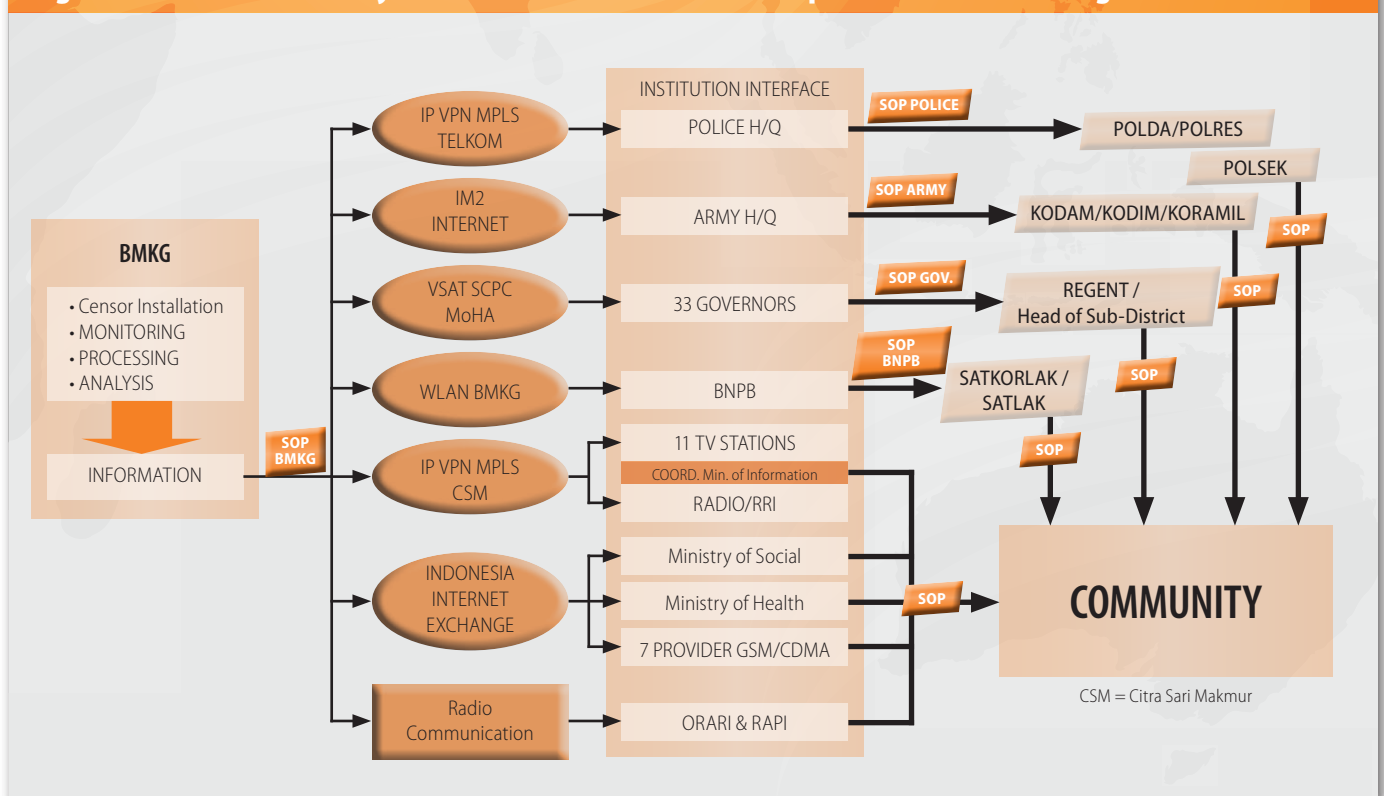
- Redundancies built in to ensure back-up of the system when one system fails

- Warning messages are adjusted to special needs including cultural, social, gender, language and education levels

- Warnings are addressed to those at risk and are area-specific

- The messages are integrated for those who need to take special action such as protection of farm animals

- Warning signs are clearly recognized

- Information is provided to the community when the danger is over

- Studies are conducted on how people interpret early warning messages and the lessons are disseminated to stakeholders
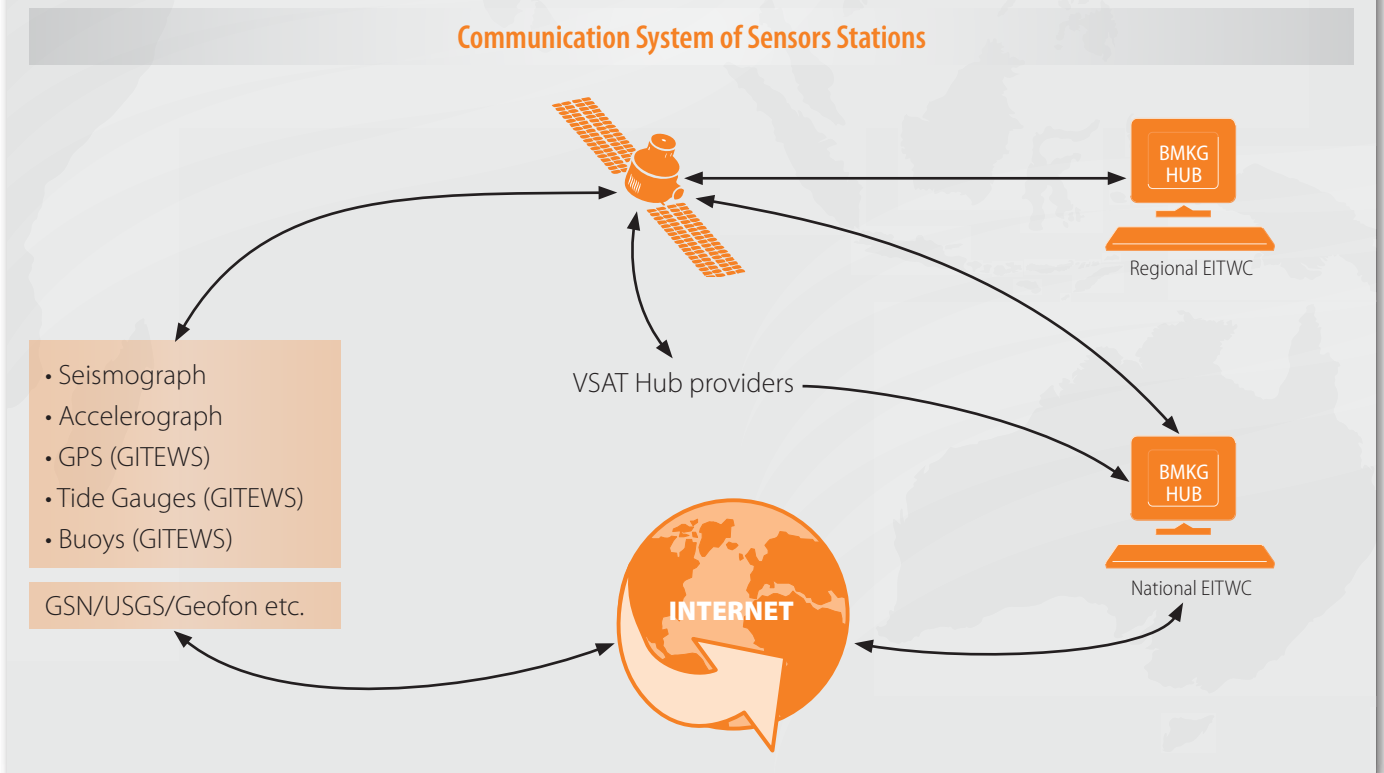
7.2 Communication Systems and Technology

Earthquakes and tsunamis. The InaTEWS ICT system includes upstream data communication and downstream information communication. Upstream data communication consists of transmission of data from the data acquisition system to the regional and national centres. The data are produced through automatic seismic data processing that relays earthquake parameters such as origin time, epicentre,

Figure 6: Communication System for Dissemination of Earthquake/Tsunami Warnings

CSM = Citra Sari Makmur

Figure 7: Sensor Stations and HUBs

Communication System of Sensors Stations

- Seismograph
- Accelerograph
- GPS (GITEWS)
- Tide Gauges (GITEWS)
- Buoys (GITEWS)

GSN/USGS/Geofon etc.

VSAT Hub providers

INTERNET

BMKG HUB — Regional EITWC

BMKG HUB — National EITWC

depth, magnitude of body-waves and the P-wave (a body wave that travels through the earth, the first detected). Other automatic data processing includes information received from DART buoys and from GPS that relays the coordinates and the time series changes. These data determine whether a tsunami will occur or not; this analysis is then communicated to stakeholders who move it through the downstream network. Several countries including Indonesia, Malaysia, Sri Lanka and Thailand are sharing their seismic data on a real time basis through the Internet, which allows countries that do not have their own network to be able to detect tsunamigenic earthquakes.

The upstream data communication is composed of five main components: equipment sensor, data submission, regional centre, national centre and media transmission. The data is sensed by equipment located in the sea, such as the DART or GPS buoys, or on land, such as seismographs. The acquired data is submitted to a regional centre from stations under its coordination and further processed to increase reliability. These centres then transmit the information to the national centre and to local communities in their vicinity using appropriate channels, such as local government agencies, police, etc. Some stations that may not be connected to a regional centre, transmit the data to the national centre directly. The German-Indonesian Tsunami Early Warning System is aiming for real time communication of sea level and seismic data.

Regional centres transmit data to the national centre, process, back-up, store acquired data and disseminate information, including early warnings, to the surrounding countries through appropriate channels and means. The national centres compile data from regional centres and data acquisition stations, and make decisions as to whether a tsunami will occur or not. The decision is made by comparing the recently acquired data with the database and then conveying the tsunami warning through various media including: 1) fixed lines (telephone, fibre optics, etc.); 2) wireless (satellite, microwave, etc.); and 3) mixed data communication.

The management of downstream information communication involves exchange of information among regional centres, national centres, and government and local authorities that include governors, district mayors, police, and TNI, among others. The president and his cabinet ministers obtain the information from national centres. Information released by the national centre must be authorized. Authorized information may be sent by using hand signs, stamps, recognized numbers, encrypted codes (such as fingerprints), and through media organizations.

The dissemination of early warning messages is undertaken in several ways including by telegraph, telephone (mobile, fixed), facsimile, TV, radio, cellular operators, mosques, churches, kentongan (hitting bamboo), and sirens. The most efficient and timely thus far is SMS via the Global Systems

for Mobile (GSM) communications available through mobile phones using two main national providers, Telkomsel and Indosat. The earthquake information is sent out via two specifically allocated short numbers and also by dialing long numbers of mobile phones, engaging other providers to ensure redundancy.[115]

A system supported by the USAID-funded IOTWS Program called RAdio and InterNET for the Communication of Hydro-Meteorological and Climate Related Information (RANET) contributed to a live drill in Indonesia. The system works by sending information into the warning system, which then prompts local operators to sound an alarm or otherwise instruct participants in the drill. NOAA developed the system to reach the 'last mile' in remote locations. To move critical information from city centres to rural populations, RANET has combined satellite broadcast capacities with Internet applications and the use of FM radio, HF radio and other terrestrial broadcast capacities.

A useful system is the 'five-in-one' system of information where receiving addresses with servers can act as a server in the InaTEWS centre, and can trigger an alarm to warn
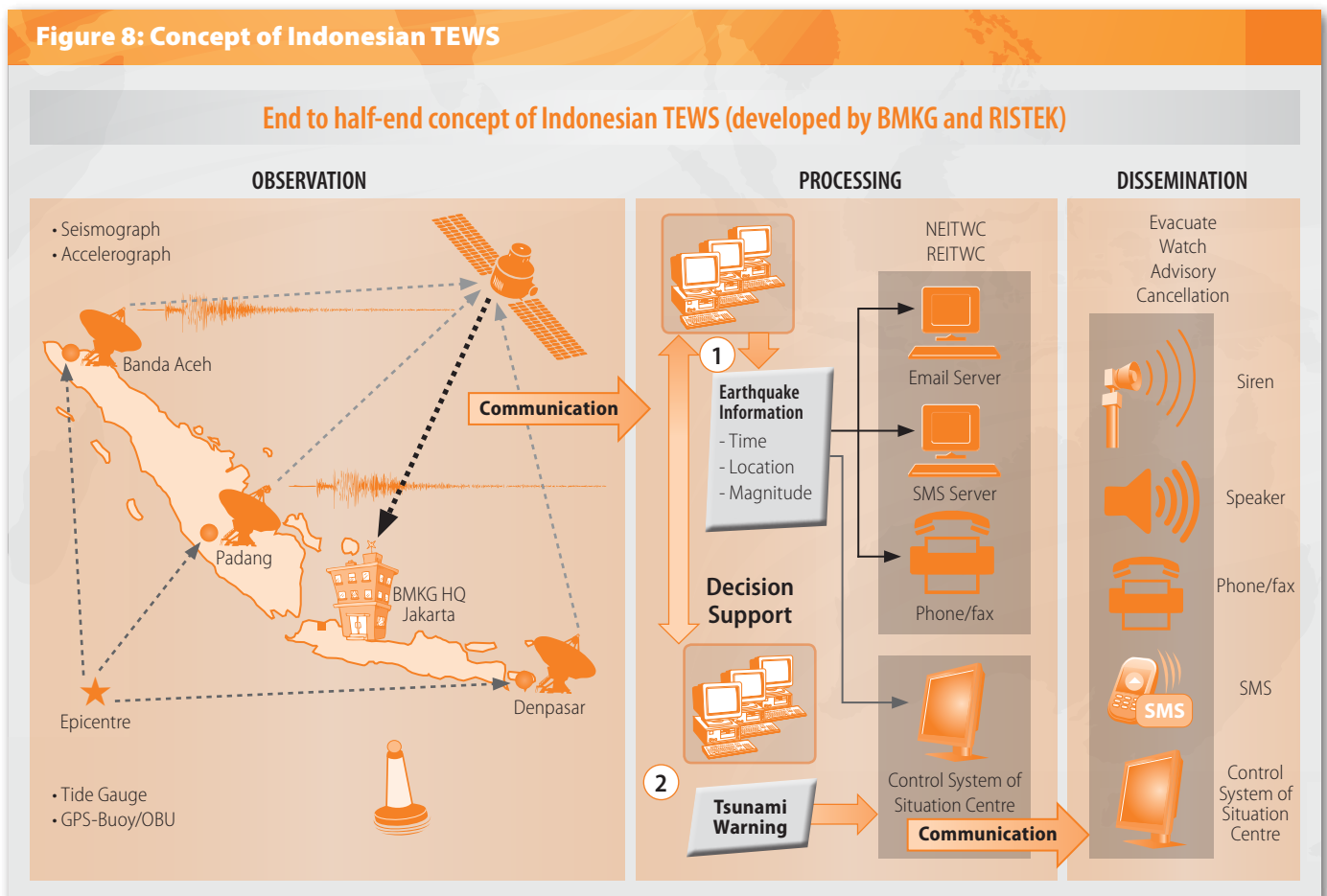
the operator; send out the information via SMS, automatic facsimile and website; and convert the text message into voice message (not yet in operation). This five-in-one system works by a message sent out from BMKG via several communication systems such as the Internet, RANET, leased channel, very small aperture terminals, and multiprotocol label switching virtual private networks. As of March 2007, the five-in-one system had been installed in more than 15 locations. To further expand the five-in-one system, NOAA donated 150 RANET receivers and more than 50 servers.

The following media actors are involved in the EWS:

- Television – TVRI (all Indonesia), RCTI, SCTV, SCTV, GLOBAL TV, METRO TV
- Radio – RRI (all Indonesia), Elshinta, Sonora, and others
- Satellite – PSN, Telkom (all Indonesia)
- Cellular operator (GSM) – Telkomsel, Indosat, Exelcom
- Cellular operator (CDMA) – Mobile-8, Flexi, Starone, Esia

Volcanic Activity Warning. EWS and effective countermeasures against volcanic eruptions and lahars have ensured successful evacuations (over 20,000 people were

---

115 Indonesia Report presented at the Fourth Session of the ICG/IOTWS, Mombasa, Kenya, 28 February – 2 March 2007.

Figure 8: Concept of Indonesian TEWS

End to half-end concept of Indonesian TEWS (developed by BMKG and RISTEK)

evacuated from Mt. Merapi in May 2006). CVGHM utilizes a system with four levels of alert:

- Alert 1 (Code Green – Active Normal) – No activity based on monitoring visual seismicity and other events. No eruptions in the foreseeable future.

- Alert 2 (Code Yellow – Danger/Waspada) – Increased seismicity and other volcanic events such as gases; visual changes around the crater and magmatic, tectonic or hydrothermal disturbances. Eruption is not imminent, however due to the increased danger, local officials should prepare for a disaster.

- Alert 3 (Code Orange – Ready to Erupt/Siaga) – Rapid rise in seismicity accompanied by obvious visual changes in the crater. Large eruption possible within one-to-two weeks, depending on data analysis.

- Alert 4 (Code Red – Active Danger/Awas) – Begin evacuation due to small eruptions and/or potential for a large eruption spewing ash, lava and gases. A major eruption is imminent, possibly within 24 hours.

These alert levels do not specify the size and explosiveness of anticipated eruptions since these factors vary widely from volcano to volcano and even at the same volcano. Volcanologists typically use the history of eruptions at a volcano, or at similar volcanoes worldwide, to forecast the likely size of anticipated eruptions. Although the public and the media tend to focus on large eruptions, most volcanic activity leads to no eruption at all or only small/middle-sized eruptions. However, even small eruptions can disrupt the lives of people living near volcanoes, and cause problems for aircraft and sensitive facilities downwind. Clouds of volcanic ash can damage aircraft, and even light ash fall can close airports and adversely affect people with respiratory problems.

Volcanic activity and stages of warning in Indonesia are clearly posted on various websites, including national monitoring agencies and others such as the US Embassy website. The Ministry of Culture and Tourism posts news features that visitors can use to update themselves on the latest warnings and alerts. As a response to the escalating alert levels for volcanic activity on Mt. Merapi in 2006, local authorities in Yogykarta and Central Java took steps to prepare the people at risk and warned vulnerable families to be vigilant and asked some to move to safer areas. The SATLAK PB for Klaten and Mageland districts had identified the people at risk on the mountain slopes and local authorities began evacuations. However, there was reluctance on the part of some communities to leave their homes (as they feared losing their livestock and belongings) until Alert Level 4, Code Red or Awas that signifies compulsory evacuation, was issued.[116]

---

116 IFRC Information Bulletin, "Indonesia – Mt. Merapi volcanic activity," 24 April 2006.

On 14 December 2006, CVGHM increased the alert status for Mt. Soputan in North Sulawesi, to Alert Level 3 due to increased volcanic and seismic activity, including an average of 75 daily tremors, more than 100 daily lava falls and the emission of thick smoke from the active volcano. On 17 December, a similar statement was issued about Mt. Talang in West Sumatra. Mt. Talang has been at Alert Level 3 since early September 2006. The Mt. Talang monitoring officer warned people to avoid traveling within 3 kilometres (1.9 miles) of the peak. Mt. Talang has produced roughly 80 tremors a day and continues to spew hot gas as high as 700 metres. Local government authorities also warned people living near Mt. Merapi to be alert for possible volcanic material floods linked to the accumulation of 6 million cubic metres of volcanic materials on the surface of the volcano that may fall into local rivers because of heavy rains. In March 2007, thousands were evacuated from Lemaba Island as Mt. Batutara spewed ash and lava. As of 31 May 2007, Soputan was on Alert Level 3 and nine volcanoes remained on Alert Level 2: Karangetang, Talang, Bromo, Merapi, Semeru, Anak Krakatau, Lokon, Dukono, and Ibu.

Summary of Main Points

1. Significant work is required for efficient and effective multi-hazard warnings to reach all of Indonesia. There are separate warning systems for most hazards, and SOP for information exchange among government staff, media, civil society and the public require formalization.

2. The responsibility for issuing alerts rests with BMKG for earthquake, tsunami, heavy rain, flood and drought; BAKOSURTANAL for hazard mapping, landslide and coastal data; LAPAN for hot spot for forest fire and climate forecasting; DESDM for volcanic eruption and landslides; Ministry of Forestry for forest fire; PU for floods and landslides; Ministry of Agriculture for drought; and local government for all hazards.

3. The actual warning messages come from BMKG and DESDM for earthquake and tsunami; LAPAN and Ministry of Forestry for forest fires; PU for floods; Ministry of Agriculture for droughts; DESDM for volcanic eruptions; and BMKG, BPPT, DKP and LIPI for oceanic disasters. Most relevant legislation is unclear on who has the ultimate warning authority. The Government Regulation as Law Substitution No. 23 of 1959 is the closest to giving the President authority to announce a dangerous situation. The Government Regulation No. 50 of 2005 gives broadcasters dissemination responsibilities but does not stipulate timing or list the issuing government institutions.

4. All developed river basins in Java, Sumatra and Sulawesi have flood emergency plans and EWS. The SATKORLAK, SATLAK and POSKO transmit flood warnings; there are four alert levels for floods. The weakness of the flood

EWS is the link to the affected communities who are frequently alerted at the last minute. This is often due to shortages of staff, lack of sirens and lack of detailed information regarding flood height and duration.

5. A series of four SOP workshops focused on the development of a dissemination strategy and identified numerous weaknesses, mostly regarding the community's ability to receive and understand warning messages, and to provide feedback to authorities on the receipt and interpretation of messages.

6. The InaTEWS ICT system includes upstream data communication that involves transmission of data from the acquisition system to the regional and national centres. Several countries including Indonesia, Malaysia, Sri Lanka and Thailand share their seismic data on a real time basis. The data is sensed by the DART or GPS buoys or seismographs. The national centres make decisions as to whether a tsunami will occur.

7. Downstream InaTEWS information communication involves regional centres, national centres, and government and local authorities that include governors, district mayors, police, and TNI, among others. The president and his cabinet ministers obtain the information from the national centre.

8. There is a fear of triggering false alarms, particularly for earthquakes and tsunamis. For instance, prior to the July 2006 earthquake and tsunami, warnings were not issued to the public, which resulted in over 600 deaths and many casualties perhaps because all data had not yet been received and analysed, and authorities feared that unnecessary panic might occur. As the TEWS monitoring system develops capacity to receive and analyse real time data, the potential for false alarms can be expected to diminish.

9. The dissemination of early warning messages is undertaken through numerous methods, the most effective being SMS. A system supported by IOTWS is the RANET that contributed to a live drill in Indonesia. A useful system is the 'five-in-one' system where receiving addresses with servers can act as a server. Media actors involved in the EWS include many TV and radio stations.

10. For volcanic eruptions and lahars, CVGHM utilizes a system with four levels of alert; most volcanic activity leads to no eruption or only small/middle-sized eruptions that can still disrupt lives. Stages of warning are clearly posted on various websites and disseminated to communities but some communities will not leave their homes until the highest alert, due to fear of losing possessions.

Recommendations for Stakeholders[117]

- Unify the concepts of warning dissemination and communication across organizations through development of a clear strategy/plan and flow-chart supported by cross-organizational SOP. Clarify the roles of information providers and distributors, and ensure that relevant stakeholders understand these roles and how they are linked.

- Upgrade technical information and communication systems to international standards to allow information from BMKG to be swiftly disseminated to communities. The communication instruments and system may need to vary with the area, and traditional instruments and systems may need to be revitalized.

- Strengthen the community's ability to understand and act upon messages. Obtain consensus in communities and among various levels of authorities on the appropriate local warning system.

- Facilitate feedback from the community on and promote circulation of messages in/by the community. Local wisdom and experience should be integrated into the InaTEWS and other EWS.

- Develop a cohesive approach for dealing with the impact from false alarms, including those due to the malfunctioning of equipment or hoaxes itented to cause panic, and for enhancing public understanding of the need for warnings.

- Strengthen public perception of warnings as protective mechanisms. Conduct an intensive and long-term media campaign on the warning messages using examples from successful national and community-based information campaigns.

- Support development of media partnerships in EWS, at national and at local levels.

---

117 These recommendations are a synthesis of those made by interviewees in the UNDP ILS EWS process as well as those mentioned in the National Workshop Report for Tsunami Early Warning Systems in Indonesia, jointly organized by RISTEK and UNDP in September 2007.

8 Response Capacity

The aim of this key element is to strengthen the ability of communities to respond to warnings and disasters through enhanced awareness of natural disaster risks, coping mechanisms and EWS functions. A technically sound warning is ineffective if people do not know how to respond. Successful warnings should activate an orderly movement of people out of harm's way and motivate people to cope with their situation by securing their assets and seeking shelter. Post-disaster response implies the wider range of relief, recovery, rehabilitation and reconstruction efforts in the aftermath of disasters. Both response to warning and response to disaster are part of disaster preparedness and are most effective when they employ clear standards and procedures as well as empower communities to participate.

The following issues have been identified in Indonesia's response capacity:

- While public education, awareness raising activities and warning response practice drills are increasing, coverage of vulnerable areas by drills and evacuation information is not adequate.

- Numerous critical activities for effective response to warnings have not yet begun or just been initiated in both Aceh/Nias and other areas.

8.1 Planning for Response to EWS and Evacuation Drills

The Law on Disaster Management mandates regular evacuation drills and practices. The law however, does not specify roles of institutions in the drills, the frequency of the drills or standards for the effectiveness of drills. Several tsunami evacuation drills in Indonesia have helped prepare vulnerable populations for real emergencies. Several highly publicized drills organized to commemorate the 2004 tsunami have served as examples to the entire region, and the inclusion of a wide range of national and international stakeholders ensured that lessons and good practices would be retained. The first tsunami drill was conducted in Padang city in West Sumatra on the first anniversary of the 2004 tsunami, and another at the end of 2006 in Bali, the most popular tourist destination in Indonesia. The exercise in Bali was carefully designed as an end-to-end EWS simulation, involving institutions at all levels and communities, and included:

- Development of a tsunami model, and composition of a drill scenario using wave height and wave travel time from the model;

- Determination of evacuation routes and shelters, and construction and installation of sign boards;

- Two months before the drill, awareness raising activities, including training of trainers, table-top simulations, community preparedness, exhibitions and rehearsals of the drill; and

- A media campaign managed by KOMINFO.

On the day of the drill, the detection of an earthquake and issuance of the warning by BMKG was simulated for the city of Denpasar. The mayor of the city switched on the sirens and 15,000 people participated in the evacuation. The RANET was used to prompt local operators to sound an alarm or instruct participants. At the evacuation site, the construction of emergency hospitals and media centres were demonstrated. After BMKG gave an 'all clear', search and rescue operations were simulated and victims were transported to the hospitals.

On 26 December 2007 the tsunami evacuation drill was held in Banten, and in 2008, the drill was held in three locations simultaneously: Manado, Gorontalo and Yogyakarta. BMKG, with the support of UNDP deployed six personnel to observe the 2008 national tsunami drill to: gather lessons learnt from the drill; analyse gaps and progresses from the 2005, 2006, 2007 and 2008 tsunami drills; and increase the awareness of key stakeholders (central government, local authorities and communities) concerning SOP, local preparedness and identification of evacuation sites. During the tsunami evacuation drills, exhibitions, coordinated by LIPI, were held to raise public awareness.

Indonesia has also been participating in the Pacific-wide tsunami exercise of 2006 and 2008 organized by IOC/UNESCO. The aim of this exercise is to motivate countries to review and test their response procedures, test the interoperability of different systems, and evaluate the issuance of warning messages by the tsunami warning centres. For the Indian Ocean Tsunami Wave Exercise 2009 (IOWave09), the 2004 tsunami will be used as the scenario for the exercise and the warning will be issued from BMKG. There are plans to include full evacuations and drills in Banda Aceh and other parts of the country. Leading up to IOWave09, InaTEWS key stakeholders (RISTEK, BMKG, LIPI, BPPT, BAKOSURTANAL) are

planning a series of workshops related to EWS, role of media in disseminating warning and SOP.

Despite several well publicized drills, the majority of earthquake and tsunami-prone areas have not yet undertaken drills. Areas such as Aceh and Nias Island are extremely vulnerable due to the still-under-developed TEWS and the high potential for earthquakes. The IFRC and PMI's assessment of 63 villages indicated that they are physically highly exposed since there are few barriers between communities and the sea.

Box 8: Lessons for Response Learnt from False Alarms

On 4 June 2007 at 11:30 am, a siren that had been installed near Banda Aceh (in Kaju district) went off accidentally perhaps due to a short circuit and sounded for 30 minutes until its power supply was cut off by angry residents. Later the same day the siren in Ulee Lheu in nearby Lhoknga sounded accidentally and frustrated residents threw rocks at its electrical panel.[118] Tensions were also heightened when hoax text messages were circulated warning of a tsunami in the Nusa Tenggara region on 7 June. Many thousands left their homes and refused to return despite reassurances that the text was not an official warning.[119]

What are the implications of these false alarms for development of an effective EWS? They might serve as indicators of the public's readiness to respond to a genuine warning and be used to identify lessons and good practice. They also call into question how the public can identify authentic warnings and take appropriate actions. Further, what is the most effective method or combination of methods to issue warnings?

In Banda Aceh, when the siren sounded, people panicked, re-living the terrifying events of the 2004 tsunami, and fled their places of work and homes with their primary concerns being personal safety, family safety and safety of property. The following outcomes were noted:[120]

- Many minor accidents occurred as people fled.

- Some who evacuated long distances required a great deal of persuasion to return.

- Doctors and nurses fled from medical facilities to search for their families and to safeguard their property; patients were often left unattended.

- Teachers quickly closed schools and also went to search for their families and to safeguard their property with the result that children of all ages were left to fend for themselves causing emotional distress particularly for younger children.

- Business owners went into vulnerable areas to lock their businesses due to fear of looting.

- Vehicles of every type took to the streets causing total gridlock; police were not present in the immediate stage to regulate traffic.

- Telephone systems were quickly overloaded and they shut down preventing further communications on the situation.

These incidents highlighted the need for the following components to be included in an Action Plan that is supported by a comprehensive system of SOP.

1. **Designate an Incident Command Centre.** All information should flow in and out of the Incident Command Centre for the sake of efficiency. There should be a dedicated communication system that will function when all others shut down to ensure that emergency services and the public have relevant information, and that local information will reach mass media for dissemination.

2. **Create an emergency traffic control plan.** The plan would organize exits from vulnerable areas and prevent people from entering them. Police require a plan for positioning officers to direct traffic supported with equipment such as megaphones. The plan should be posted near roads and be correlated with evacuation routes. Regular drills are required.

3. **Develop evacuation plans for hospitals and schools, and SOP for hospital and school staff.** Each medical facility and school requires its own evacuation plan and corresponding regular drills. This plan should include the roles of hospital and school staff in caring and/or evacuating patients and students. Each child should be aware of the plan and his/her role in it.

4. **Encourage planning by business owners.** To avoid chaos in evacuations, business owners should develop emergency plans that details procedures for their staff in closing their businesses if they are not present and ensuring everybody's safety.

5. **Develop a backup system for telephones.** A backup system for telephones needs to be developed so that essential communications can be maintained in emergencies, distinct from the dedicated system mentioned in point 1 above.

6. **Designate safe buildings.** Buildings appropriate for evacuation should be designated as such and be posted with signage for identification by the public.

7. **Prepare mobile information vehicles.** These vehicles should be ready for immediate deployment to vulnerable areas to provide information, and their routes need to be worked out in harmony with the emergency traffic control plan.

---

118 *Jakarta Post*, "Indonesian villagers damage tsunami warning siren," 9 June 2007.

119 Ian MacKinnon, "Aceh residents disable tsunami warning system after false alarm," *Guardian Unlimited*, 7 June 2007.

120 Robin Willison, *Reflections on the false tsunami alarm of 4 June 2007 in Banda Aceh*, UNDP Indonesia, 6 June 2007.

Community Participation for Disaster Preparedness Merapi Volcanic Eruption – Central Java

Prone Area Map for Merapi Volcano

GPS recorded:

- Disaster Camp; Satkorlak, Satlak, Ministry of Social, Indonesian Red Cross, etc.
- Health facilities (hospitals, health centres)
- Tower
- Bunker

"Evacuation Route to Disaster Refugee Camp"

Good practice in community participation in response to warning is already available from experience in dealing with volcanic hazards. The BAKOSURTANAL provides evacuation maps for the Mt. Merapi volcanic area to provincial and district disaster management teams, sub-district military units and police units, the PMI and other response organizations such as NGOs. Evacuation routes are clearly marked to shelters in safe areas, and GPS coordinates are available for the evacuation area, health facilities and warning towers.

The participants at the Workshop for Developing SOP for TEWS for NAD Province (April 2007) identified the following

aspects of response to warnings that require significant development:

- Warnings are produced and disseminated by credible sources such as government, religious leaders and community institutions.
- Public perceptions on tsunami risk and warning services are analysed to predict community response.
- A strategy to build credibility and confidence in warnings is developed.
- Evacuation plans are enacted through government policies and regulations, there is agreement on the plans and they are disseminated.
- Individual groups that need special attention such as elderly, children and disabled persons are identified, and special protection and safety activities for these groups are included in evacuation plans.
- Routine drills are conducted.
- Communities are trained to identify natural signs of danger.
- Mass media are used to raise awareness.
- Public awareness programmes are evaluated and updated each year.

RISTEK has developed Guidelines on Tsunami Drill Implementation for City and Regency (2008) that documents Indonesia's experience in conducting tsunami drills since 2005.

Figure 9: Disaster Response Management
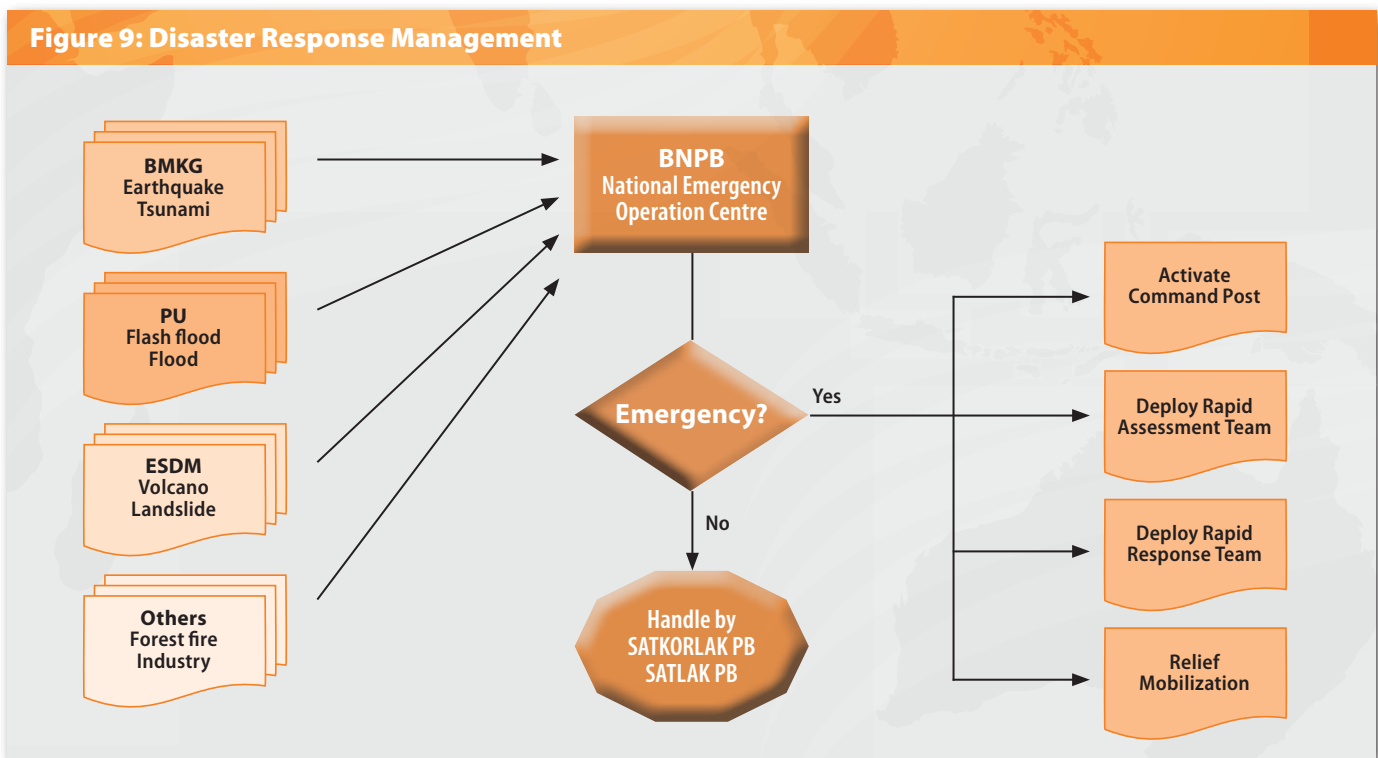
8.2 Analysis of Disaster Response

The following disaster response operation illustrates the roles of various organizations to meet the needs of affected people.

Incident Command System (ICS) – Hosted by BAKORNAS PB, the IOTWS and the United States Forest Service conducted an ICS basic course in April 2007 for 35 GoI staff and NGOs. The ICS has been in use in the US for decades to help governments manage the potentially chaotic situation following a disaster or crisis and is based on the organization of a team to deal with major functional areas. These are command, operations, finance and administration, planning, and logistics. The training is already underway in Sri Lanka and in May 2007 a regional workshop allowed Indonesians and Sri Lankans to exchange innovative strategies for developing capacity in disaster management, culminating in a meeting with the Indonesian Vice President, which demonstrated Indonesia's commitment to further develop its ICS capabilities.[121]

Box 9: Floods in DKI Jakarta Province, Bekasi and Tangerang, Banten Province 4 February 2007

Torrential rain for several days in Bogor, a city located 60 kilometres south of Jakarta and at a higher altitude, combined with heavy rains over Jakarta triggered flooding in Jakarta, Bekasi and Tangerang in February 2007. Thousands of houses, buildings (including 1,498 schools), and roads were inundated. In Jakarta, more than 60 percent of the five mayoral areas were inundated, with East Jakarta worst affected. More than 340,000 were made homeless. Telephone lines and electricity networks were cut off in some parts of the city. Flood water levels rapidly increased reaching four meters in some areas. People were trapped on the roofs of their houses while evacuation and distribution of logistics were compounded by the limited number of available rubber boats and the large extent of the flooding. In Bogor, continuous rains triggered a landslide on 3 February, causing two deaths and left three persons missing, and 19 houses damaged.

The BAKORNAS PB, SATKORLAK PB Jakarta, PMI and BMKG provided information on affected people and relief assistance needs to assistance agencies and the media. SATKORLAK PB in cooperation with related departments and offices (such as the Department of Health, Public Works, Social Affairs, PMI, Search and Rescue) evacuated affected people, and provided basic supplies, emergency shelters, health clinics, mobile latrines and public kitchens. The PMI deployed Field Action Teams to carry out an assessment and facilitate the evacuation process together with the local government in the affected areas. The President visited the flooded areas and distributed relief packages. The Indonesian Air Force mobilized two helicopters to monitor the situation. The military and police deployed personnel to help in the evacuation process and to start guarding the property of displaced people from possible looting in selected areas.

BAKORNAS PB coordinated internally and internationally, and established an operational centre to support the Provincial Government of Jakarta. It also deployed a liaison officer to coordinate with the Provincial Government of Jakarta and SATKORLAK, and another liaison officer at Halim airport. OCHA and UNDP set up a support structure to the BAKORNAS PB information centre for information management. The UN Resident and Humanitarian Coordinator Office in Jakarta monitored the situation in close contact with pertinent government and non-government institutions, as well as PMI.

---

121 IOTWS ICS Factsheet and website.

8.3 Community Preparedness and Response

Figure 10: Disaster Management System involving Communities
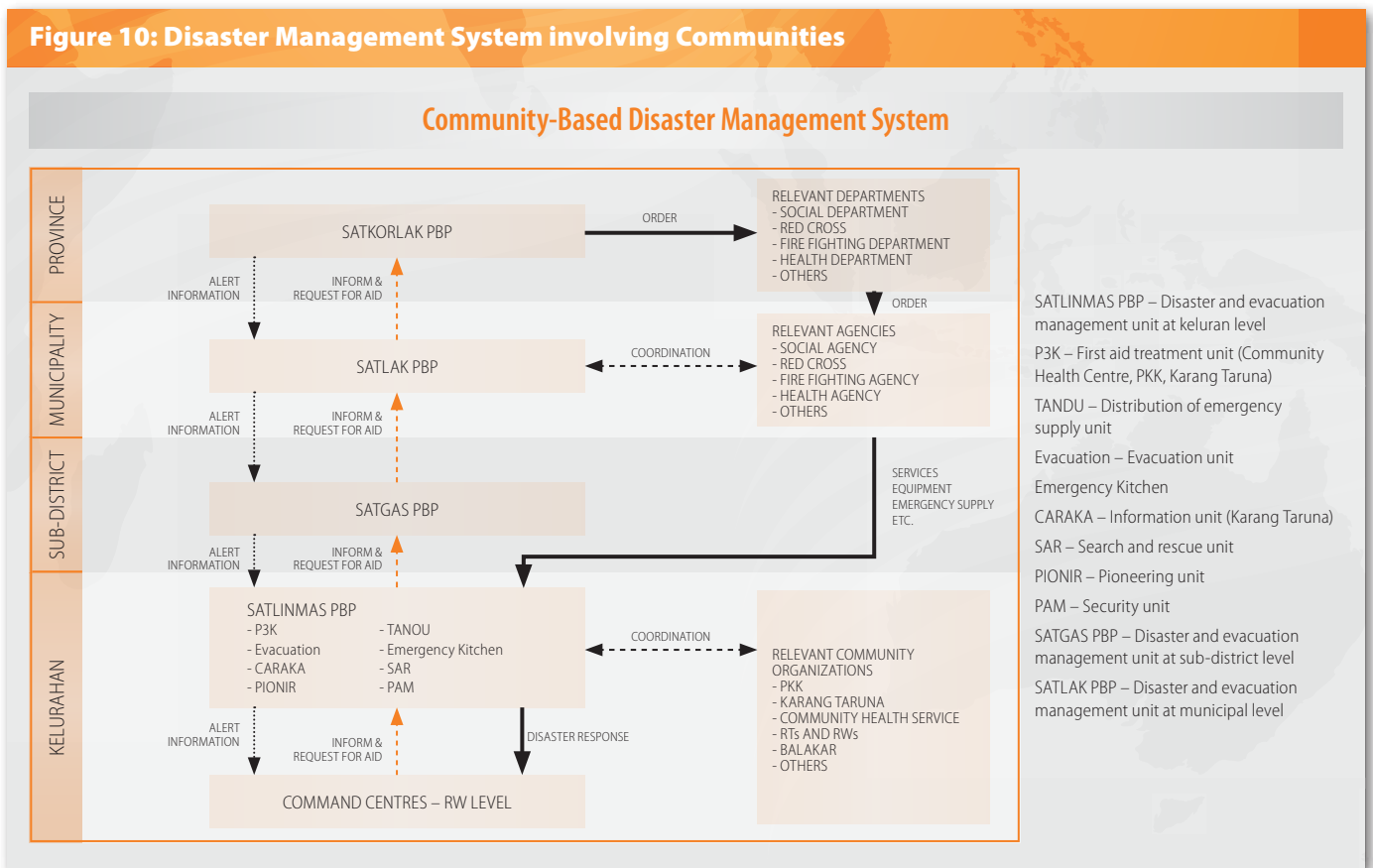
Indonesia is embracing a new paradigm in disaster management that focuses on accountability to at-risk and/ or disaster affected communities and sensitivity to gender, participatory, equity and justice perspectives. Figure 11 shows such a community-based disaster management system reflecting Indonesian institutions. The Law on Disaster Management supports and promotes community participation.[122] Some examples of community-based programmes are given below.

PMI's Integrated Community-Based Risk Reduction (ICBRR) Program. The PMI partners in the Red Cross Movement (ICRC, IFRC and national societies) have teamed-up in Aceh to support PMI in a multi-faceted DRR programme to help raise awareness of disasters among vulnerable communities. A tested method of disaster management, the ICBRR was refined and adapted for use in Aceh by American Red Cross disaster management experts. These efforts include utilizing EWS, strengthening PMI's capacity in preparedness activities, and building on PMI's existing

disaster preparedness programmes including community-based disaster management.

Some activities implemented under the ICBRR are training of trainers on techniques and methodology for hazard identification and monitoring, installation of early warning radio equipment, video presentations on disaster preparedness, and distribution of 15,000 calendars with relevant DRR messages.

IDEP's Community-based Crisis Preparedness and Response Program. In July 2003, with support from USAID, MPBI, CRS and BAKORNAS PB, the IDEP Foundation (Bali-based NGO) launched a programme to help address community vulnerability. It included extensive research, a series of needs assessments, and the development, piloting and distribution of a culturally appropriate Community-based Crisis Preparedness and Response Program. As part of this project, IDEP produced a detailed report of the response and recovery processes undertaken after the Bali Bombing Tragedy.

---

122 Suprayoga Hadi, "Community Based Disaster Risk Management in Indonesia," presentation made at the 40th ADB Annual Meeting, 7 May 2007.

8.4 Early Warning as Part of Disaster Recovery

Recovery activities need to address community vulnerabilities and gaps in national capacities, and part of recovery resources should be directed to enhancing preparedness and early warning measures. Indonesia participates in the Tsunami Recovery Impact Assessment and Monitoring System (TRIAMS) that has established a draft set of core indicators. The ProVention Consortium solicited expert papers to generate DRR indicators that reflect effective institutional and legislative practices and capacities, among others. Some indicators are:[123]

- Increase in the number of public information dissemination campaigns via media and schools for measurable change in public understanding of how to act on early warning messages

- Numbers of preparedness and response plans to reflect improved information on multiple risks in high risk areas

- Number of policies and legislation drafted or revised to facilitate action, enforce regulations and/or provide incentives

- Number of schools and hospital buildings conforming to building regulations and level of transfer of this practice to other high risk areas

Summary of Main Points

1. While public education and drills are increasing, coverage of vulnerable areas with drills and evacuation information is not adequate. Numerous critical activities for effective response to warnings have not yet started or just been initiated in Aceh/Nias and in other areas.

2. The Law on Disaster Management mandates regular evacuation drills and practices but does not specify roles of institutions in the drills, the frequency of the drills or indicators for the effectiveness of drills. Tsunami evacuation drills in Padang, Bali, Banten, Manado, Gorontalo and Yogyakarta have helped prepare vulnerable populations but most earthquake and tsunami-prone areas have not undertaken drills.

3. Good practice in community participation in response to warning is already available from the experience in dealing with volcanic hazards. BAKOSURTANAL provides evacuation maps and ensures that evacuation routes are clearly marked. The participants at the Workshop for Developing SOP for TEWS for NAD Province pointed to needs for analysis of public risk perception, approved evacuation plans that protect the most vulnerable

people, routine drills and evaluation of public awareness programmes.

4. The typical response to disasters includes the BNPB systems and numerous international and national actors. BNPB is adopting the ICS that includes the components of command, operations, finance and administration, planning, and logistics. A regional workshop allowed Indonesians and Sri Lankans to exchange innovative strategies for increasing capacity in ICS.

5. Indonesia is focusing on accountability to at-risk and/or disaster affected communities incorporating sensitivity to gender, participatory, equity and justice perspectives. There are many examples of community-based programmes including PMI's ICBRR and IDEP's Community-based Disaster Management.

6. Indonesia participates in the TRIAMS that has established a draft set of core DRR indicators including increases in the numbers of public information dissemination campaigns, preparedness and response plans, policies and legislation, and schools and hospital buildings conforming to building regulations.

Recommendations for Stakeholders[124]

- Develop regulations and SOP that mandate the:

  - Frequency of evacuation drills in high risk areas;

  - Evaluation of drills according to specific indicators of success and feedback from participants;

  - Clear identification and realistic mapping of evacuation routes;

  - Identification of designated places for evacuation; and

  - Development of specific procedures for where to seek shelter and how to reach these safe areas considering the needs of particularly vulnerable groups.

- Establish a coordination forum on early warning to allow all actors to vet problems and concerns and to advocate for appropriate resources and capacity development. Involve local governments, NGOs, businesses, education institutions, community-based organizations and networks. Furthermore:

  - Develop joint strategies and action plans for expanding the reach of community-based disaster management and capacity development programmes.

---

123 ProVention Consortium, *TRIAMS Risk Reduction Indicators – Institutional Capacities*, contributed by Yasemin Aysan.

124 These recommendations are a synthesis of those made by interviewees in the UNDP ILS EWS process as well as those mentioned in the National Workshop Report for Tsunami Early Warning Systems in Indonesia, jointly organized by RISTEK and UNDP in September 2007.

- ° Expand coverage of drills, evacuation information and response planning, particularly in high risk areas and communities.

- ° Promote well coordinated disaster response plans at district and community levels by strengthening the capacity of BNPB, and regional/provincial/district disaster management agencies.

- ° Ensure that NGOs and businesses have plans to support the response to warnings.

- Undertake lessons learned exercises after evacuation drills or actual warnings, and ensure that a responsible coordinating body captures and analyses results for follow-up and incorporation into preparedness plans and training.

- Strengthen optimal use of the ICS by involving local authorities and communities in awareness raising and participation in planning efforts.

Gender Aspects in the Context of Institutional and Legislative Systems for Early Warning in Indonesia

The institutional and legal frameworks in Indonesia hold opportunities for ensuring that laws, regulations, and SOP for DRR and the EWS are supportive of both genders. This chapter mentions fundamental issues affecting gender equality, access to resources, participation in decision-making and gender-related disaster effects. Relevant disaster-related legislation and institutional roles are examined through gender lens. Finally, recommendations are made with reference to other sections of the report that look at various components of the people-centred EWS: risk knowledge, monitoring and warning, dissemination and communication, and response.

MDG 3: Promote Gender Equality and Empower Women

The GoI has formulated poverty frameworks to work toward the MDGs; however, a UN 2006 progress report cites deterioration in several indicators. Gender gaps in literacy have been reduced and overall progress in equality in education is lacking. Poverty is a major factor hindering women's ability to prepare and respond to EWS, and take action to protect themselves and their livelihoods from disasters. Although some wealthier areas will reduce extreme poverty by 2008, the least developed provinces are not expected to reach MDG targets until the end of the century.[125]

The GoI multi-donor study[126] reported overall slow progress in Indonesia towards gender equality. Progress in reducing maternal mortality has been weak. Women's economic role is gradually being strengthened but these efforts are hampered by the Marriage Law that defines a husband's role as the breadwinner and a wife's role as the caretaker of the home and children (UNESCAP estimates that inequalities in the labour market cost Indonesia $2.4 billion each year). Gender-based violence and discrimination are persistent problems given the failure of the government and dominant social institutions to address its roots.[127]

125 ADB, *From Poverty to Prosperity: A Country Poverty Analysis for Indonesia*, 2006.

126 Gender in Community Driven Development Project: Implications for PNPM (National Community Empowerment Project) – Working paper on the findings of the joint donor and government mission, GoI, World Bank, ADB, DFID and Government of Australia, 2007.

127 OneWorldnet.com, Summary of Progress on the MDGs.

Table 1: MDG 3 Progress in Indonesia

MDG 3: Promoting Gender Equality and Empowering Women	1992	1996	1999	2002
Ratio of girls to boys in primary education (7–12 years)	100.6%	99.8%	100.1%	100.1%
Ratio of girls to boys in junior secondary education (13–15 years)	101.3%	103.4%	102.5%	102.6%
Ratio of girls to boys in senior secondary education (16–18 years)	98.0%	96.1%	103.2%	97.1%
Ratio of females to males in tertiary education	85.1%	85.3%	90.0%	92.8%
Ratio of literate females to males (15–24 years); literacy gender parity index	97.9%	99.1%	99.4%	99.8%
Share of women in wage employment in the non-agricultural sector	29.2%	28.3%	31.2%	28.3%
Proportion of seats held by women in the National Parliament	12.5%	12.5%	8.8%	11.3%

Source: Government of Indonesia, *Progress Report on the Millennium Development Goals,* 2004.

Table 2: Gender Disparity in Indonesia, Sri Lanka and Thailand

Country	UNDP Human Development Index Rank (2008) – out of 179 countries	UNDP Gender-related Development Index Rank (2008)	Social Watch Gender Equity Index Value (2008) Grading from 1–100	Evolution of the Gender Equity Index (2008) Variation 2008/2004 (%)
Indonesia	109	93	52	0.1
Sri Lanka	104	90	53	-5.4
Thailand	81	67	70	-8.9

9.1 Gender-related Disaster Effects

The 2004 tsunami affected both poor and affluent communities. Women and children were the majority of casualties. Villages along the Aceh Jaya coast, such as Padan Datar, lost nearly 80 percent of their female population. The disproportionate loss has been attributed to the time of the disaster at 8 a.m. when many women were preparing food indoors. At this time of day, part of the male population was in the foothills collecting fruit or in the ocean fishing. Differences in physical strength and ability to survive the force of the waves played a major role – women would often prioritize the welfare of their children and in some cases they all perished. UNDP estimated that the overall death toll was 60 percent female and 40 percent male.[128]

Many men particularly the poorest suffered from loss of livelihoods, some permanently as their fishing areas or farmlands were damaged by the tsunami, or they had to seek shelter far from farming or fishing areas. Work initially provided by assistance organizations was short term and provided no security for the future. Many men who lost their wives had difficulties in taking on unfamiliar tasks to care for their children and homes. Both genders were affected by psychosocial issues due to the trauma and social changes. Both genders, by nature independent and proactive, became recipients of aid with little opportunity to influence assistance strategies.[129]

9.2 Good Practices in Support of Gender Equality in DRR and EWS

The 2004 tsunami response illustrated vividly the legal constraints for women, including limitations on women's access to land and inheritance. The tsunami response as well as the response to the May 2006 earthquake on Java Island also showed conclusively that women are powerful forces for preparedness and recovery. UN/ISDR has compiled case studies for the purpose of replicating good gender-related practices among and within countries. Two good practices in Indonesia are summarized below:

1. Women's groups were mobilized in 2005 to ensure the **inclusion of gender equality provisions in the Law on Governing Aceh (LoGA)**, adopted in July 2006. Another initiative is underway for engendering the bylaws (known locally as Qanun) to implement the LoGA provisions. As a result of the advocacy work, the post-tsunami land distribution scheme allows Acehnese women to have their names registered as individual or joint owner in the title deeds. Prior to the advocacy effort, the land titling policy for tsunami survivors was to give ownership to heads of a family unit, who are usually men.[130]

2. Following the May 2006 earthquake, women in Yogyakarta villages worked alongside men to **organize their communities in the absence of external support**. The women ran temporary shelters, community kitchens and distributed aid for as long as two months before they received external assistance. For most of the women involved, it was the first time they participated in decision-making and played public roles on community issues. These initiatives have been maintained through subsequent efforts by a local NGO called UPLINK (Urban Poor Link) and the GROOTS International network[131] to sustain women's participation in disaster-related decision-making, and to strengthen and transfer effective practices that build resilience of and through women.[132]

---

128 Tsunami Evaluation Coalition, *Impact of the Tsunami Response on Local and National Capacities: Indonesia Country Report – Aceh and Nias*, April 2006.

129 Reed et al., CARE and World Vision, *Multi-agency Evaluation of Tsunami Response: Thailand and Indonesia*, August 2005.

130 UNIFEM, Mitra Sejati Perempuan Indonesia and Jaringan Perempuan untuk Kebijakan, "Using Political Momentum to Engender Legislation in the Reconstruction Context: Engendering and Strengthening Women's Legal Rights in Aceh," in UN/ISDR, *Gender Perspective: Working Together for Disaster Risk Reduction – Good Practices and Lessons Learned*, Geneva, June 2007, pages 20–22.

131 Grassroots Organizations Operating Together in Sisterhood – International: a US-headquartered international network of grass-roots women's organizations working with over 40 organizations in Asia, Africa, Europe, Latin America and North America.

132 GROOTS International and UPLINK, "Grassroots Women Handle Quake Impact Unaided: Developing Grassroots Women Trainers on Disaster Recovery and Resilience Building," in UN/ISDR, *Gender Perspective: Working Together for Disaster Risk Reduction – Good Practices and Lessons Learned*, Geneva, June 2007, pages 23–26.

9.3 International and Domestic Gender Equality and Human Rights Law and Policy

Indonesia has adopted policies that can be used as springboards for integrating gender concerns in DRR and EWS, including the major international conventions that uphold principles of gender equality. These instruments include the UN Convention on the Political Rights of Women ratified by Law No. 68 of 1958, the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) ratified by Law No. 7 of 1984, and the Optional Protocol to the CEDAW that was signed in 2000. The GoI has ratified many International Labour Organization (ILO) Core Conventions as well as the Convention on the Rights of the Child. The GoI has committed to acting upon the 1994 Copenhagen Declaration on Social Development, the 1995 Cairo International Conference on Population and Development, and the 1995 Beijing Platform for Action (BPA). The implementation of the BPA has been addressed through a National Action Plan (that legally requires governments to formulate national policies aimed at ending discrimination in the workplace) and the adoption of a National Plan to End Violence Against Women.[133]

The CEDAW forms part of domestic law and has been cited before courts in discrimination cases. A legal review of women's political rights funded by the United Nations Development Fund for Women (UNIFEM) and implemented by the Indonesian Center for Women in Politics, took place in October 2006. The exercise identified legislations that are inconsistent with CEDAW principles, and formulated proposals for legal amendments to harmonize the laws and various implementing regulations with CEDAW. Numerous obstacles to achieving women's equality (similar to those obstructing the MDGs) range from legal impediments and localized armed conflict to social and cultural practices that harm women. Muslim women face particular obstacles to equality before Shari'a courts. Recommendations include training of government officials and judges in gender awareness and possibly exploring the relationship between CEDAW norms and Shari'a law.

Further domestic gender mainstreaming instruments include a Presidential Decree issued in 2000 and the Medium-Term Development Plan 2004–2009 that identifies gender mainstreaming as a target. The State Ministry for Women's Empowerment issued guidelines in 2002 for gender mainstreaming and efforts have resulted in production of gender-disaggregated statistics in some provinces, districts and sub-districts, as well as the application of a Gender Analysis Pathway in a range of ministries. An increasing number of gender aspects are included in annual development plans at the district level.

In 2002, Law No. 31 on Political Parties was enacted followed by Law No. 12 of 2003 on the Election of Members to the House of Representatives, the Regional Representative Council and the Regional House of Representatives. Both laws clearly mandate a quota of 30 for women in political parties. Nevertheless, female participation in public institutions at various levels (national, provincial and regency/city) is still quite low.

9.4 Governance and Institutional Arrangements

Three critical factors prevent gender inclusiveness in the Indonesian government. These are: 1) Completely insufficient representation of women in politics; 2) The predominance of patriarchal systems that work to override laws and advocacy efforts; and 3) As a result of 1) and 2), limited capacity of women decision makers to raise and address gender aspects. The trend toward decentralization has unintentionally made way for a number of local governments to institute public policies based on Shari'a law that may have discriminatory effects for women.

Increased political participation of women is a factor believed to be critical to promote better protection of women from disasters. At a national level, it is a matter of concern that women have not been able to increase their political voice in the legislature; in fact their participation has decreased since 1992. Women's participation at the district level – the level that has become the focus of decision-making since decentralization – is the lowest.[134]

9.4.1 Barriers to Gender Equality and Enforcement of Legal Instruments

An examination of the legal foundation for gender equality indicates that it is not the lack of laws but rather a lack of clarity on roles and enforcement that weaken the capacity of government to protect families from loss of life, dignity, livelihoods and possessions in disasters. Overall, corruption and poor governance have resulted in under-achievement of development objectives. Other issues include the following:

- **The laws need review and streamlining.** Conflicts between adat (customary) laws based on local kinship systems and the constitution occur, and the influence of adat laws on women varies from one locality to the

---

133 ADB, *Indonesia: Country Gender Assessment*, July 2006; and UNIFEM website, About the CEDAW and Indonesia Country Page.

134 Gender in Community Driven Development Project: Implications for PNPM (National Community Empowerment Project) – Working paper on the findings of the joint donor and government mission, GoI, World Bank, ADB, DFID and Government of Australia, 2007.

other.[135] There is a web of conflicting laws that requires untangling.

- **Gender awareness training and research are critical needs.** There is still a fundamental lack of understanding of the benefits and importance of mainstreaming gender in policies and programmes. Gender aspects are still viewed as primarily falling into the social sphere, as opposed to having direct economic consequences.

- **Government resources for women need restructuring.** Women's empowerment divisions tend to be poorly staffed, under-resourced, and not appropriately placed within local government structures.

- **Civil society resources should be more widely used.** Civil society organizations and community-based organizations have a significant role to play in the promotion of gender equality but their involvement at the local and national level is not optimized.

9.5 Gender Equality in Domestic Disaster Policies, Plans and Legislation

Most disaster-related legislation in Indonesia focuses on inter-institutional mechanisms, and institutional roles in addressing the special needs of females and males vulnerable to disaster are not mentioned. The constitution of 1945 guarantees equality to women and is one of the few legal instruments that makes mention of children and vulnerable groups. Article 28G of the constitution states that: "Every person shall have the right to protect his or her family, honour, dignity, and property, and shall have the right to feel secure against and receive protection from the threat of fear." Article 34 states that: 1) Impoverished persons and abandoned children shall be taken care of by the State; and 2) The state shall develop a system of social security for all of the people, and shall empower the inadequate and underprivileged in society in accordance with human dignity.

Law No. 6 of 1974 on Social Welfare covers social assistance to citizens who lost their social roles or were affected by either social or natural disasters. The GoI is tasked with maintenance of a social insurance system and tutoring, training and social rehabilitation, including for disadvantaged, abandoned, and disoriented people or groups. The review by GTZ of legislation as a basis for InaTEWS concluded that although it regulates the efforts of the government in providing assistance, the law falls short of being an appropriate framework for InaTEWS as it does not explicitly describe in what form the social assistance shall be provided, and does not verify which institution is responsible or what form of legislation will regulate the follow up.[136]

The Law on Disaster Management reiterates the principles found in the constitution regarding non-discrimination but stops short of specifically giving women a more prominent role in the management of disaster mitigation and response. Gender equality is only mentioned once in Article 26 and in regard to humanitarian workers rather than affected people. Women are relegated to a position of victims in most parts of the law.

Under Part Three, "Victim and Refugee Management," Articles 16 and 17 draw attention to the need for prioritization of aid to poor and vulnerable communities, as well as to women, pregnant women, lactating mothers, disabled persons, children and elderly people. The government guarantees "victims and refugees secure and equitable access to adequate quantity of water for drinking, cooking, personal hygiene and household needs." Other guarantees of equity, participation and measures to avoid backsliding include the following:

- Article 20: guarantees health and nutritional support to the most vulnerable groups.

- Article 22: guarantees victims and refugees access to and continuation of their education.

- Article 25: promotes an active community role based on the principle of transparency, the dissemination of correct information on disaster management and on community approval with special emphasis on vulnerable groups.

9.6 Stakeholders on Gender Aspects in DRR and EWS

Despite strategic placement of legal frameworks and policy instruments, it is apparent that reliance on laws and policies is not sufficient to achieve gender equality. Other actions involving all actors in the organizations mentioned below are critical to mainstreaming gender and understanding the barriers to achieving gender equality. Of particular importance is the support that civil society organizations can offer to government organizations to improve services for women. Good practices should be widely replicated including the increasing levels of compilation of gender-disaggregated statistical data and the production of gender

---

135 ADB, 2006: The word adat literally translated means tradition. Indonesia comprises about 500 ethnic groups speaking more than 600 languages. During the New Order era, efforts to promote ethnic identities were seen as a threat to the nation's unity, but with the fall of Suharto and the beginning of the reform era of Indonesian politics, ethnicity has emerged as an important issue in the social and political arena. A 2002 ADB study on indigenous people and poverty in Indonesia defines indigenous peoples as adat communities, or communities that follow adat law.

136 Anthony D. M. Sihaan, *Legal Framework for Disaster Management Particularly in the Field of Early Warning*, GTZ, December 2006.

analyses in a number of provinces, districts and sub-districts through the combined efforts of national and international agencies.

BAPPENAS includes a Directorate for Population, Social Welfare and Women's Empowerment that is responsible for the promotion of gender mainstreaming in national development planning. **MENKO KESRA** has a Deputy for Women's Empowerment who can strategically advocate for gender equality. Among government organizations, **LIPI** is well poised to draw attention to gender aspects through its ongoing sensitization programmes. **BNPB**, as the national disaster management agency has a significant role to play in promoting gender equity in disaster management and risk reduction. The SATKORLAKS and SATLAKS, however, are not adequately empowered to interact with other authorities and may have limited social and political impact.

The **State Ministry for Women's Empowerment (SMWE)** coordinates government agencies, private sector entities and community-based organizations for women's empowerment and welfare, and the protection of children. The SMWE deploys around 20 percent of its budget on 'dana stimulan' or stimulation funds to provincial and district levels to increase the awareness of government officials, and to finance regional Women's Empowerment Divisions (WEDs) and gender focal points in the areas of gender analysis, technical methods of mainstreaming gender and collection of gender-disaggregated data. The WEDs, however, have proved to have limited ability to influence higher-level officials as they are under-financed and often headed by low-ranking officers. Numerous **women's study centres** located within many universities work with the WEDs to carry out advocacy activities. The demand for their services has increased with the mainstreaming efforts. The centres, administered by the office of university rectors, are endowed with relatively small budgets but are reliable sources of information on gender aspects, although their capacity differs widely from region to region.[137]

Several hundred national **NGOs** work toward the realization of women's rights. They have been involved in the implementation of women's conventions, including CEDAW, the International Conference on Population and Development, and the BPA. The role of the NGOs is changing in response to political reform and democratization, as well as to the changing dynamics among national, provincial and local level development agents induced by decentralization. Given the governance and legal issues mentioned above, many analyses toss responsibility for ensuring gender equality to the NGOs, but this will clearly have its own limitations in terms of impacting government policy unless collaborative efforts are undertaken.

137 ADB, *Indonesia: Country Gender Assessment*, July 2006.

Community groups have risen out of the 2004 tsunami and other disasters, such as GROOTS International, an international network of grass-roots women's organizations that seeks to link with and learn from the experiences of other communities. These groups have the potential to realize important gains for women as leaders in DRR, and support should be continuous in order to maintain their momentum.

Summary of Main Points

1. The institutional and legal frameworks hold opportunities for ensuring that laws, regulations and SOP for the EWS are supportive of both genders. However, progress on the achievement of the MDGs, and MDG 3 in particular, has been slow. Gender gaps in literacy have been reduced and overall progress in equality in education is lacking. Women's potential economic role is hampered by the Marriage Law.

2. Women and children constituted the majority of casualties in the 2004 tsunami partly due to their activities at the time of day and weaker physical strength. Many men, particularly the poorest, suffered from loss of livelihoods; both genders were affected by psychosocial issues, and lacked sufficient voice in the design and implementation of assistance strategies.

3. The 2004 tsunami and the May 2006 earthquake highlighted both legal constraints for women's participation and women as powerful forces for preparedness and recovery. Two replicable practices included the mobilization of women's groups in 2005 that ensured the inclusion of gender equality provisions in the LoGA; and support for women in Yogyakarta villages who helped to organize their communities in the absence of external support.

4. Women have not been able to increase their political voice in the legislature and their participation is lowest at the district level, the focus of decentralized decision-making. The lack of clarity on roles and enforcement of laws weaken the capacity of government to protect families, livelihoods and possessions in disasters. Necessary steps to remove gender equality barriers include reviews of laws, gender awareness training and research, restructuring government women's divisions, and greater use of civil society resources.

5. Issues in governance and law focusing on gender equality include conflicts between adat (customary) laws and the constitution, the institution of public policies by local governments based on Shari'a law, and a web of conflicting laws. Review of the CEDAW alongside national laws and practice indicates numerous obstacles to achieving women's equality; Muslim women face particular difficulties before Shari'a law.

6. Indonesia has ratified the major international gender equality conventions including the CEDAW, many ILO Core Conventions, as well as the Convention on the Rights of the Child. The GoI has committed to acting on the 1995 BPA through a National Action Plan and the adoption of a National Plan to End Violence Against Women.

7. Indonesia has adopted a variety of gender mainstreaming instruments that could act as springboards for addressing gender aspects of DRR and EWS, including guidelines for gender mainstreaming, application of a Gender Analysis Pathway in a range of ministries, and an increasing number of gender aspects included in annual development plans at the district level.

8. The constitution of 1945 guarantees equality to women. Law No. 6 of 1974 on Social Welfare covers social assistance to citizens affected by either social or natural disasters, but does not include adequate regulatory mechanisms. The Law on Disaster Management stops short of specific provisions that would give women a more prominent role in disaster mitigation and response. Women are relegated to a position of victims in most parts of the law.

9. Ministries that have gender-related mandates include BAPPENAS Directorate for Population, Social Welfare and Women's Empowerment, MENKO KESRA Deputy for Women's Empowerment, LIPI and BNPB.

10. The SMWE coordinates government agencies, private sector entities and community-based organizations, and finances regional WEDs. Numerous women's study centres located within many universities work with the WEDs to carry out advocacy activities.

11. Several hundred national NGOs work toward the realization of women's rights and should cooperate with ministries to impact government policy. Community groups have risen out of the 2004 tsunami and other disasters and their capacity should continue to be built.

Recommendations for Stakeholders[138]

Promote gender sensitive policies and programmes for DRR and EWS through:

Including women and men in governance and institutions for EWS

- Ensure that plans and regulations to implement the Law on Disaster Management and its EWS component emphasize a more active role of women in decision-

making. Specifically, ensure that the plan for EWS capacity development encourages participation of women from different sectors (government, civil society, communities, etc.)

- Clearly stipulate activities that designate EWS roles of and protective measures for women and men and girls and boys.

- Provide support for gender awareness training to government staff and research to increase knowledge about gender aspects.

Strengthening understanding of gender-based vulnerability and capacity

- Use existing gender sensitive tools developed nationally to assess the vulnerability of each gender and their access to information regarding trends on hazards and vulnerabilities.

- Make effective use of education systems, female politicians and legislators, and organizations and groups with gender-related mandates to further risk knowledge and participation in risk management and EWS, particularly in the least developed provinces.

- Provide capacity development support to community groups and networks to help change attitudes and promote empowerment of women through risk knowledge.

- Ensure the participation of women in development of building codes, land titling and environmental protection laws and practices particularly at district/municipality levels.

Promoting the potential of women as EWS and DRR actors

- Empower women through training and replication of good practices to become actors in community-based DRR and EWS (to strengthen community-based monitoring and early warning in particular).

- Involve women in the development of policies to address the human causes of floods, landslides and fires.

Ensuring warning messages reach both genders

- Prepare actionable warning messages that employ a gender sensitive approach in the context of community-based disaster preparedness and awareness programmes. Various times of day and the activities that females and males will be engaged in should be considered in terms of how each group can be effectively reached and the reaction time they will need to flee to safety relative to the types of disasters they may face. The protection of children will require extra time for evacuation.

---

138 These recommendations 'bounce off' recommendations in the other chapters.

Learning to design EWS that work for women and men

- Make optimum use of good practices and lessons learned in previous disasters in Indonesia and other countries to support the critical roles played by women and men in preparedness and response using national and community-based training programmes as vehicles.

- Evacuation drills, routes and procedures should be mapped taking into account gender considerations such as access and security, etc. for women.

Annex I – Glossary of Key Terms [139]

Building codes

Ordinances and regulations controlling the design, construction, materials, alteration and occupancy of any structure to insure human safety and welfare. Building codes include both technical and functional standards.

Capacity

A combination of all the strengths and resources available within a community, society or organization that can reduce the level of risk, or the effects of a disaster. Capacity may include physical, institutional, social or economic means as well as skilled personnel or collective attributes such as leadership and management. Capacity may also be described as capability.

Capacity development

The process through which individuals, organizations and societies obtain, strengthen and maintain the capabilities to set and achieve their own development objectives over time (UNDP).

*On the other hand, **capacity building** commonly refers to a process that supports only the initial stages of building or creating capacities and alludes to an assumption that there are no existing capacities to start from. Capacity building can be relevant to crisis or immediate post-conflict situations where existing capacity has largely been lost due to capacity destruction or capacity flight.*

Disaster

A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses that exceed the ability of the affected community or society to cope using its own resources.

A disaster is a function of the risk process. It results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk.

Disaster risk reduction

The conceptual framework of elements considered with the possibilities to minimize vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development.

Early warning

The provision of timely and effective information, through identified institutions, that allows individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response.

Early warning systems include a chain of concerns, namely: understanding and mapping the hazard; monitoring and forecasting impending events; processing and disseminating understandable warnings to political authorities and the population; and undertaking appropriate and timely actions in response to the warnings.

El Niño-southern oscillation (ENSO)

A complex interaction of the tropical Pacific Ocean and the global atmosphere that results in irregularly occurring episodes of changed ocean and weather patterns in many parts of the world, often with significant impacts, such as altered marine habitats, rainfall changes, floods, droughts, and changes in storm patterns.

Environmental degradation

The reduction of the capacity of the environment to meet social and ecological objectives and needs. Potential effects are varied and may contribute to an increase in vulnerability and the frequency and intensity of natural hazards.

Forecast

Definite statement or statistical estimate of the occurrence of a future event (UNESCO, WMO).

---

139 See UN/ISDR http://www.unisdr.org/eng/library/lib-terminology-eng%20home.htm.

Geographic Information Systems (GIS)

Analysis that combines relational databases with spatial interpretation and outputs often in form of maps. A more elaborate definition is that of computer programs for capturing, storing, checking, integrating, analysing and displaying data about the earth that is spatially referenced.

Geographic information systems are increasingly being utilized for hazard and vulnerability mapping and analysis, as well as for the application of disaster risk management measures.

Hazard

A potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydro-meteorological and biological) or induced by human processes (environmental degradation and technological hazards). Hazards can be single, sequential or combined in their origin and effects. Each hazard is characterized by its location, intensity, frequency and probability.

Mitigation

Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards.

Preparedness

Activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property.

Prevention

Activities to provide outright avoidance of the adverse impact of hazards and means to minimize related environmental, technological and biological disasters.

Public awareness

The processes of informing the general population, and increasing levels of consciousness about risks and how people can act to reduce their exposure to hazards. This is particularly important for public officials in fulfilling their responsibilities to save lives and property in the event of a disaster.

Recovery

Decisions and actions taken after a disaster with a view to restoring or improving the pre-disaster living conditions of the stricken community, while encouraging and facilitating necessary adjustments to reduce disaster risk.

Risk

The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions.

Conventionally risk is expressed by the notation Risk = Hazards x Vulnerability. Some disciplines also include the concept of exposure to refer particularly to the physical aspects of vulnerability.

Vulnerability

The conditions determined by physical, economic and environmental factors or processes that increase the susceptibility of a community to the impact of hazards.

Government of Indonesia

BAKORNAS PB, presentation by B. Wisnu Widjaja, Head of the Natural Disaster Mitigation Division at the Workshop to Improve the Compilation of Reliable Data on Disaster Occurrence and Impact, Bangkok, Thailand, April 2006.

BAKORNAS PB, *Indonesia Disaster Management Information System*, National Information Prepared for World Conference on Disaster Reduction, 2005.

BAPPENAS, "Community Based Disaster Risk Management in Indonesia," Presentation by Suprayoga Hadi, Director for Regional Development II, made at the 40th ADB Annual Meeting, 7 May 2007.

BAPPENAS and BAKORNAS PB, *National Action Plan for Disaster Reduction 2006–2009*.

BMG and LAPAN, *Lessons Learned from Landslide Early Warning in the Rainy Season of 2002–2003*, 2004.

GoI, *Workplan for 2007: NAD Nias Recovery and Disaster Mitigation and Management*.

GoI, *Framework Convention on Civil Defense Assistance*, entered into force 2003.

GoI and FRG, *Mitigation of GeoHazards in Indonesia*, prepared for Kobe, Japan, 2005.

GoI/UNDP, *Country Programme Action Plan 2006–2010*.

Gunawan, H. and Widia Bagja, I., *Global Precipitation Measurement (GPM) Data Use in Indonesia*, Center of Remote Sensing Application and Technology Development, LAPAN, 2005.

Legislations available in Bahasa Indonesia:

- Act No. 41/1999 concerning Forestry
- Act No. 37/1999 on Foreign Relations
- Act No. 23/1997 concerning Environmental Management
- Act No. 24/1992 concerning Spatial Planning
- Act No. 23/1992 concerning Health
- Act No. 5/1990 concerning Conservation of Biological Natural Resources and its Ecosystems
- Act No. 4/1984 concerning Epidemics
- Act No. 11 /1974 concerning Water Resources Management
- Act No. 6/1974 concerning Basic Arrangement on Social Welfare
- Decision III of 2000 of the People's Consultative Assembly
- Decree of Chairman of BAKORNAS PBP of 1995 on Organization, Tasks, Function and Job Description

RISTEK and UNDP, *National Workshop Report for Tsunami Early Warning Systems in Indonesia*, September 2007.

Sutardi, *Action Report Toward Flood Disasters Reduction: Indonesian case*, Indonesian Water Partnership, 2005.

Triutomo, S., *Indonesia: Interim national progress report on the implementation of the Hyogo Framework for Action (2007–2009)*, BNPB, 30 September 2008.

United Nations

CRED and UNDP, Workshop to Improve the Compilation of Reliable Data on Disaster Occurrence and Impact, jointly organized by CRED and UNDP Regional Centre in Bangkok on 2–4 April 2006.

IOC/UNESCO, *Expert Missions to Indian Ocean Countries to Assess Requirements and Capacities for an Effective National Early Warning and Mitigation System: Indonesia*, August 2005.

UN Office of Legal Affairs, *Making Decentralized Coastal Zone Management Work for the Southeast Asian Region: Comparative Perspectives*, 2007.

UN Secretary-General's Special Envoy for Tsunami Recovery, William J. Clinton, *Lessons Learned from Tsunami Recovery: Key Propositions for Building Back Better*, December 2006.

UNDP, *Human Development Report*, 2006.

UNDP, *A Global Review: UNDP Support for Institutional and Legislative Systems for Disaster Risk Management: Executive Summary*, 2004.

UNDP Indonesia, *Reflections on the false tsunami alarm of 4 June 2007 in Banda Aceh*, 6 June 2007.

UNESCAP, *Mapping Study on Tsunami Early Warning Systems in the Indian Ocean and Southeast Asia: Final Report*, August 2007.

UNHCR, *Final Report: Coastal Design and Tsunami Mitigation*, August 2005, and Red R PowerPoint presentation, April 2006.

UNICEF, *Evaluation of UNICEF Tsunami Response: Indonesia*, 2006.

UN/ISDR, *Global Survey of Early Warning Systems*, Pre-print version released at the Third International Conference on Early Warning, Bonn, Germany, 27–29 March 2006.

World Bank, *Indonesia Environment Monitor 2003*.

World Bank, *Indonesia: Environment and natural resource management in a time of transition*, 2001.

Other Resources

Abdulharis, R., Hakim, D.W. et al., *Geo-information as Disaster Management Tools in Aceh and Nias, Indonesia: A Post-disaster Area*, 2005.

Abidin, H.Z., Hendrasto, M. et al., *Studying Landslide Displacements in Megamendung (Indonesia) Using GPS Survey Method*, ITB Department of Geodetic Engineering, 2006.

Action Contre La Faim, "Supporting End to End Flood Early Warning Systems in South East Asia: ACF's Experience," presentation made at the Third International Conference on Early Warning: From concept to action, Bonn, Germany, 27–29 March 2006.

ADB, *Country Synthesis Report on Urban Air Quality Management*, December 2006.

ADB, *Indonesia: North Java Flood Control Sector Project – Completion Report*, December 2006.

ADPC, *Indonesia Country Report*.

ADRC, *Disaster Information on Member Countries: Indonesia*.

American Red Cross, *Strengthening Indonesian Communities through Disaster Training*, 8 September 2006.

Applegate, G., Chokkalinggam, U. et al., *The underlying causes and impacts of fires in Southeast Asia*, Center for International Forestry Research, Indonesia and International Centre for Research in Agroforestry, 2001.

Asia Foundation, *Indonesia Rapid Decentralization Appraisal (IRDA) – Fourth Report*.

BBC, *Indonesia Tsunami system not ready*, July 2006.

CARE, *Community Based Disaster Risk Management: A response to increased risk with emphasis on forest fires*, 2001.

CARE and World Vision, *Multi-agency Evaluation of Tsunami Response: Thailand and Indonesia*, August 2005.

Finzi, E., Bleich, G. et al., *The control of avian influenza in Indonesia: A community based approach*, April 2006.

GTZ, *Status of Tsunami Warning Chain on Community Level*, (discussion paper prepared by GTZ-IS based on experiences in three pilot areas), September 2007.

GTZ, *Legal Framework for Disaster Management Particularly in the Field of Early Warning*, December 2006.

GTZ, German-Indonesian Cooperation for Tsunami Early Warning System Capacity Building in Local Communities, *Early Warning Experiences for Flood, Volcano & Forest Fire in Indonesia and Tsunami in Pacific Region*, Working Document No.7, Baseline-Study, December 2006.

IFRC, *Indonesia: Laws, Policies, Planning and Practices on International Disaster Response*, July 2005.

Indonesia Report presented at the Fourth Session of the ICG/IOTWS, Mombasa, Kenya, 28 February – 2 March 2007.

Indonesian Agroclimate and Hydrology Research Institute, *Utilization of Satellite Imagery for Vegetation Drought Monitoring in Indonesia*, 2005.

Indonesian Friends of the Earth Website, Description of Programs.

Indonesian Society for Disaster Management, *Disaster Management in Indonesia: A Briefing Paper for Legislative Reform*, 2005.

ISDR/CRED, Disaster Data, *Indonesia*, 2005.

Jakarta Post "New body to continue Aceh projects," 14 February 2009.

Jakarta Post, "Indonesian villagers damage tsunami warning siren," 9 June 2007.

Jakarta Post, "After the Flooding, the blame game begins," 4 February 2007.

Jakarta Post, "Land titles in Aceh – so much hope but more action needed," 2 December 2006.

JICA, *Integrated Sediment-Related Disaster Management Project – Mount Merapi*, 2002–2006.

Lavigne, F., Thouret, J-C., Sukatja, B. et al., *Lahar monitoring and warning systems in Indonesia*, 2006.

Mayer, J., "Transboundary Perspectives in Managing Indonesia's Fires," *Journal of Environment and Development, Vol. 15: No. 2*, SAGE Publications, 2006.

Nicholson, W.C., "Legal Issues: Warning Systems," in *Early Warning Systems – A Public Risk Institute Symposium*, 2005.

OneWorldnet.com, Summary of Progress on the MDGs.

Tan, K-J. A., *The ASEAN Agreement on Transboundary Haze Pollution: Prospects for Compliance and Effectiveness in Post-Suharto Indonesia*, October 2005.

Tan, K-J. A., "Environmental Laws and Institutions in Southeast Asia: A Review of Recent Developments," *Singapore Yearbook of International Law (SYBIL), 2004, Vol. VIII*.

Thorburn, C.C., *A Long Row to Hoe, Decentralization, Reformasi and Land Management Policy in Indonesia*, Monash University, Australia, 2004.

Tsunami Global Lessons Learned Project, *The Tsunami Legacy: Innovations, Breakthroughs and Change*, 2009.

University of Rhode Island, *Evaluation of the CRMP*, 2003.

US Energy Information Administration, *Indonesia Environmental Issues*, 2004.

USAID/Asia, *US Indian Ocean Tsunami Warning System Program: Review of Policies and Institutional Capacity for Early Warning and Disaster Management in Indonesia*, January 2007.

USAID, IOTWS, ICS Factsheets and Website.

Weinstein, S., Oppenheimer, D. and Benz, H., *Mission #3: Assessment and recommendations*, PTWC and USGS, December 2006.

Yayasan IDEP, *Community Based Disaster Management (CBDM) Kit*, Yayasan IDEP website.

Documents Consulted – Gender Chapter

Government of Indonesia

GoI, *Gender in Community Driven Development Project: Implications for PNPM (National Community Empowerment Project) – Working paper on the findings of the joint donor and government mission*, GoI, World Bank, ADB, DFID and Government of Australia, 2007.

United Nations

ADB, *Indonesia: Country Gender Assessment*, July 2006.

ADB, *From Poverty to Prosperity: A Country Poverty Analysis for Indonesia*, 2006.

Division for the Advancement of Women and UN/ISDR, *Gender Mainstreaming Guidelines for Disaster Management Programmes: A Principled Socio-Economic and Gender Analysis (SEAGA) Approach*, Expert Group Meeting on Environmental Management and the Mitigation of Natural Disasters: A Gender Perspective, Ankara, Turkey, 6–9 November 2001.

Inter-Agency Standing Committee, *Different Needs, Equal Opportunities: A Gender Handbook for Humanitarian Action* (Draft), 28 July 2006.

UN Department of Economic and Social Affairs, *The Millennium Development Goals Report 2007*, June 2007.

UNDP, *Human Development Index*, 2006.

UNESCAP, *Opening Address* by Savitri Goonesekere, Expert Group Meeting on CEDAW for National Machineries and Senior Law-making Officials on How to Effectively Integrate and Implement the CEDAW at the National Level to Promote the Human Rights of Women, Bangkok, Thailand, 18–20 July 2007.

UNFPA, *Response to the Tsunami: Update at Six Months*, 2005.

UNIFEM website, "About the CEDAW" and "Indonesia Country Page."

UN/ISDR, *Gender Perspective: Working Together for Disaster Risk Reduction – Good Practices and Lessons Learned*, Geneva, June 2007.

Other Resources

Abarquez, I. and Murshed, Z., *Community Based Disaster Risk Management: Field Practitioners Handbook*, ADPC, 2004.

Ariyabandu, M., Women: *The risk managers in natural disasters*, Intermediate Technology Development Group, South Asia, 2003.

Carballo, M., Heal, B. and Horbaty, G., "Impact of the tsunami on psychosocial health and well-being," *International Review of Psychiatry*, June 2006; 18(3): 217–223, International Centre for Migration and Health, Geneva, Switzerland.

CARE and World Vision, *Multi-agency Evaluation of Tsunami Response: Thailand and Indonesia*, August 2005.

Experiences from Asia (Indonesia) and Central America (Nicaragua) in local@glob *Disaster Risk Reduction and Sustainable Local Development*, Issue No. 3, 2006.

Gender Equality and Disaster Risk Reduction Workshop – Call to Action, Honolulu, Hawaii USA, 2004.

Mar'iyah, C., *The Political Representation of Women in Indonesia: How Can It Be Achieved?* Paper prepared for workshop hosted by International Institute for Democracy and Electoral Assistance in Jakarta, Indonesia, 25 September 2002.

Molin Valdés, H., "Women, disaster risk reduction and sustainable development," in local@glob *Disaster Risk Reduction and Sustainable Local Development*, Issue No. 3, 2006.

OXFAM, The tsunami's impact on women, *OXFAM Briefing Note*, 2005.

Social Watch, *Gender Equity Index 2008*.

Thompson, M., *The long recovery process: Women struggle to rebuild shattered lives*, Unitarian Universalist Service Committee, 2005.

Tsunami Evaluation Coalition, *Impact of the Tsunami Response on Local and National Capacities: Indonesia Country Report*, April 2006.

Annex III – Developing Early Warning Systems: A Checklist[140]

Key Element 1:

RISK KNOWLEDGE

Aim: *Establish a systematic, standardized process to collect, assess and share data, maps and trends on hazards and vulnerabilities.*

Key Actors

International, national and local disaster management agencies; meteorological and hydrological organizations; geophysical experts; social scientists; engineers; land use and urban planners; researchers and academics; organizations and community representatives involved in disaster management; international and UN agencies such as WMO, UN/ISDR, UNEP, UNU-EHS, UNOSAT, UNDP, FAO, UNESCO.

Checklist

1. Organizational Arrangements Established

- Key national government agencies involved in hazard and vulnerability assessments identified and roles clarified (e.g. agencies responsible for economic data, demographic data, land use planning, social data etc).

- Responsibility for coordinating hazard identification, vulnerability and risk assessment assigned to one national organization.

- Legislation or government policy mandating the preparation of hazard and vulnerability maps for all communities in place.

- National standards for the systematic collection, sharing and assessment of hazard and vulnerability data developed, and standardized with neighbouring or regional countries, where appropriate.

- Process for scientific and technical experts to assess and review the accuracy of risk data and information developed.

- Strategy to actively engage communities in local hazard and vulnerability analyses developed.

- Process to review and update risk data each year, and include information on any new or emerging vulnerabilities and hazards established.

2. Natural Hazards Identified

- Characteristics of key natural hazards (e.g. intensity, frequency and probability) analysed and historical data evaluated.

- Hazard maps developed to identify the geographical areas and communities that could be affected by natural hazards.

- An integrated hazard map developed (where possible) to assess the interaction of multiple natural hazards.

3. Community Vulnerability Analysed

- Community vulnerability assessments conducted for all relevant natural hazards.

- Historical data sources and potential future hazard events considered in vulnerability assessments.

- Factors such as gender, disability, access to infrastructure, economic diversity and environmental sensitivities considered.

- Vulnerabilities documented and mapped (e.g. people or communities along coastlines identified and mapped).

4. Risks Assessed

- Interaction of hazards and vulnerabilities assessed to determine the risks faced by each region or community.

- Community and industry consultation conducted to ensure risk information is comprehensive and includes historical and indigenous knowledge, and local information and national level data.

- Activities that increase risks identified and evaluated.

- Results of risks assessment integrated into local risk management plans and warning messages.

5. Information Stored and Accessible

- Central 'library' or GIS database established to store all disaster and natural hazard risk information.

---

140 This checklist is drawn from UN/ISDR, Developing Early Warning Systems: A Checklist, An outcome of the Third International Conference on Early Warning (EWCIII) hosted by the Government of Germany in Bonn, 27–29 March 2006.

- Hazard and vulnerability data available to government, the public and the international community (where appropriate).

- Maintenance plan developed to keep data current and updated.

Key Element 2:

MONITORING AND WARNING SERVICE

Aim: *Establish an effective hazard monitoring and warning service with a sound scientific and technological basis.*

Key Actors

National meteorological and hydrological services; specialised observatory and warning centres (e.g. for water, volcano); universities and research institutes; private sector equipment suppliers; telecommunications authorities; quality management experts; regional technical centres; UN agencies such as UN/ISDR, WMO, FAO, UNESCO, UNEP, UNOSAT, OCHA, ITU.

Checklist

1. Institutional Mechanisms Established

- Standardized process, and roles and responsibilities of all organizations generating and issuing warnings established and mandated by law.

- Agreements and interagency protocols established to ensure consistency of warning language and communication channels where different hazards are handled by different agencies.

- An all-hazard plan to obtain mutual efficiencies and effectiveness among different warning systems established.

- Warning system partners, including local authorities, aware of which organizations are responsible for warnings.

- Protocols in place to define communication responsibilities and channels for technical warning services.

- Communication arrangements with international and regional organizations agreed and operational.

- Regional agreements, coordination mechanisms and specialized centres in place for regional concerns such as tropical cyclones, floods in shared basins, data exchange, and technical capacity building.

- Warning system subjected to system-wide tests and exercises at least once each year.

- A national all-hazards committee on technical warning systems in place and linked to national disaster management and reduction authorities, including the national platform for disaster risk reduction.

- System established to verify that warnings have reached the intended recipients.

- Warning centres staffed at all times (24 hours per day, seven days per week).

2. Monitoring Systems Developed

- Measurement parameters and specifications documented for each relevant hazard.

- Plans and documents for monitoring networks available and agreed with experts and relevant authorities.

- Technical equipment, suited to local conditions and circumstances, in place and personnel trained in its use and maintenance.

- Applicable data and analysis from regional networks, adjacent territories and international sources accessible.

- Data received, processed and available in meaningful formats in real time, or near-real time.

- Strategy in place for obtaining, reviewing and disseminating data on vulnerabilities associated with relevant hazards.

- Data routinely archived and accessible for verification and research purposes.

3. Forecasting and Warning Systems Established

- Data analysis, prediction and warning generation based on accepted scientific and technical methodologies.

- Data and warning products issued within international standards and protocols.

- Warning analysts trained to appropriate international standards.

- Warning centres equipped with appropriate equipment needed to handle data and run prediction models.

- Fail-safe systems in place, such as power back-up, equipment redundancy and on-call personnel systems.

- Warnings generated and disseminated in an efficient and timely manner and in a format suited to user needs.

- Plan implemented to routinely monitor and evaluate operational processes, including data quality and warning performance.

Key Element 3:

DISSEMINATION AND COMMUNICATION

Aim: *Develop communication and dissemination systems to ensure people and communities are warned in advance of impending natural hazard events and facilitate national and regional coordination and information exchange.*

Key Actors

International, national and local disaster management agencies; national meteorological and hydrological services; military and civil authorities; media organizations (print, television, radio and online); businesses in vulnerable sectors (e.g. tourism, aged care facilities, marine vessels); communitybased and grassroots organizations; international and UN agencies such as UN/ISDR, IFRC, UNDP, UNESCO, UNEP, WMO, OCHA.

Checklist

1. Organizational and Decision-making Processes Institutionalised

- Warning dissemination chain enforced through government policy or legislation (e.g. message passed from government to emergency managers and communities etc).

- Recognized authorities empowered to disseminate warning messages (e.g. meteorological authorities to provide weather messages, health authorities to provide health warnings).

- Functions, roles and responsibilities of each actor in the warning dissemination process specified in legislation or government policy (e.g. national meteorological and hydrological services, media, NGOs).

- Roles and responsibilities of regional or cross border early warning centres defined, including the dissemination of warnings to neighbouring countries.

- Volunteer network trained and empowered to receive and widely disseminate hazard warnings to remote households and communities.

2. Effective Communication Systems and Equipment Installed

- Communication and dissemination systems tailored to the needs of individual communities (e.g. radio or television for those with access; and sirens, warning flags or messenger runners for remote communities).

- Warning communication technology reaches the entire population, including seasonal populations and remote locations.

- International organizations or experts consulted to assist with identification and procurement of appropriate equipment.

- Multiple communication mediums used for warning dissemination (e.g. mass media and informal communication).

- Agreements developed to utilise private sector resources where appropriate (e.g. amateur radios, safety shelters).

- Consistent warning dissemination and communication systems used for all hazards.

- Communication system is two-way and interactive to allow for verification that warnings have been received.

- Equipment maintenance and upgrade programme implemented and redundancies enforced so back-up systems are in place in the event of a failure.

3. Warning Messages Recognised and Understood

- Warning alerts and messages tailored to the specific needs of those at risk (e.g. for diverse cultural, social, gender, linguistic and educational backgrounds).

- Warning alerts and messages are geographically-specific to ensure warnings are targeted to those at risk only.

- Messages incorporate the understanding of the values, concerns and interests of those who will need to take action (e.g. instructions for safeguarding livestock and pets).

- Warning alerts clearly recognisable and consistent over time and include follow-up actions when required.

- Warnings specific about the nature of the threat and its impacts.

- Mechanisms in place to inform the community when the threat has ended.

- Study into how people access and interpret early warning messages undertaken and lessons learnt incorporated into message formats and dissemination processes.

Key Element 4:

RESPONSE CAPABILITY

Aim: *Strengthen the ability of communities to respond to natural disasters through enhanced education of natural hazard risks, community participation and disaster preparedness.*

Key Actors

Community-based and grassroots organizations; schools; universities; informal education sector; media (print, radio,

television, on-line); technical agencies with specialised knowledge of hazards; international; national and local disaster management agencies; regional disaster management agencies; international and UN agencies such as OCHA, UNDP, UNEP, FAO, UNESCO, UN/ISDR, IFRC, WMO.

Checklist

1. Warnings Respected

• Warnings generated and distributed to those at risk by credible sources (e.g. government, spiritual leaders, respected community organizations).

• Public perception of natural hazard risks and the warning service analysed to predict community responses.

• Strategies to build credibility and trust in warnings developed (e.g. understanding difference between forecasts and warnings).

• False alarms minimised and improvements communicated to maintain trust in the warning system.

2. Disaster Preparedness and Response Plans Established

• Disaster preparedness and response plans empowered by law.

• Disaster preparedness and response plans targeted to the individual needs of vulnerable communities.

• Hazard and vulnerability maps utilized to develop emergency preparedness and response plans.

• Up-to-date emergency preparedness and response plans developed, disseminated to the community, and practiced.

• Previous disaster events and responses analysed, and lessons learnt incorporated into disaster management plans.

• Strategies implemented to maintain preparedness for recurrent hazard events.

• Regular tests and drills undertaken to test the effectiveness of the early warning dissemination processes and responses.

3. Community Response Capacity Assessed and Strengthened

• Community ability to respond effectively to early warnings assessed.

• Response to previous disasters analysed and lessons learnt incorporated into future capacity building strategies.

• Community-focused organizations engaged to assist with capacity building.

• Community and volunteer education and training programmes developed and implemented.

4. Public Awareness and Education Enhanced

• Simple information on hazards, vulnerabilities, risks, and how to reduce disaster impacts disseminated to vulnerable communities and decision-makers.

• Community educated on how warnings will be disseminated and which sources are reliable and how to respond to different types of hazards after an early warning message is received.

• Community trained to recognise simple hydro-meteorological and geophysical hazard signals to allow immediate response.

• On-going public awareness and education built in to school curricula from primary schools to university.

• Mass media and folk or alternative media utilized to improve public awareness.

• Public awareness and education campaigns tailored to the specific need of each audience (e.g. children, emergency managers, media).

• Public awareness strategies and programmes evaluated at least once per year and updated where required.

Cross-Cutting Issue:

GOVERNANCE AND INSTITUTIONAL ARRANGEMENTS

Aim: *Develop institutional, legislative and policy frameworks that support the implementation and maintenance of effective early warning systems.*

Key Actors

Political leaders; policy makers (e.g. environment, development and planning departments); international, national and local disaster management agencies; meteorological and hydrological organizations; researchers and academics; non-government organizations; international and UN agencies such as UNDP, UNEP, FAO, UNESCO, UN/ISDR, WMO, World Bank and regional development banks, IFRC.

Checklist

1. Early Warning Secured as a Long Term National and Local Priority

• Economic benefits of early warning highlighted to senior government and political leaders using practical methods such as a cost-benefit analysis of previous disasters.

- Examples and case studies of successful early warning systems disseminated to senior government and political leaders.

- Early warning role models or "champions" engaged to advocate early warning and promote its benefits.

- The priority natural hazard risk requiring an early warning system identified, and operational arrangements within a multihazard framework established.

- Early warning integrated into national economic planning.

2. Legal and Policy Frameworks to Support Early Warning Established

- National legislation or policies developed to provide an institutional and legal basis for implementing early warning systems.

- Clear roles and responsibilities defined for all organizations (government and nongovernment) involved in early warning.

- Overall responsibility and authority for coordination of early warning assigned to one national agency.

- One political leader or senior government official empowered by law as the national decision maker.

- Policies developed to decentralise disaster management and encourage community participation.

- Local decision making and implementation of early warning systems placed within broader administrative and resource capabilities at the national or regional level.

- Regional and cross-border agreements established to ensure early warning systems are integrated where possible.

- Relationships and partnerships between all organizations involved in early warning institutionalised and coordination mechanisms mandated.

- Early warning integrated into disaster reduction and development policies.

- Monitoring and enforcement regime in place to support policies and legislation.

3. Institutional Capacities Assessed and Enhanced

- Capacities of all organizations and institutions involved assessed and capacity building plans and training programmes developed and resourced.

- Non-governmental sector engaged and encouraged to contribute to capacity building.

4. Financial Resources Secured

- Government funding mechanism for early warning and disaster preparedness developed and institutionalised.

- Access to funding at the international or regional level explored.

- Public/private partnerships utilised to assist with early warning system development.