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Strengthening Public Alert and Warning Capacity in APEC Economies

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STRENGTHENING PUBLIC ALERT & WARNING CAPACITY IN APEC ECONOMIES

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STRENGTHENING PUBLIC ALERT & WARNING CAPACITY IN APEC ECONOMIES

Phase I Project Report

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ACRONYMS

APEC	Asia Pacific Economic Cooperation
AHA Centre	ASEAN Centre for the Coordination of Humanitarian Assistance
ASEAN	Association of Southeast Asian Nations
BNPB	National Board for Disaster Management
CAP	Common Alerting Protocol
CBS	Cellular Broadcast Services
CDC	Center for Disease Control
CfE-DMHA	Center for Excellence in Disaster Management and Humanitarian Assistance
CI	Core Indicator
CONOPS	Concept of Operations
CSO	Civil Society Organization
DDPM	Department of Disaster Prevention and Mitigation
DisasterAWARE	All-hazard Warning, Analysis, and Risk Evaluation
DMO	Disaster Management Organization
DMRS	Disaster Monitoring and Response System
DRR	Disaster Risk Reduction
EMOPS	Emergency Operations System
EPWG	Emergency Preparedness Working Group
EWS	Early Warning System
GDACS	Global Disaster Alert and Coordination System
HFA	Hyogo Framework for Action
HMA	Hazard Monitoring Agency
ICT	Information and Communication Technology
IDB	Inter-American Development Bank
IFRC	International Federation of Red Cross and Red Crescent Societies
MAEDI	Ministry of Foreign Affairs and International Development
MCDEM	Ministry of Civil Defence and Emergency Management
NDMC	National Disaster Management Centre
NIDM	National Institute of Disaster Management
NSC	National Security Council

ONEMI	Ministry of the Interior National Emergency Bureau
PDC	Pacific Disaster Center
RIMES	Regional Integrated Multi-Hazard Early Warning System for Africa and Asia
RVA	Risk and Vulnerability Assessment
SFDRR	Sendai Framework for Disaster Risk Reduction
SIGRID	Sistema de Información para la Gestión del Riesgo de Desastres
SINPAD	Sistema de Información para la Repuesta y Rehabilitación
SMS	Short Message Service
SOP	Standard Operating Procedure
TCP	Tropical Cyclone Programme
UNDP	United Nations Development Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNEP	United Nations Environment Programme
UNISDR	United Nations International Strategy for Disaster Reduction
US-ATAARI	US-APEC Technical Assistance to Advance Regional Integration
USNSTC	US National Science and Technology Committee
WMO	World Meteorological Organization

EXECUTIVE SUMMARY

In order to advance operationalization of the APEC DRR Framework in the area of early warning, the US-APEC Technical Assistance to Advance Regional Integration (US-ATAARI) is working with the APEC Emergency Preparedness Working Group on an APEC co-funded project, “Strengthening Public Alert and Early Warning Capacity.” The project has two main objectives: 1) strengthen public alert and early warning capacity through peer-to-peer learning, and 2) identify APEC practices in public alert and early warning, with the aim of developing APEC-specific principles. This study report represents a first step toward achieving these objectives.

The study revealed that there has been significant investment in the development and expansion of technical monitoring systems since the 2004 Indian Ocean Tsunami, and monitoring systems in the region are relatively sophisticated.

APEC economies use multiple warning channels to reach at-risk populations. However, several economies described challenges associated with communications infrastructure, particularly in remote areas, and cited ongoing coordination and communication issues between early warning system (EWS) stakeholders. Intra- and inter-economy systems integration and stronger partnerships and information-sharing among stakeholders are the next steps. The study suggests an understanding of risk and vulnerability should inform the design and implementation of early warning systems and associated outreach. There is room for improvement in terms of the implementation and application of risk and vulnerability assessment, a fundamental piece of the APEC DRR Framework.

On the issue of response to warnings, most survey respondents were only somewhat confident that the general public would take appropriate action when a warning is issued. While many factors influence individual decision-making and behavior, better integration of civil society organizations into preparedness and response activities may improve response outcomes.

Governance and institutional arrangements underpin all other components of early warning systems. Disaster management and disaster risk reduction legislation and policy have improved dramatically in APEC economies since 2004. However, gaps in early warning laws and policies remain. Effective institutional frameworks for early warning systems facilitate coordination and promote the sharing of critical information both within and among economies.

Based on the results of this study, the following recommendations are offered to enhance early warning systems in support of the APEC DRR Framework:

1. Encourage consistent implementation and application of risk and vulnerability assessments in the design, implementation and maintenance of early warning systems.
2. Support regional cooperation and partnerships to realize the interoperability of multi-hazard early warning systems within and across economies.
3. Document concepts of operation, decision authorities, and information flows for early warning systems. This activity should incorporate all early warning system stakeholder groups to clarify roles, challenges, and opportunities.
4. Encourage partnerships with the private and non-profit sectors to augment the capacity, reach, and effectiveness of early warning systems.
5. Continue outreach to the general public to improve response results and increase confidence among disaster management officials in the public’s ability to respond appropriately to alerts and warnings.

INTRODUCTION

Priority for Action 2 of the Hyogo Framework for Action (Hyogo Framework) encouraged actors around the world to “identify, assess and monitor disaster risks and enhance early warning.” The Sendai Framework for Disaster Risk Reduction (DRR), adopted in 2015, sets a global target to “substantially increase the availability of and access to multi-hazard early warning systems (EWS) and disaster risk information and assessments to people by 2030.” Like these global frameworks, the APEC DRR Framework identifies effective early warning as an important piece of an overall strategy to reduce disaster risk across the region.

Much progress has been made within APEC economies to address this priority, but gaps and challenges remain in the consistent implementation of people-centered early warning systems (EWS). Key components of an effective EWS were identified in a “checklist” developed for the Third International Conference on Early Warning held in 2006.¹ Those components are risk knowledge; monitoring and warning services; dissemination and communication; and response capability. All components must be supported by good governance and appropriate institutional mechanisms. The checklist is still relevant 10 years later and can aid economies in their contributions to the global target to “substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030” as outlined in the Sendai Framework for Disaster Risk Reduction (Sendai Framework).

In 2015, after the adoption of the Sendai Framework, APEC economies worked to develop the APEC Disaster Risk Reduction Framework and an associated work plan. Effective early warning is recognized as an important element in an overall strategy to reduce disaster risk and limit losses across the region. In order to advance operationalization of the Framework within the area of early warning, the US-APEC Technical Assistance to Advance Regional Integration (US-ATAARI) is working with the APEC Emergency Preparedness Working Group (EPWG) on an APEC co-funded project “Strengthening Public Alert and Early Warning Capacity.” The project has two main objectives: 1) strengthen public alert and early warning capacity through peer to peer learning, and 2) identify APEC practices in public alert and early warning, with the aim of developing APEC-specific principles.

Project objectives are being addressed through a set of phased activities. Phase I consisted of information-gathering activities intended to result in better understanding of public alert and early warning system capacities within the APEC region and to identify ongoing gaps and challenges. Results of Phase I activities will be disseminated in Phase II. The intended output of Phase II is a set of approved APEC-wide principles associated with the development of early warning systems and the generation, flow, and application of related information.

This document outlines Phase I activities and is divided into six sections. A preliminary set of suggestions for addressing gaps and prioritizing further activities is provided in the final section.

¹ United Nations International Strategy for Disaster Reduction (UNISDR). (2006). *Developing Early Warning Systems: A Checklist*. Retrieved from: <http://www.unisdr.org/2006/ppew/info-resources/ewc3/checklist/English.pdf>

I. METHODOLOGY

Data gathering for the Phase I study consisted of two main activities: a desk study and a survey of stakeholders in APEC economies. Both the desk study and survey touched on all key aspects of effective early warning systems. Survey data collection focused on information related to legal authority and roles; information flow; how well warning systems and associated outreach address the varying needs of at-risk populations; and key challenges and capability gaps. Partnerships and perceptions of public response were also addressed. The desk study helped to inform recommendations and good practices that can help APEC economies develop guiding principles for public alerting and early warning.

The desk study entailed a review of available literature, both online resources and hard copy documents obtained as a result of the team's past work in the field of early warning. Resources included government documents and public releases, documents submitted through DRR reporting programs such as the Hyogo Framework for Action Monitor, reviews of individual economy capabilities by external organizations, project reports and announcements, and general reviews of the state and direction of early warning systems at the global and/or regional levels. A list of resources reviewed can be found in Appendix I.

Surveys were developed for three stakeholder groups: disaster management organizations (DMOs), hazard monitoring agencies² (HMAs), and civil society organizations (CSOs). Survey questions were tailored for each type of organization based on their general activities related to public alerting and early warning. However, many questions appeared on two or more of the surveys, with the HMA and DMO surveys having the greatest overlap. This approach helped streamline individual surveys while enabling capture of a broader range of total information. It also created the opportunity to identify potential differences in perception between organizations.

Surveys ranged in length from 13 questions (CSO survey) to 25 questions (HMA survey) and were written in English. Most questions were closed, though a few questions requested that participants elaborate on a previous answer or provide a free response. Surveys were administered online via Survey Monkey and were also made available as offline Microsoft Word documents to potential respondents. The three surveys are included as Appendix 2.

Contact information for HMA, DMO and CSO stakeholders was compiled for each economy through online searches of relevant organizations, the project team's professional networks, and APEC representatives. Preliminary lists of potential contacts were sent to APEC EPWG focal points for feedback. Suggestions and updates to the contact list were incorporated before surveys were distributed by email. Two general follow-up emails were sent to encourage participation. Personal contact was made with individual respondents for follow-up where feasible.

Data obtained through Survey Monkey and through the return of survey documents were compiled, coded, and analyzed using Microsoft Excel and SPSS, a statistical software program.

² A hazard monitoring agency is an agency with scientific or technical expertise that is responsible for researching, monitoring, and analyzing hydrometeorological, geological, or other environmental conditions.

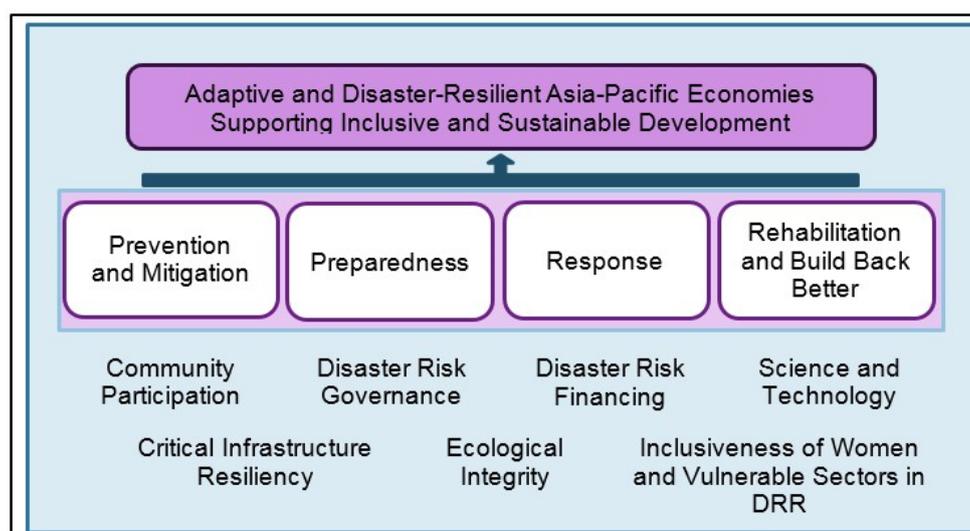
II. FRAMING THE STUDY

The results, discussion, and recommendations presented in this report are framed by guidance contained in documents related to early warning and larger DRR frameworks. Three of particular relevance are highlighted below: the APEC DRR Framework, an early warning checklist developed by UNISDR³, and some of the guiding principles on early warning put forth by the International Federation of Red Cross and Red Crescent Societies (IFRC). All three of the documents reflect ideas expressed in the Hyogo and Sendai Frameworks.

THE APEC DRR FRAMEWORK

The Sendai Framework underscores the role of regional cooperation in reducing disaster risk. In 2015, APEC Leaders developed a DRR Framework under which “the APEC community can collectively identify and explore areas for enhanced cooperation.”⁴ The APEC DRR Framework consists of four pillars that interact to support adaptive and disaster resilient APEC economies. (See Figure I.) Figure I also features key elements of an environment that enables achievement of this goal.

Figure I: Four Pillars of the APEC DRR Framework and Enabling Environment



Source: APEC 2015.

Of particular relevance to early warning systems are the identification of risk outlined in Pillar 1 (Prevention and Mitigation) and several aspects of Pillar 2 (Preparedness). A high level overview of Pillar 2 is included as Table 1 below. Areas of collaboration included in the APEC DRR Framework relevant to early alert and warning are outlined in Table 2.

³ UNISDR. (2006). Checklist.

⁴ Asia Pacific Economic Cooperation (APEC). (2015). *Annex A – APEC Disaster Risk Reduction Framework*. Output of the 2015 APEC Ministerial Meeting in Manila, Philippines. Retrieved from: http://www.apec.org/Meeting-Papers/Annual-Ministerial-Meetings/Annual/2015/2015_amm/annexa.aspx.

Table 1: Overview of APEC DRR Framework Pillar 2: Preparedness

Key Activities of the Preparedness Pillar	
1.	Harnessing regional cooperation to strengthen early warning mechanisms for transboundary hazards in the region such as tsunamis and typhoons.
2.	Establishing and strengthening the capacities of communities to anticipate, cope, and recover from the negative impacts of disasters.
3.	Enhancing urban and rural planning using risk and hazard mapping techniques and information.
4.	Strengthening critical infrastructure, including social and cultural infrastructure.
5.	Cooperation between government and businesses to increase the resilience of supply chains.
6.	Utilizing current and advanced Information and Communications Technologies for comprehensive disaster management system.
7.	Development and promotion of financial tools, such as microinsurance and catastrophic risk insurance.
8.	Promotion of business continuity planning.

Adapted from APEC 2015.

Table 2: APEC DRR Framework Areas of Collaboration Relevant to Early Warning Systems

Pillar	Area for Collaboration
1: Prevention and Mitigation	Utilization of science, technology and research to prepare for, prevent and mitigate disaster impacts.
	Promotion of open access to non-sensitive risk and hazard mapping information, which is understandable and easily accessible for households, communities, businesses, and governments to ensure making appropriate decisions.
	Identification of vulnerable and hazardous areas, and taking mitigating steps to reduce disaster risks of affected communities.
2: Preparedness	Voluntary sharing of non-sensitive information and best practices to improve early warning systems and development of comprehensive disaster risk management systems utilizing current and advanced science and technology as well as Information and Communications Technologies.
	Capacity-building and voluntary technology-transfer to sustain the development, improvement and exchange of important Disaster Risk Reduction (DRR) skills, knowledge, and technologies, as mutually agreed.
	Emphasis of government and business cooperation in a whole-of-society approach to preparedness.

Adapted from APEC 2015.

THE EARLY WARNING SYSTEM CHECKLIST

The checklist developed for the Third International Conference on Early Warning⁵ was intended as a nontechnical reference tool that outlined a set of basic elements, actions, and good practices associated with effective, people-centered early warning systems. It continues to be used as guidance today and is a useful framework for evaluation and discussion. A high-level overview of the checklist is included as Table 3.

Table 3: Key Elements of Effective Early Warning Systems⁶

Key Early Warning System Component	Checklist
<p>Risk Knowledge</p> <p><i>Aim: Establish a systematic, standardized process to collect, assess and share data, maps and trends on hazards and vulnerabilities.</i></p>	<ol style="list-style-type: none"> 1. Organizational arrangements established 2. Natural hazards identified 3. Community vulnerability analyzed 4. Risks Assessed 5. Information stored and accessible
<p>Monitoring and Warning Service</p> <p><i>Aim: Establish an effective hazard monitoring and warning service with a sound scientific and technological basis.</i></p>	<ol style="list-style-type: none"> 1. Institutional mechanisms established 2. Monitoring systems developed 3. Forecasting and warning systems developed
<p>Dissemination and Communication</p> <p><i>Aim: Develop communication and dissemination systems to ensure people and communities are warned in advance of impending natural hazard events and facilitate economy-wide and regional coordination and information exchange.</i></p>	<ol style="list-style-type: none"> 1. Organizational and decision-making processes institutionalized 2. Effective communication systems and equipment installed 3. Warning messages recognized and understood
<p>Response Capability</p> <p><i>Aim: Strengthen the ability of communities to respond to natural disasters through enhanced education of natural hazard risks, community participation and disaster preparedness.</i></p>	<ol style="list-style-type: none"> 1. Warnings respected 2. Disaster preparedness and response plans established 3. Community response capacity assessed and strengthened 4. Public education and awareness enhanced
<p>Governance and Institutional Arrangements</p> <p><i>Aim: Develop institutional, legislative and policy frameworks that support the implementation and maintenance of effective early warning systems.</i></p>	<ol style="list-style-type: none"> 1. Early warning secured as a long term economy-level and local priority 2. Legal and policy frameworks to support early warning established 3. Institutional capacities assessed and enhanced 4. Financial resources secured

Adapted from UNISDR 2006.

⁵ UNISDR. (2006). Checklist.

⁶ Language, including UNISDR language, throughout this document has been adapted to be consistent with APEC usage.

IFRC GUIDING PRINCIPLES FOR EARLY WARNING SYSTEMS

In 2012, the IFRC developed a set of Guiding Principles for each of the components outlined in the UNISDR checklist. Of particular relevance here are those pertaining to the cross-cutting themes highlighted in the checklist. While specifically developed for community-level efforts, these principles are relevant for warning systems at all levels of government. The IFRC principles and APEC economies that were highlighted as examples of good practices for each principle at the community level are included as Table 4.

Table 4: IFRC Guiding Principles and Examples of Good Practices

Guiding Principles for Cross-cutting Themes	Economies in which Community Level Good Practices were Highlighted by IFRC
1. Integrate within DRR: EWS is not a stand-alone	Indonesia*
2. Aim for synergy across levels: community, economy and regional/global	
3. Insist on multi-hazard EWS	Indonesia, the Philippines, Viet Nam, Regional
4. Systematically include vulnerability	
5. Design EWS components with multiple functions	
6. Accommodate multiple timescales	
7. Embrace multiple knowledge systems	Thailand, Indonesia
8. Account for evolving risk and rising uncertainty	Australia, China
9. EWS without borders: target the full vulnerability and hazard-scape	
10. Demand appropriate technology	Indonesia
11. Require redundancy in indicators and communication channels	
12. Target and reach disadvantaged and vulnerable groups	Indonesia, Viet Nam
13. Build partnership and individual engagement	Indonesia, the Philippines, Viet Nam, USA

**While not highlighted by IFRC, the community-based early warning systems developed by Universitas Gadjah Mada and implemented in collaboration with communities (see Fathani et al. 2015) are an excellent example of EWS integrated into a wider risk reduction program. The effectiveness of the approach has been recognized by the government of Indonesia.*

III. DESK STUDY ON STATE OF EARLY WARNING IN APEC ECONOMIES

A review of the literature indicates that substantial progress has been made in APEC economies on many of the key components of early warning, as well as on some cross-cutting principles. The 2004 Indian Ocean Tsunami catalyzed the development of both technical and institutional elements of EWS across the region. However, progress has not been consistent across the essential components of early warning systems, across hazards, or across economies.

LEGAL AUTHORITY AND INSTITUTIONAL MECHANISMS

Influenced by international efforts such as the Hyogo Framework, there has been a substantial increase in disaster management legislation in the Asia-Pacific since 2004.⁷⁻⁸⁻⁹ Such legislation is often a major step toward securing high-level advocacy and resources for disaster management programs and policies.

Laws and accompanying frameworks may include reference to the provision of alerts and warnings (e.g., Peru and the Philippines in APEC), but other economies (e.g., Brunei Darussalam) may not have specific laws governing them.¹⁰⁻¹¹⁻¹²⁻¹³⁻¹⁴ The distribution of authority and responsibility differs among economies. Some economies place greater responsibility and/or authority on provincial or prefectural authorities

⁷ United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP). (2011). *Early Warning Systems in the Indian Ocean and Southeast Asia: 2011 Report on Regional Unmet Needs*. Bangkok: UNESCAP.

⁸ Rogers, D., and Tsirkunov, V. (n.d.). *Implementing Hazard Early Warning Systems: GFDRR WCIDS Report 11-03*. Retrieved from: http://www.preventionweb.net/files/24259_implementingearlywarningsystems1108.pdf.

⁹ World Meteorological Association (WMO). (2015). *Synthesis of the Status and Trends with the Development of Early Warning Systems: A Contribution to the Global Assessment Report 2015*. Geneva: UNISDR.

¹⁰ Rogers and Tsirkunov. (n.d.). GFDRR Report.

¹¹ Inter-American Development Bank (IDB) (2010). *Peru to Reduce Natural Disasters Vulnerability, Boost Response Capacity with IDB Assistance*. Retrieved from IDB: <http://www.iadb.org/en/news/news-releases/2010-09-23/peru-to-reduce-natural-disasters-vulnerability-with-idb-assistance.8004.html>.

¹² Brunei National Disaster Management Centre (NDMC). (2011). *National Progress Report on the Implementation of the Hyogo Framework*. Retrieved from: http://www.preventionweb.net/files/18630_brn_NationalHFAprogress_2009-11.pdf.

¹³ Government of Peru. (2012). *National Progress Report on the Implementation of the Hyogo Framework*. Retrieved from: http://www.preventionweb.net/files/40146_PER_NationalHFAprogress_2013-15.pdf.

¹⁴ Republic of the Philippines. (2010). *Philippine Disaster Risk Reduction and Management Act of 2010*. Retrieved from IFRC: <http://www.ifrc.org/docs/idrl/878EN.pdf>.

(e.g., Australia and Chile), while others (e.g., Viet Nam) are more centrally controlled.¹⁵⁻¹⁶⁻¹⁷⁻¹⁸ A few economies have formally partnered with private entities to provide monitoring and warning services.¹⁹⁻²⁰

Monitoring, alerting, and specific warning responsibilities often do not all lie with the same agency or at the same level of government. This is generally appropriate given differing areas of expertise and responsibility. However, consistency, coordination, and clarity of roles are cited as ongoing challenges in this complicated space²¹⁻²², especially for economies that may have minimal protocols or procedures.²³⁻²⁴ Improved links between HMAs and DMOs are seen as particularly important.²⁵⁻²⁶

MONITORING SYSTEMS

Multiple studies²⁷⁻²⁸⁻²⁹⁻³⁰⁻³¹ have noted substantial investment in technical monitoring and warning systems, as well as community based initiatives, in recent years.³² Analysis has also improved; fully operational nowcasting capabilities exist in Australia; Canada; China; Hong Kong, China; and the US.³³ Investments

¹⁵ Australia Attorney General's Department. (2013). *Australia's Emergency Early Warning Arrangements*.

¹⁶ Chile Ministry of the Interior National Emergency Bureau (ONEMI). (2013). *National Progress Report on the Implementation of the Hyogo Framework*. Retrieved from: http://www.preventionweb.net/files/29019_chl_NationalHFAprogress_2011-13.pdf.

¹⁷ Center for Excellence in Disaster Management and Humanitarian Assistance (CfE-DMHA). (2015a). *Vietnam: Disaster Management Reference Handbook*. Honolulu, HI: CfE-DMHA.

¹⁸ United Nations Development Programme (UNDP). (2015a). *National Progress Report on the Implementation of the Hyogo Framework*. Retrieved from: http://www.preventionweb.net/files/42305_VNM_NationalHFAprogress_2013-15.pdf.

¹⁹ Government of Canada. (2015). *National Public Alerting System*. Retrieved from Public Safety Canada: <http://www.publicsafety.gc.ca/cnt/mrgnc-mngmnt/mrgnc-prprdss/ntnl-pblc-lrtng-sstm-en.aspx>.

²⁰ Webb and McEntire. (2016). "Emergency Management in New Zealand: Potential Disasters and Opportunities for Resilience." In T. Islam and J. Ryan (eds.) *Hazard Mitigation in Emergency Management*. Oxford: Butterworth-Heinemann.

²¹ WMO. (2015). Synthesis.

²² French Ministry of Foreign Affairs and International Development (MAEDI). (2015). *Climate Risk and Early Warning Systems: CREWS Initiative*. Presentation for COP21. Retrieved from: http://www.unisdr.org/files/45967_crewspresentation.pdf.

²³ UNDP. (2015b). *UNDP to work with the Government of Papua New Guinea to Establish Early-Warning System to Fight Floods*. Retrieved from UNDP: http://www.pg.undp.org/content/papua_new_guinea/en/home/presscenter/pressreleases/2015/04/23/undp-to-work-with-the-government-of-papua-new-guinea-to-establish-early-warning-system-to-fight-floods-.html.

²⁴ Brunei NDMC. (2011). Progress Report.

²⁵ United Nations Environment Programme (UNEP). (2012). *Early Warning Systems: A State of the Art Analysis and Future Directions*. Nairobi: UNEP.

²⁶ Rogers and Tsirkunov. (n.d.). GFDRR Report.

²⁷ UNESCAP. (2011). Unmet Needs.

²⁸ French MAEDI. (2015). CREWS.

²⁹ Rogers and Tsirkunov. (n.d.). GFDRR Report.

³⁰ WMO. (2015). Synthesis.

³¹ UNESCAP. (2015). *Strengthening Regional Multi-Hazard Early Warning Systems*. Bangkok: UNESCAP.

³² UNESCAP. (2011). Unmet Needs.

³³ Rogers and Tsirkunov. (n.d.). GFDRR Report.

continue to be made at both economy and regional levels to advance technology and augment spatial coverage.

A number of regional monitoring and analysis efforts that improve coverage of key hazards in the Asia Pacific region have been established (e.g., the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia, or RIMES, the ASEAN Agreement on Transboundary Haze Pollution, the Tropical Cyclone Programme (TCP), and various tsunami-focused initiatives). Systems and cooperative mechanisms related to tropical cyclones and tsunamis are the most developed. Regional entities such as the ASEAN Centre for the Coordination of Humanitarian Assistance (AHA Centre) are also leveraging technical partnerships and institutional mechanisms to integrate monitoring and warning outputs from multiple sources into a single system (DMRS, the Disaster Monitoring and Response System). UNESCAP has called for an integrated, regional EWS.³⁴

Regional efforts fill gaps and provide benefits to APEC economies by improving access to information, augmenting analysis capabilities, and distributing the financial burden of developing and maintaining systems. However, coverage of some transboundary hazards such as floods and landslides could be improved.³⁵ Some economies (e.g., Papua New Guinea) still lack basic monitoring and warning systems for key hazards³⁶ overall or in known at-risk areas.³⁷ While progress has been made in earthquake early warning³⁸⁻³⁹⁻⁴⁰, it is still cited as a critical gap in some earthquake prone countries.⁴¹⁻⁴²

³⁴ UNESCAP. (2015). Strengthening EWS.

³⁵ UNESCAP. (2015). Strengthening EWS.

³⁶ UNDP. (2016, April 29). *New Report Assessed PNG's Early Warning Systems to Fight Floods*. Retrieved from ReliefWeb: <http://reliefweb.int/report/papua-new-guinea/new-report-assessed-png-s-early-warning-systems-fight-floods>.

³⁷ Government of Peru. (2012). Progress Report.

³⁸ McElroy, A. (2014, August 7). *Early warning saves lives in China earthquake*. Retrieved from UNISDR: <https://www.unisdr.org/archive/38869>.

³⁹ McElroy, A. (2015, March 15). *Japan provides early warning example*. Retrieved from UNISDR: <https://www.unisdr.org/archive/43134>.

⁴⁰ Japan Cabinet Office. (2012). *National Progress Report on the Implementation of the Hyogo Framework*. Retrieved from: http://www.preventionweb.net/files/31426_jpn_NationalHFAprogress_2011-13.pdf.

⁴¹ New Zealand Ministry of Civil Defence and Emergency Management (MCDEM). (2015). *National Progress Report on the Implementation of the Hyogo Framework for Action*. Retrieved from: http://www.preventionweb.net/files/43014_NZL_NationalHFAprogress_2013-15.pdf.

⁴² US National Science and Technology Committee (USNSTC). (2012). *National Progress Report on the Implementation of the Hyogo Framework*. Retrieved from: http://www.preventionweb.net/files/28816_usa_NationalHFAprogress_2011-13.pdf.

Monitoring systems in the region are generally sophisticated⁴³, but some APEC economies struggle to provide comprehensive monitoring and warning for all the hazards they face.⁴⁴⁻⁴⁵⁻⁴⁶⁻⁴⁷⁻⁴⁸ In addition, benefits are not realized evenly. If early warning is viewed primarily as a technical or scientific activity⁴⁹, limited integration of other EWS stakeholders (e.g., DMOs, community groups, NGOs) could lessen the end-to-end effectiveness of systems and decrease the value of investments.

DISSEMINATION AND COMMUNICATION

In two studies, UNESCAP⁵⁰⁻⁵¹ highlighted challenges with dissemination and communication in the Asia-Pacific region. These included a lack of Standard Operating Procedures (SOPs) for information flows from governments to communities; the need for stronger partnerships between stakeholders such as NGOs, governments, and media; and challenges in “last-mile” dissemination. Rogers and Tsirkunov⁵², UNEP⁵³, and WMO⁵⁴ have also identified the need for better coordination and communication mechanisms among EWS stakeholders at multiple levels. While some economies have very formalized standards⁵⁵, this same need was highlighted in many economies’ responses to the Hyogo Framework Monitor.

The majority of APEC economies disseminate information through multiple and varied communication channels, including mass media, social media, radio, SMS, and sirens. However, protocols for dissemination may not exist⁵⁶, may not be locally standardized⁵⁷⁻⁵⁸, or may not be disseminated using

⁴³ UNESCAP. (2015). Strengthening EWS.

⁴⁴ Malaysia National Security Council (NSC). (2012). *National Progress Report on the Implementation of the Hyogo Framework*. Retrieved from: http://www.preventionweb.net/files/28824_mys_NationalHFAprogress_2011-13.pdf.

⁴⁵ National Institute of Disaster Management (NIDM). (2014). *Brunei Darussalam*. Retrieved from NIDM: http://nidm.gov.in/easindia2014/err/pdf/country_profile/brunei_darussalam.pdf.

⁴⁶ UNDP. (2016). PNG Flood Report.

⁴⁷ CFE-DMHA. (2015b). *Indonesia: Disaster Management Reference Handbook*. Honolulu, HI: CFE-DMHA.

⁴⁸ Thailand Department of Disaster Prevention and Mitigation (DDPM). (2015). *National Progress Report on the Implementation of the Hyogo Framework*. Retrieved from: http://www.preventionweb.net/files/41674_THA_NationalHFAprogress_2013-15.pdf.

⁴⁹ UNESCAP. (2015). Strengthening EWS.

⁵⁰ UNESCAP. (2011). Unmet Needs.

⁵¹ UNESCAP. (2015). Strengthening EWS.

⁵² Rogers and Tsirkunov. (n.d.). GFDRR Report.

⁵³ UNEP. (2012). EWS.

⁵⁴ WMO. (2015). Synthesis.

⁵⁵ Carafano, J. J. (2016). *The Great Eastern Japan Earthquake: Assessing Disaster Response and Lessons for the U.S.* Retrieved from The Heritage Foundation: <http://www.heritage.org/research/reports/2011/05/the-great-eastern-japan-earthquake-assessing-disaster-response-and-lessons-for-the-us>.

⁵⁶ Brunei NDMC. (2011). Progress Report.

⁵⁷ Chile ONEMI. (2013). Progress Report.

⁵⁸ Indonesia National Board for Disaster Management (BNPB). (2014). *National Progress Report on the Implementation of the Hyogo Framework*. Retrieved from: http://www.preventionweb.net/files/41507_IDN_NationalHFAprogress_2013-15.pdf.

appropriate language.⁵⁹ In addition, communication facilities may be limited⁶⁰, and there may still be challenges in reaching remote areas, even in economies with well-developed systems.⁶¹⁻⁶² It is not clear that alerts and messages are people-centered and consistently tailored for the needs of specific groups.⁶³⁻⁶⁴⁻⁶⁵

RESPONSE CAPABILITY

These same studies noted related weaknesses in response capability. Several recommendations outlined in a 2011 UNESCAP review of EWS in the region also highlighted weaknesses in response capacity and effective outreach. Similar challenges were cited in Hyogo Framework Monitor reports. Authorities are not always confident that the public will take appropriate action⁶⁶, and are concerned that there is a lack of awareness of the importance of EWS⁶⁷ as well as limited local resources and capacity to respond.⁶⁸⁻⁶⁹ In Hyogo Framework reports, local-level preparedness was the aspect of EWS that economies most frequently indicated was not in place, even when overall ratings for Core Indicator 3 were high. (See Table 5 and

⁵⁹ Malaysia NSC. (2012). Progress Report.

⁶⁰ Papua New Guinea National Disaster Center (NDC). (2012). *National Progress Report on the Implementation of the Hyogo Framework* Retrieved from: http://www.preventionweb.net/files/28697_png_NationalHFAprogress_2011-13.pdf.

⁶¹ USNSTC. (2012). Progress Report.

⁶² UNDP. (2015a). Progress Report.

⁶³ UNESCAP. (2015). Strengthening EWS.

⁶⁴ UNDP. (2015a). Progress Report.

⁶⁵ WMO. (2015). Synthesis.

⁶⁶ Australia Attorney General's Department. (2015) *National Progress Report on the Implementation of the Hyogo Framework*. Retrieved from: http://www.preventionweb.net/files/40149_AUS_NationalHFAprogress_2013-15.pdf.

⁶⁷ Indonesia BNPB. (2014). Progress Report.

⁶⁸ New Zealand MCDEM. (2015). Progress Report.

⁶⁹ Thailand DDPM. (2015). Progress Report.

Table 6.)

HYOGO FRAMEWORK FOR ACTION PRIORITY 2 REPORTING

Priority 2 of the Hyogo Framework called on economies to “identify, assess, and monitor disaster risks and enhance early warning.” Tables 5 and 6 display the levels of progress reported by APEC economies for Hyogo Framework Priority for Action 2. Table 5 shows progress across four indicators on a scale of 1 to 5 (1 = minor progress with few signs of planning; 5 = comprehensive achievement). Indicator 1 addresses risk knowledge, indicator 2 represents monitoring, and indicator 3 includes aspects of both dissemination and communication as well as response capability. Indicator 4 highlights regional cooperation and cuts across the other three indicators. Table 6 contains detailed responses for indicator 3, which relates specifically to EWS. Responses were not always consistent with written comments contextualizing the rating.

Average reported progress scores for each economy across the indicators ranged from 2.25 (Papua New Guinea) to 4.5 (Australia). The average score among APEC economies was 3.59. Of the four Core Indicators, indicators 1 (risk & vulnerability assessments) and 2 (hazard and vulnerability monitoring), received the lowest average scores across APEC economies (3.41). APEC economies reported the most progress achieved in Core Indicator 3, related to early warning systems.

Table 5. Summary of Progress toward Hyogo Framework for Action Priority 2: Identify, Assess, and Monitor Disaster Risks and Enhance Early Warning (scale of 1 to 5)

APEC Economy	Core Indicator 1: Risk & Vulnerability Assessments	Core Indicator 2: Hazard and Vulnerability Monitoring	Core Indicator 3: Early Warning Systems for all Major Hazards	Core Indicator 4: Transboundary Assessments
Australia	4	4	5	5
Brunei Darussalam	3	3	2	3
Canada	3	4	4	4
Chile	4	3	4	3
People’s Republic of China	4	4	4	4
Hong Kong, China	No Report	No Report	No Report	No Report
Indonesia	4	4	4	4
Japan	4	4	4	4
Republic of Korea	4	4	5	4
Malaysia	4	4	5	4
Mexico	2	3	4	3
New Zealand	4	4	4	4
Papua New Guinea	2	2	3	2
Peru	4	3	3	4
The Philippines	3	3	3	4
Russia	No Report	No Report	No Report	No Report

APEC Economy	Core Indicator 1: Risk & Vulnerability Assessments	Core Indicator 2: Hazard and Vulnerability Monitoring	Core Indicator 3: Early Warning Systems for all Major Hazards	Core Indicator 4: Transboundary Assessments
Singapore	No Recent Report	No Recent Report	No Recent Report	No Recent Report
Chinese Taipei	4	5	5	5
Thailand	2	2	4	3
United States of America	4	4	4	4
Viet Nam	3	3	4	3

Table 6. Summary of Hyogo Framework for Action Priority 2 Core Indicator 3: Early Warning Systems for all Major Hazards

APEC Economy	Early Warnings Acted on	Local Level Preparedness	Communication Systems / Protocols Used	Media Involvement of Media in Dissemination
Australia	Yes	No	Yes	Yes
Brunei Darussalam	Yes	Yes	No	Yes
Canada	Yes	Yes	Yes	Yes
Chile	Yes	Yes	Yes	Yes
People's Republic of China	Yes	Yes	Yes	Yes
Hong Kong, China	NA	NA	NA	NA
Indonesia	Yes	Yes	Yes	Yes
Japan	Yes	Yes	Yes	Yes
Republic of Korea	Yes	Yes	Yes	Yes
Malaysia	Yes	Yes	Yes	Yes
Mexico	Yes	No	Yes	Yes
New Zealand	Yes	Yes	Yes	Yes
Papua New Guinea	No	No	No	No
Peru	Yes	Yes	Yes	Yes
The Philippines	Yes	Yes	Yes	Yes
Russia	NA	NA	NA	NA
Singapore	NA	NA	NA	NA
Chinese Taipei	Yes	Yes	Yes	Yes
Thailand	Yes	Yes	Yes	Yes
United States of America	No	Yes	Yes	Yes
Viet Nam	Yes	No	Yes	Yes

IV. APEC SURVEY RESULTS

RESPONDENTS

Surveys were sent to 140 points of contact representing hazard monitoring agencies (HMA), disaster management organizations (DMO), and civil society organizations (CSO). A total of 31 completed surveys were received, for an overall completion rate of 22%. Four surveys submitted were partially completed and two contained only organization information. Completed responses were received for 12 HMAs representing nine economies, 15 DMOs representing 13 economies, and four CSOs representing four economies.

There was some overlap between the HMA and DMO survey types; where answers were available, they were coded to the appropriate survey prior to analysis. Wholly incomplete surveys were not included in the analysis below. In surveys where only some of the closed questions were answered, responses were included where available and the denominator was adjusted for reporting.

LEGAL AUTHORITY TO ISSUE HAZARD ALERTS AND WARNINGS⁷⁰

DMO and HMA respondents were both asked to identify institutional bodies with legal authority to issue alerts and/or warnings. Central DMOs and/or HMAs were the most common agencies identified as having legal authority to issue hazard alerts (**see Figure 2**). However, a much higher percentage of DMOs (76%, 13/17) indicated that the central DMO is an agency with the legal authority to issue hazard alerts than did HMAs (42%, 5/12). Ten of the 17 DMOs that responded to the question (59%) indicated that both the central HMA and the central DMO have legal authority to issue a hazard alert, compared to only four HMAs (33%; 4/12).

Both types of organizations more frequently indicated that provincial/prefectural DMOs have legal authority to issue alerts than provincial/prefectural HMAs have that authority; the percentage difference was higher with HMA respondents. The same percentage of HMA participants (75%, 9/12) who said that the central HMA had authority to issue alerts also indicated that local governments had the same authority. This percentage was much higher than that of DMO participants (35%, 6/17).

Two DMOs identified the central Center for Disease Control (CDC) as an entity with legal authority. These are counted separately, though a CDC could be considered the central monitoring agency for health related hazards. The HMA respondent from Hong Kong, China, clarified that there is no “legal” authority to issue alerts, as there is “no law governing the issuance of alerts in Hong Kong, China.” That does not mean there is no responsibility: “Hong Kong Observatory is the government department in Hong Kong, China, responsible for issuing alerts on hazards related to weather and geophysical science.”

⁷⁰ For the purposes of this survey and report, an alert is any text, voice, video, or other information provided by an authorized official to provide situational awareness to the public and/or private sector about a potential or ongoing emergency situation. An alert does not necessarily require immediate actions to protect life, health, and property. A warning is any text, voice, video, or other information provided by an authorized official to provide direction to the public and/or private sector about an ongoing emergency situation. A warning requires immediate actions to protect life, health, and property.

A DMO respondent in Viet Nam pointed to the Ministry of Natural Resources and Environment and the Central Committee on Disaster Prevention and Control as having authority for alerting and warning rather than an individual agency or office.

One of the HMA respondents from the Philippines indicated that while local governments had the authority to issue alerts and warnings, the information generally originates from the central HMAs and is passed to other offices; this response reflects institutional mechanisms and procedures that were relatively common among economies. Mexico's HMA respondent indicated that seismic alerts originate with a civil organization rather than a government agency.

The proportion of HMA respondents indicating that the central HMA and the provincial level DMO have authority increased when referencing warnings rather than alerts. Similarly, a much higher number of DMOs reported that local entities had the authority to issue warnings rather than alerts (see **Figure 3**). The biggest discrepancies in perceptions of authority between HMAs and DMOs appear to be related to the roles of the central DMOs and local governments.

Figure 2: Institutions with the Legal Authority to Issue Hazard Alerts - Percentage of Disaster Management Organization and Hazard Monitoring Agency Responses

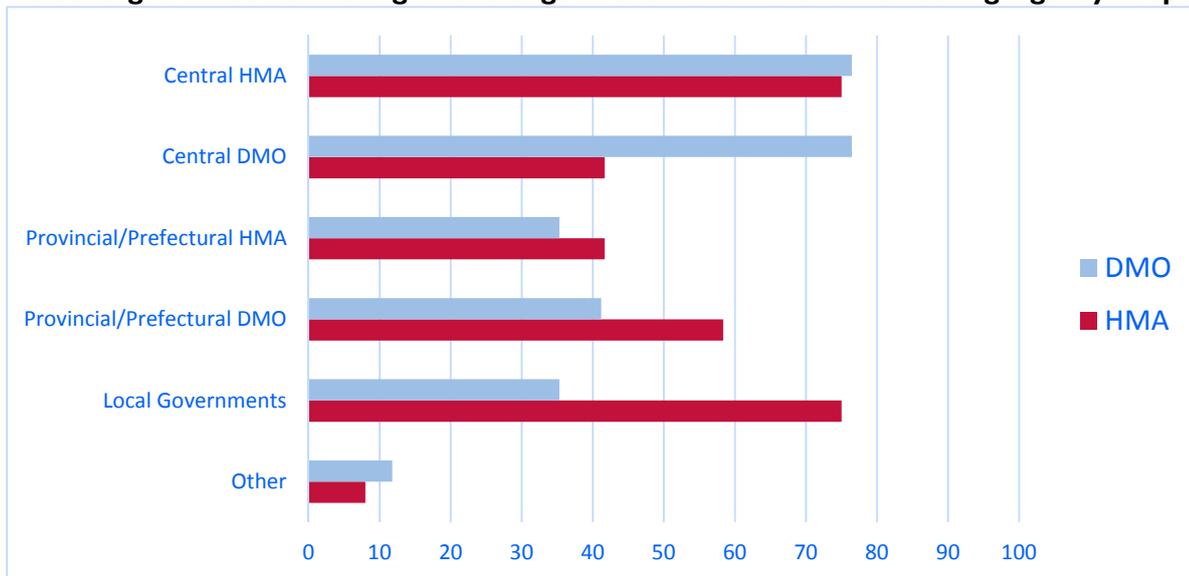
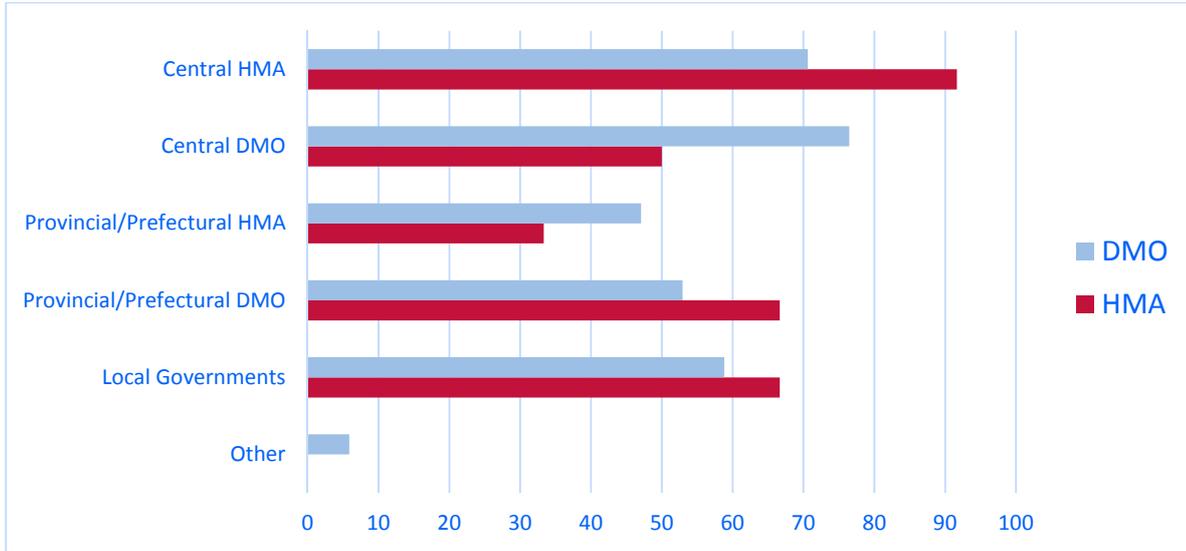


Figure 3: Institutions with the Legal Authority to Issue Hazard Warnings - Percentage of Disaster Management Organization and Hazard Monitoring Agency Responses

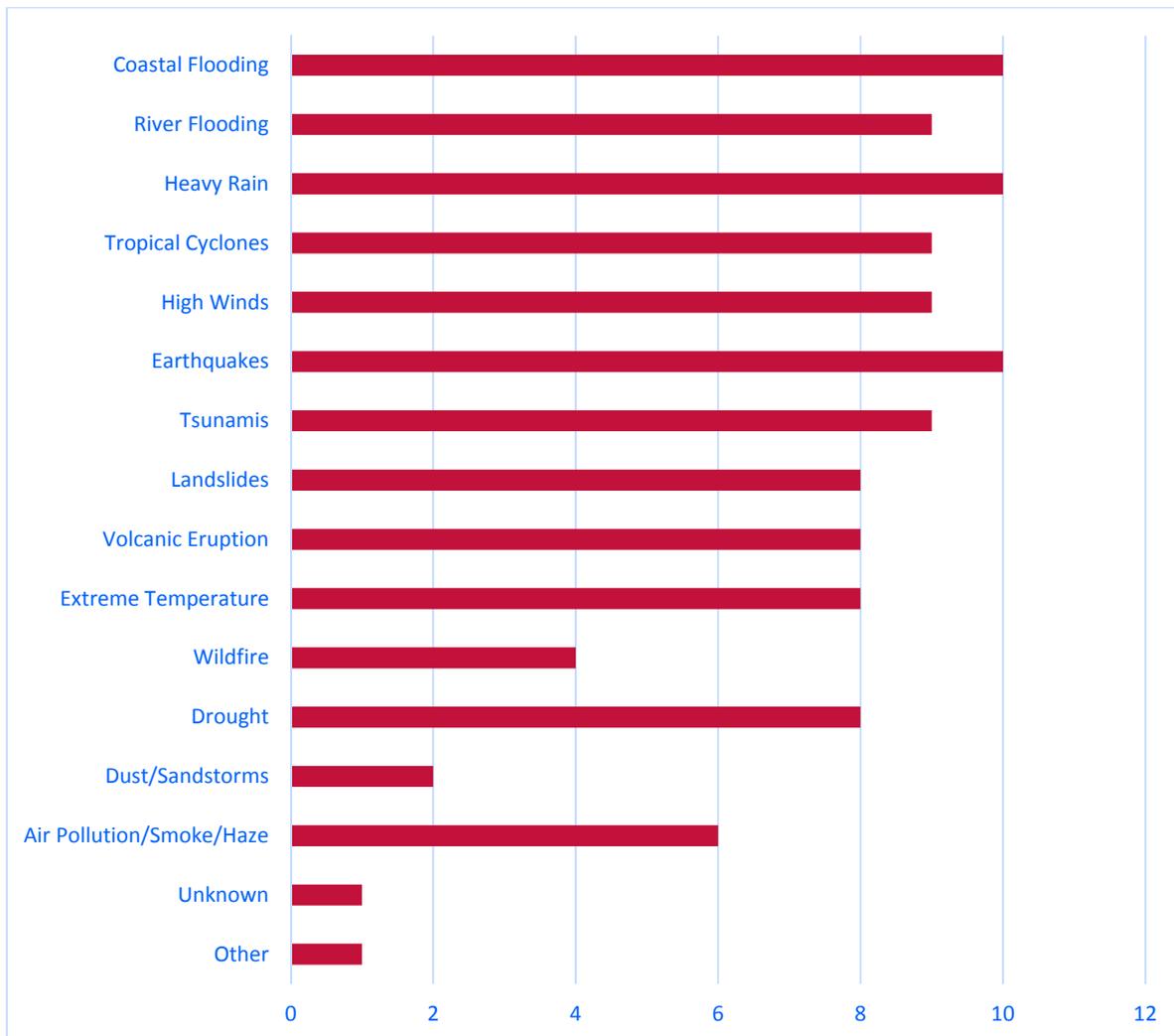


MONITORING SYSTEMS

Hazard monitoring agencies (HMA) were also asked about the hazards for which their economies maintain monitoring systems (see Figure 4). Coastal flooding, heavy rain, and earthquakes are the most common hazards for which monitoring systems are reportedly in place. Systems monitoring wildfires and dust/sandstorms were least common. Heavy snow, mentioned by New Zealand, was the only hazard added to the survey by any economy.

55 percent of HMAs reported that hazard monitoring systems were mostly *automated* with some manual procedures. 45 percent indicated systems mostly *manual* with some automation. 82 percent of HMA respondents indicated that central monitoring agencies in their economies have reliable communications connections with the World Meteorological Organization's (WMO) Global Telecommunications System regional telecommunications hub.

Figure 4: Types of Hazards Monitored – Frequency of Hazard Monitoring Agency Responses



SOURCES OF HAZARD INFORMATION

Identifying sources of hazard information can help to map information flows and support improved communication. All but one disaster management organization (DMO) participating in the survey indicated they regularly seek or receive hazard information from central hazard monitoring agencies (HMAs) (see .

Figure 5). This is unsurprising, given that most economies identified policies or procedures related to information flowing from central HMAs to the central DMO.

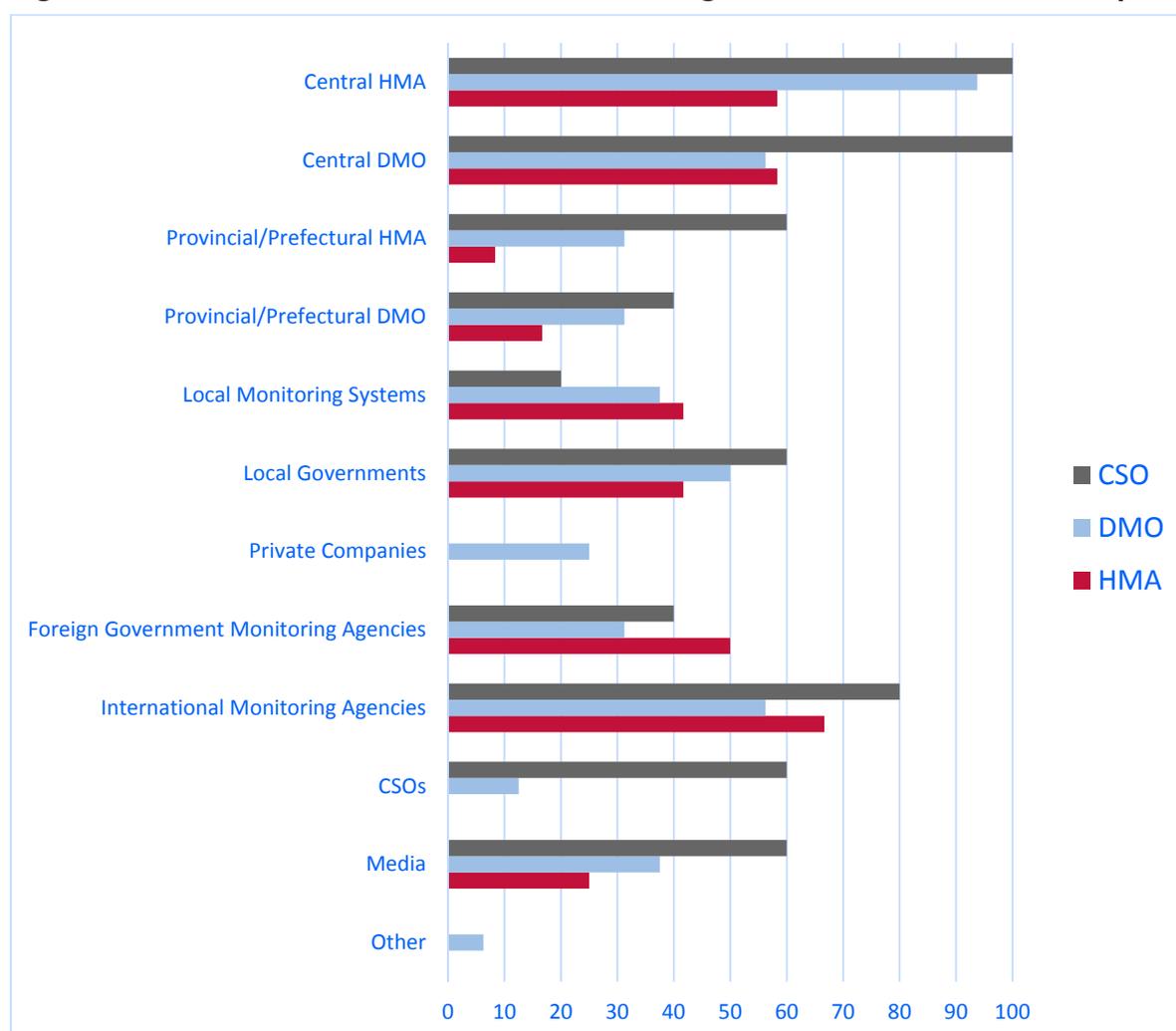
Central HMAs may see themselves exclusively as providers rather than consumers of information. One central HMA outlined a process where they provided information, but consulted international and foreign government sources.

All civil society respondents reported obtaining hazard information from both central DMOs and central HMAs. 42% of HMA respondents obtained information from local sources, including local monitoring systems and local governments. A higher proportion of HMAs are connected to local monitoring systems

compared with DMOs. The opposite was true for local governments, with DMOs reporting greater interaction than HMAs. A majority of both DMOs and HMAs reported they obtain information from international monitoring agencies, as did most civil society organization (CSO) respondents.

50 percent of HMAs reported gathering information from foreign government hazard monitoring agencies compared with 31 percent of DMOs. Only DMOs reported obtaining information from private companies. In general, DMOs reported obtaining information from a wider range of sources than HMAs. This perhaps relates to DMOs' primary role as consumers that must act on the information they receive.

Figure 5: Sources of Hazard Information – Percentage of DMO, HMA and CSO Responses



DISSEMINATION OF ALERTS AND WARNINGS

Understanding the mechanisms used to disseminate alert and warning information enables a more robust mapping of information flows that can support development of a larger Concept of Operations with clear Standard Operating Procedures.

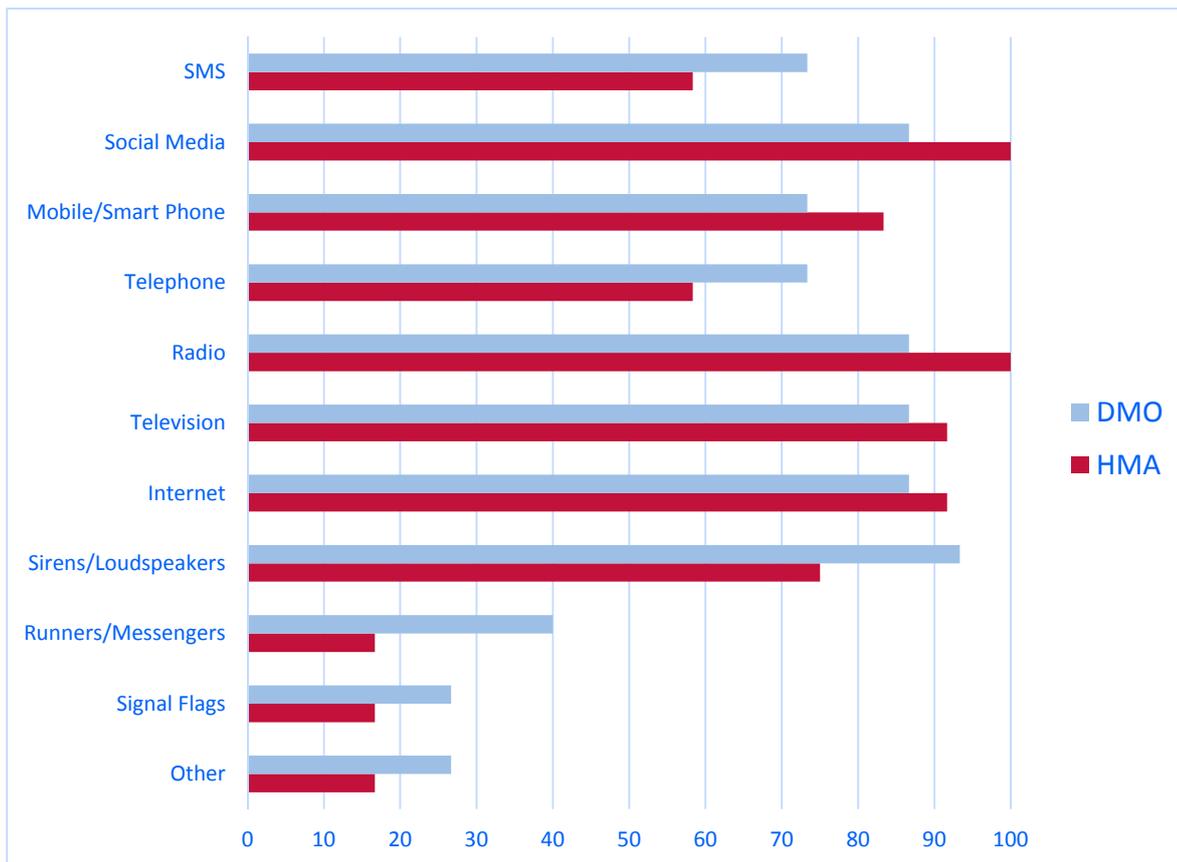
All DMO respondents indicated there are formal policies and procedures for communicating alerts and/or warnings from central HMAs to DMOs. 73 percent of DMOs and 82 percent of HMAs indicated their economies had formal policies and procedures to communicate alerts and warnings from central

HMA to central DMOs and that these policies were followed all of the time. DMOs from three economies indicated the policies and procedures were followed most of the time. One DMO reported that such policies and procedures are followed only some of the time. Over 75% of DMOs and HMAs indicated that the communication of alerts and/or warnings is mostly or completely automated.

Economies were also queried regarding procedures to facilitate communication between central agencies and provincial or local governments. 91 percent of eligible HMAs (Hong Kong, China, does not have sub-economy authorities) and 82% of responding DMOs indicated that formal policies/procedures exist for communicating alerts and/or warnings between central agencies and provincial or local authorities.

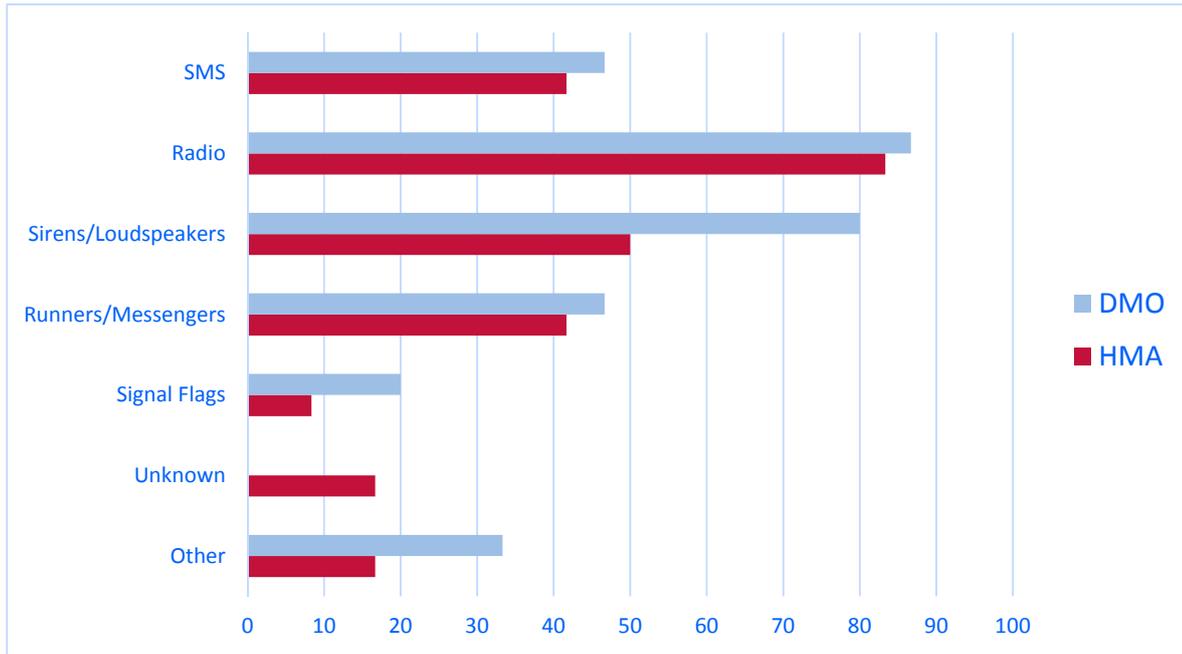
The most commonly reported methods used to disseminate alerts and warnings to the public are: radio, television, and social media (see Figure 6). Sirens are the most commonly referenced method among DMOs. The Internet is heavily used by HMAs and DMOs. Telephones and SMS were more commonly used by DMOs than by HMAs, as were low-tech methods like signal flags and runners. Cellular Broadcast Services (CBS), fax, email, and bells and whistles were identified by DMOs and HMAs as alternative methods.

Figure 6: Official Methods Used to Disseminate Alerts and Warnings to the Public - Percentage of DMO and HMA Responses



DMOs and HMAs were also asked about dissemination of alerts and warnings to remote areas with limited communications infrastructure (Figure 7). Radio was the most frequently cited mechanism among both groups (87 and 83 percent of respondents, respectively). 80 percent of DMOs identified the use of sirens or loudspeakers as well. Several alternative dissemination mechanisms were raised, including door-to-door alerting and other forms of direct contact, telephone trees, Radiofax, and Cellular Broadcast Services (CBS).

Figure 7: Mechanisms for Alert and Warning Dissemination in Remote Areas with Limited Infrastructure – Percentage of DMO and HMA Responses



56 percent of DMO (9/16) and 33 percent of HMA respondents reported that warning systems in their economies were tested an average of once per month. 19 percent of DMOs and 25 percent of HMAs reported testing occurred every three months. Three HMA respondents reported systems were tested once per year.

PARTNERSHIPS AND AGREEMENTS

Partnerships can augment capacity and improve the effectiveness of early warning systems by enhancing networks for information collection and dissemination, providing expertise and analytical capabilities, supporting awareness and response, and sharing financial burdens. 88 percent of disaster management organization (DMO) representatives reported that arrangements for using private sector resources to disseminate alerts and warnings exist within their economies. 50 percent of hazard monitoring agencies (HMA) reported the existence of such arrangements for hazard monitoring or warning dissemination.

The difference in DMO and HMA responses may be due to participation of different economies in the DMO and the HMA surveys. Lack of familiarity with agreements within others agencies' area of responsibility may be another contributing factor.

DMOs generally focused on arrangements with broadcasting and communications companies or the role of mobile phone apps. Other entities, such as convenience stores in Chinese Taipei or mining companies

in Australia, were also mentioned as assisting with warning dissemination. HMAs highlighted the contributions of private observational networks and dissemination mechanisms.

Seven of fifteen DMOs reported their respective economies have agreements in place to integrate alerting and warning systems across international boundaries. Only two HMAs reported the same.

However, 42 percent of HMA respondents indicated that their economies have agreements to integrate monitoring systems across international boundaries. Economies highlighted their respective roles as contributors and consumers of monitoring information. Multiple economies mentioned cooperation related to early warning for tsunamis and the Tsunami Warning System in the Pacific, as well as the World Meteorological Organization. HMAs highlighted integration of observational networks and sharing of related outputs.

INTEGRATING RISK AND VULNERABILITY ASSESSMENTS

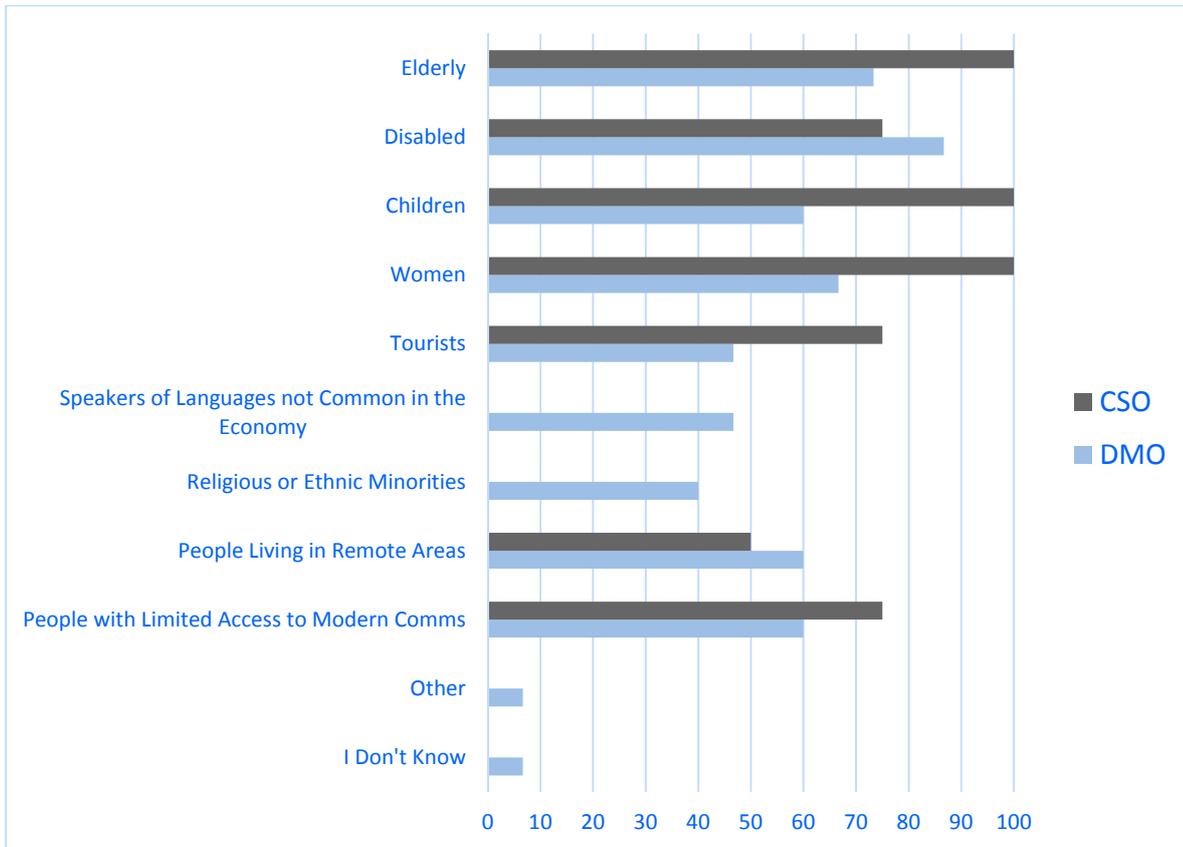
53 percent of disaster management organization (DMO) respondents stated that risk assessments were used consistently to inform the design of warning systems. All DMOs that responded to the question reported that risk assessments were used at least “somewhat” in their economies. Of the hazard monitoring agency (HMA) respondents, 58 percent indicated their economies use risk assessments consistently. Four reported using risk assessments “somewhat.” Only one economy reported that risk assessments were not used to inform system development.

47 percent of DMOs and 50 percent of HMAs surveyed reported warning methods used in their economies consistently consider the needs of potentially vulnerable groups. Only one civil society organization (CSO) reported the same. Six DMOs, five HMAs, and two CSOs reported that the needs of vulnerable groups were somewhat considered. Two DMOs, one HMA, and one CSO reported no consideration of potentially vulnerable groups.

Only DMOs and CSOs were surveyed regarding which potentially vulnerable groups’ needs are addressed by their economy’s warning methods (**see Figure 8**). Overall, disabled individuals and the elderly were the groups whose needs were most frequently addressed. Two-thirds of DMOs and all CSOs also identified women’s needs as being addressed. Religious and ethnic minorities and speakers of different languages were among the least-addressed groups. The DMO response rate for tourists was also relatively low at 47 percent. Chinese Taipei and Viet Nam cited migrant workers as a vulnerable population whose needs are addressed by those economies’ warning methods.

CSOs were also asked specifically about potential gender differences in obtaining hazard-related information. Two of four respondents indicated that there was no substantive difference. Canadian and Vietnamese CSOs stated there were some differences in how men and women access hazard information. A common theme was differences in familiarity with emergency management structures. Respondents also noted potential gender differences in the use of technology.

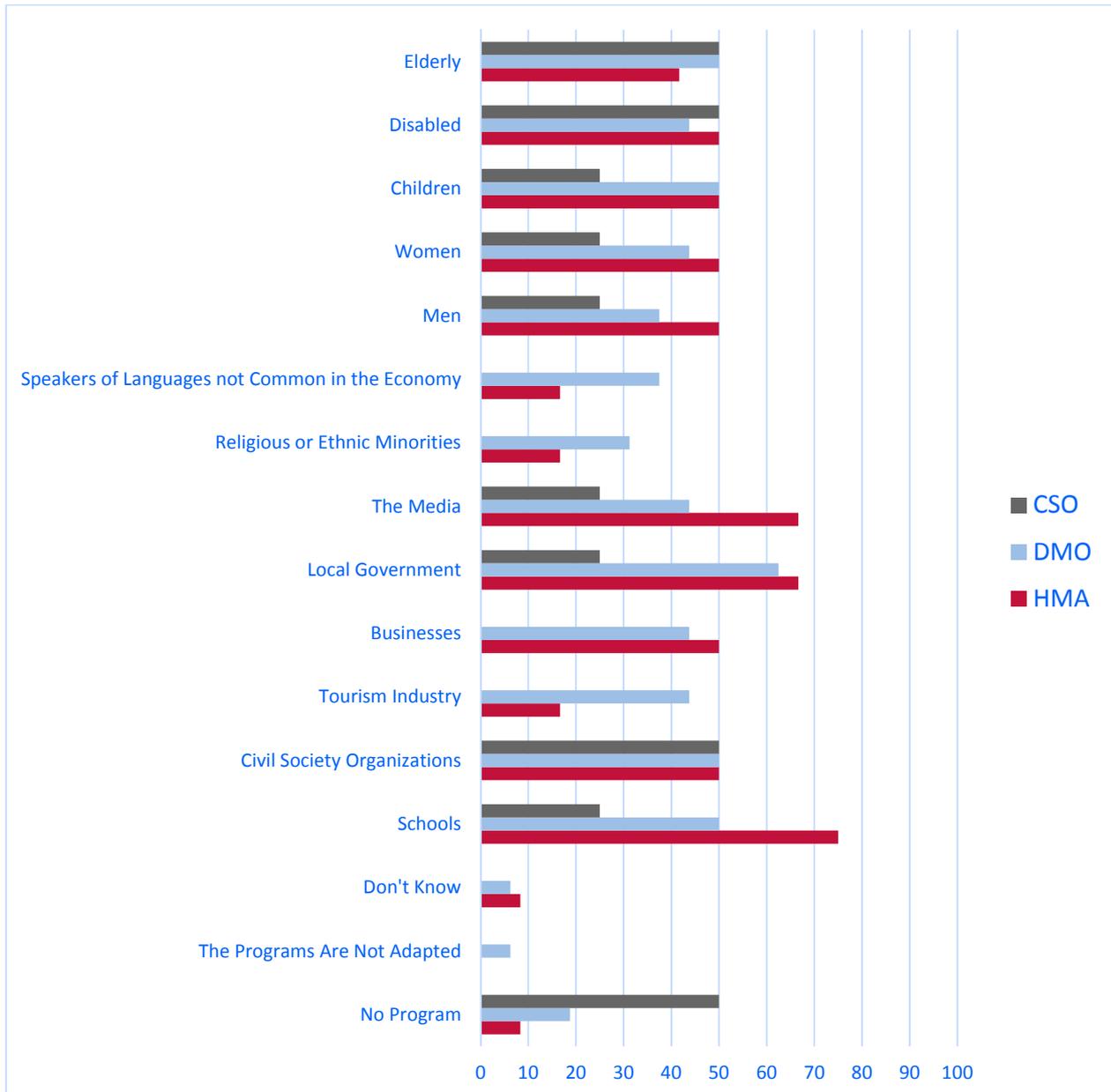
Figure 8: Potentially Vulnerable Groups whose Needs are Addressed by Warning Methods – Percentage of DMO and CSO Responses



PUBLIC AWARENESS AND RESPONSE

75 percent of DMOs, 83 percent of HMAs, and 50 percent of CSOs surveyed indicated that their organizations conducted awareness programs to inform people about warning systems and messages. The groups for which awareness programs are adapted are displayed in Figure 9. Among DMOs, the most commonly cited group for which awareness programs are adapted is local government. The next most-commonly targeted groups include children, schools, the elderly, and civil society organizations. For HMAs, the most commonly targeted groups are schools, the media, and local government. The two CSOs both have adapted programs for the elderly, disabled, and other civil society organizations.

Figure 9. Groups for which Awareness Programs are Adapted – Percentage of DMO, HMA and CSO Responses

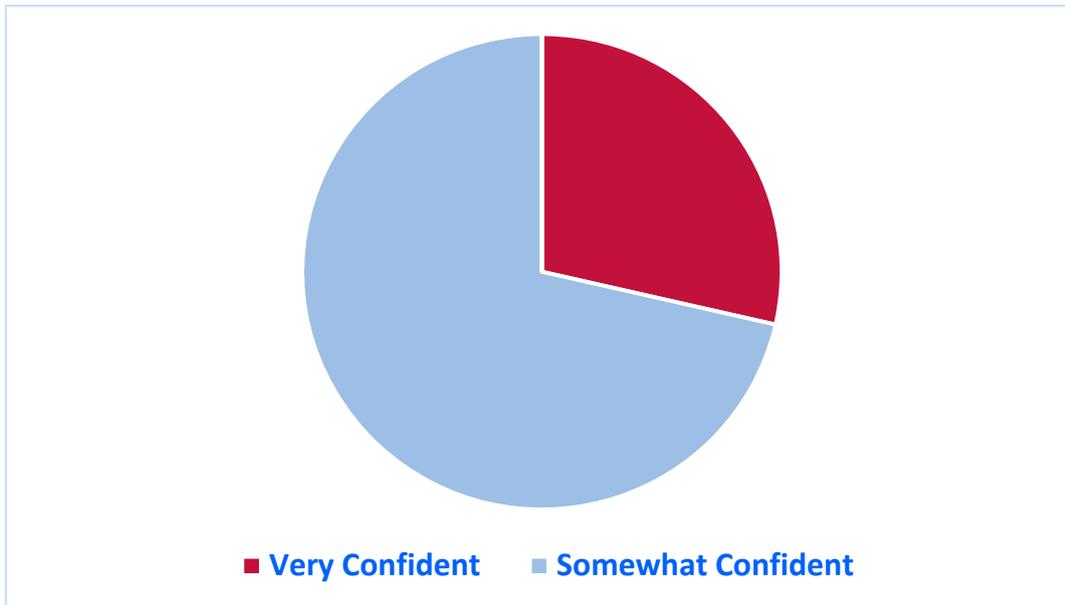


47 percent of DMO respondents indicated they were “very concerned” that unofficial communication about alerts and/or warnings could create confusion among those individuals being warned; 27 percent of DMOs reported being “a little concerned.” HMA respondents tended to worry more. 83 percent of HMA respondents reported they were “very concerned” that unofficial communications about alerts and/or warnings could create confusion. CSO participants were much less concerned with 50 percent of respondents stating they were only “a little concerned.”

DMO participants were asked about whether they thought the general public would take appropriate action if a warning is issued. 27 percent indicated they were “very confident” and the remainder indicated they were “somewhat confident” that the general public would do so (see Figure 10). Some respondents gave open-ended responses to further explain their answers. Most referenced the complex

decision-making context. Response actions are influenced by a number of factors including, but not limited to, availability of information, outreach, and education. Others pointed to constraints of the physical system or differences in knowledge and familiarity depending on the hazard.

Figure 10: Confidence of DMOs that General Public Will Take Appropriate Action in Response to Warnings



CSOs can be a valuable resource during preparedness and response activities. 50 percent of CSO respondents indicated that NGOs and CSOs are “very active” in supporting community response to warning messages in their economies. 40 percent of DMOs surveyed felt the same. The majority of DMOs (53%, 8/15) perceived NGOs and CSOs as “somewhat active.”

Information on how the public responds during incidents helps DMOs and HMAs improve messaging and warning systems. 47 percent of DMO respondents indicated that a government agency of some sort systematically gathers information on how the general public responds to alerts and/or warnings in their economies. Others pointed to exercises as data collection mechanisms and a reason why additional data is not needed.

CHALLENGES

Representatives from participating organizations were asked about the biggest challenges to effective monitoring, alerting and/or warning in their economy. Four areas were highlighted in the responses:

- improved technical capacity for monitoring, analysis, and dissemination;
- coordinated and integrated information management, flow, and sharing;
- improved outreach and local response; and
- funding challenges

Other challenges mentioned included increased access to unofficial information, and increasing public expectations of monitoring and warning agencies.

V. DISCUSSION

Discussion is roughly organized by the key components of early warning systems identified in the UNISDR checklist⁷¹ in Table 3 on page 6. Linkages to the APEC DRR Framework and IFRC Guiding Principles are also referenced in each subsection.

RISK KNOWLEDGE

Risk knowledge was addressed indirectly through the survey. It is accepted that hazards and vulnerabilities must be identified and assessed in order for early warning system designs to be effective. However, Hyogo Framework Priority 2, Core Indicator 1, which addresses risk and vulnerability assessments, had the lowest average progress scores across APEC economies. Several economies indicated incomplete achievement with limited commitment and capacity in this area. This is somewhat consistent with survey results, with some economies reporting that risk assessments were not integrated into the development of monitoring or that warning systems and that warning methods do not consider the needs of vulnerable groups.

Around half of disaster management organization (DMO) and hazard monitoring agency (HMA) respondents indicated that assessments were consistently used to inform early warning system development and help identify warning methods that address the needs of potentially vulnerable groups.

The results of this study suggest risk and vulnerability assessments remain an area of possible investment and improvement in APEC economies. This is consistent with Pillar I of the APEC DRR Framework, the UNISDR early warning system checklist, and IFRC guiding principles. In particular, the vulnerabilities of religious and ethnic minorities, those who speak less common languages, and tourists may all need to be considered more carefully.

MONITORING SYSTEMS

This study confirmed that APEC economies monitor a wide variety of hazards. The majority of hazard monitoring agency respondents reported that monitoring systems are mostly automated, and that systems are at least moderately robust. However, a large number of respondents specifically cited technical improvements in monitoring systems as one of their biggest challenges in public alert and warning.

Challenges mentioned ranged from augmenting spatial coverage to extending capabilities to monitor and analyze different types of hazards. Self-reported scores for Hyogo Framework Priority 2 Core Indicator 2 (hazard and vulnerability monitoring) also highlight perceived weaknesses in this area.

Some gaps in monitoring systems have been addressed through regional cooperation, particularly in the case of tsunamis and tropical cyclones. Further development of these cooperative mechanisms is likely to improve the efficiency and coverage of technical monitoring systems, as well as improve access to existing information. This is a key element of preparedness under the APEC DRR Framework.

⁷¹ UNISDR. (2006). Checklist.

Localized monitoring systems operated by local governments, civil society organizations, and private companies may be an underutilized means of augmenting monitoring capacity. Only 42 percent of HMAs reported obtaining information from local monitoring systems. If linked to economy-level programs and systems, diverse local systems could provide a broader view of conditions, potentially at a lower cost.

Additional opportunities might be found by connecting to other private networks. Only the United States reported using private networks to augment monitoring systems, and only four respondents reported obtaining information from private sector sources. Further development of CSO and private sector partnerships aligns with collaborative elements highlighted in the APEC DRR Framework, as well as guidance issued at the 2011 APEC Ministerial Meeting in Honolulu.

Several survey respondents also identified the need for better integration and management of information from multiple monitoring and warning sources. This is easier when systems are automated, but manual processes can also be accommodated. Several economies are attempting to address this need through the development of web-accessible economy-level systems such as the Sistema de Información para la Respuesta y Rehabilitación (SINPAD) and the Sistema de Información para la Gestión del Riesgo de Desastres (SIGRID) in Peru and InAWARE and VinAWARE in Indonesia and Viet Nam, respectively.

Economies may also leverage investments in regionally or globally available systems such as ASEAN's DMRS, the Emergency Operations System (EMOPS), or the Global Disaster Alert and Coordination System (GDACS).⁷² These systems integrate dynamic information on hazards and relevant environmental conditions from multiple sources, model outputs, and static contextual data.

While some systems, like GDACS, are primarily intended for use in the response phase, these integrative systems help streamline monitoring activities for decision makers and assist with dissemination processes. For example, with the appropriate institutional and technical mechanisms, outputs of community-based landslide monitoring and warning systems in Indonesia⁷³ could be consumed by integrative monitoring and alerting platforms at the economy-level such as InAWARE, and interoperable regional systems like DMRS. DMRS and InAWARE already have synching capabilities.

Web-based systems that make use of internationally recognized formats and standards such as the Common Alerting Protocol (CAP) represent an efficient means of sharing information and increasing the impact of local and economy-level investments.

DISSEMINATION AND COMMUNICATION

Both the desk study and the survey indicated that APEC economies use multiple channels to reach at-risk populations. However, several economies described challenges associated with communications infrastructure, particularly in remote areas. A respondent from Chinese Taipei noted the need to evaluate the relative effectiveness of multiple dissemination channels and upgrades in technology.

⁷² These systems are freely available to disaster managers in relevant areas of coverage. Some data and functions are publicly available, but most of these systems have password protected components. For additional information, previews of the systems, and/or login requests, use the following links: SINPAD - <http://sinpad.indeci.gob.pe/PortalSINPAD/>; SIGRID - <http://sigrid.cenepred.gob.pe/sigrid/>; InAWARE - <http://inaware.bnpb.go.id/inaware/>; VinAWARE - <http://www.vinaware.mard.gov.vn/vinaware/>; DMRS - <http://dmrs.ahacentre.org/dmrs/>; EMOPS - <http://www.pdc.org/solutions/products/disasteraware-emops/>; GDACS - <http://www.gdacs.org/>.

⁷³ See Fathani, T. F., Karnawati, D., Wilopo, W., Anderson, C., Bell, H., and Shirkhodai, R. (2015). *Extending Best Practices in Early Warning Systems for Building Community Resilience*. Honolulu, HI: READY Asia-Pacific.

Most economies engage both the media and the private sector to help disseminate alert and warning messages. However, these engagements appear to treat private sector stakeholders as dissemination outlets rather than as partners who could better support outreach and response capacity. Exceptions include the work of Chinese Taipei and Australia with convenience stores and mining companies, respectively.

Additional challenges relating to the media concern coverage of unofficial alerting sources. 83 percent of hazard monitoring agencies (HMAs) and 47% of disaster management organizations (DMOs) surveyed indicated they were very concerned about the negative effects of unofficial communications concerning alerts and warnings. Further investment in media outreach and partnering activities may help to mitigate this challenge.

The majority of HMA and DMO respondents indicated there were protocols in place for communicating alerts and warnings in their economies, and that these protocols were followed most or all of the time. However, recent reports and survey responses indicate that coordination and communication between early warning system stakeholders continues to be a challenge. Six respondents cited coordination and communication issues when asked about their biggest challenges with alert and warning.

Finally, responses to questions regarding legal authorities and information sources indicate that there may be mismatches in perceptions of roles and authorities, particularly surrounding the central DMO and local governments. However, it is unclear whether the protocols to which respondents referred are part of a broader set of norms for all stakeholders, or apply only to the respondent's agency or community of practice. In addition, DMOs and HMAs may not have enough insight into others' norms, needs, and practices.

RESPONSE CAPABILITY

Hyogo Framework Priority 2 Core Indicator 3 (early warning systems) had the highest average score of any of the Hyogo indicators analyzed. However, four of the 17 economies that completed a National Progress Report indicated insufficient preparedness at the local level, and two indicated that early warnings were not acted upon. Seven who answered the open-ended question about early warning system challenges cited issues relating to community awareness, concern, and action.

The majority of respondents indicated that their organizations conduct awareness programs related to early warning, and that there is some customization for specific groups. Local government and the media—two key partners of HMAs and DMOs in promoting awareness and effective response—were some of the most highly-targeted groups among HMAs and DMOs. However, customization rates for even these key stakeholders were still under 70%.

Survey responses indicated that civil society organizations (CSOs) could be better-integrated into early warning and community response programs. Most DMOs and half of CSO respondents reported CSOs as being only “somewhat active” in supporting community response to warning messages. CSOs themselves cited improved coordination and information sharing, as well as messaging and dissemination support as ways that CSOs could contribute. Engagement with CSOs presents an opportunity for new partnerships that serve as force multipliers for early warning systems. This would create a positive enabling environment and build upon the APEC DRR Framework, which enjoins community participation.

GOVERNANCE AND INSTITUTIONAL ARRANGEMENTS

In several economies, early warning systems do not appear to be overtly included in legal and policy frameworks. This is in spite of substantial advancement in the development of DRR policies as a whole.

Effective institutional frameworks for early warning systems facilitate coordination and promote the sharing of information. In addition, strong legal, policy, and regulatory frameworks may help support consistent allocation of funding for the initiation, expansion, and maintenance of early warning systems. Resource allocation and sustainability was cited as a concern by several economies in both Hyogo Framework reports and the surveys. Policy frameworks and the implementation of various legal mechanisms of cooperation can also facilitate partnerships that augment capacity and better distribute costs.

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VI. RECOMMENDATIONS

By the standards of the Hyogo Framework for Action, progress has been made in APEC economies in terms of components of early warning systems over the past decade. However, opportunities for improvement remain to build on successes and capitalize on what has been learned from shared experiences.

Based on the results of this study, the following recommendations are offered. The recommendations are tied to the pillars and areas for collaboration outlined in the APEC DRR Framework, and are informed by best practices and guiding principles from UNISDR and the IFRC.

1. Encourage consistent implementation and application of risk and vulnerability assessments in the design, implementation, and maintenance of early warning systems.
2. Support regional cooperation and partnerships to realize the interoperability of multi-hazard early warning systems within and across economies.
3. Document concepts of operation, decision authorities, and information flows for early warning systems. This activity should incorporate all EVS stakeholder groups to clarify roles, challenges, and opportunities.
4. Encourage partnerships with the private and non-profit sectors to augment the capacity, reach, and effectiveness of early warning systems.
5. Continue outreach to the general public and media to improve response results and increase confidence among disaster management officials in the public's ability to respond appropriately to alerts and warnings.

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APPENDIX 2: ALERT AND EARLY WARNING SURVEYS

APEC PUBLIC ALERT AND EARLY WARNING SURVEY: DISASTER MANAGEMENT ORGANIZATION

Economy⁷⁴:

Agency/Organization:

Office:

Title:

Please answer each question by checking or making bold the appropriate choices. For text boxes, please provide a short explanation.

1. Within your economy, which institutions have the legal authority to issue hazard alerts⁷⁵?

Check all that apply.

Central hazard monitoring agencies⁷⁶

Central disaster management organization

Provincial/prefectural hazard monitoring agencies

Provincial/prefectural disaster management organizations

Local governments

Other _____

I don't know

2. Within your economy, which institutions have the legal authority to issue warnings⁷⁷?

⁷⁴ Select one from: Australia; Brunei Darussalam; Canada; Chile; People's Republic of China; Hong Kong, China; Indonesia; Japan; Republic of Korea; Malaysia; Mexico; New Zealand; Papua New Guinea; Peru; The Philippines; Russia; Singapore; Chinese Taipei; Thailand; United States; Viet Nam

⁷⁵ An alert is any text, voice, video, or other communication provided by an authorized official to give information to the general public about a potential or ongoing emergency situation. An alert does not necessarily require immediate actions to protect life, health, and property.

⁷⁶ A hazard monitoring agency is an agency with scientific or technical expertise responsible for researching, monitoring, and analyzing hydrometeorological, geological, or other environmental conditions.

⁷⁷ A warning is any text, voice, video, or other information provided by an authorized official to give direction to the general public about an ongoing emergency situation. A warning requires immediate actions to protect life, health, and property.

Check all that apply.

- Central hazard monitoring agencies
- Central Disaster Management Organization
- Provincial/prefectural hazard monitoring agencies
- Provincial/prefectural organizations
- Local governments
- Other _____
- I don't know

3. From which sources does your institution regularly seek or receive hazard information?

Check all that apply.

- Central hazard monitoring agencies
- Central disaster management organization
- Sub-economy/Provincial/prefectural hazard monitoring agencies
- Provincial/prefectural disaster management organizations
- Local monitoring systems
- Local governments
- Private companies
- Foreign government monitoring agencies
- International monitoring organizations
- Civil society organizations (CSOs)
- Media
- Other _____
- I don't know

4. Within your economy, are there formal policies and procedures for communicating alerts and/or warnings from central hazard monitoring agencies to the central disaster management organization?

- Yes
- No
- I don't know

5. If yes, how often are these policies and procedures followed?

- All of the time

- Most of the time
 - Some of the time
 - Rarely
 - I don't know
6. If there are formal procedures for communicating alerts and/or warnings from central hazard monitoring agencies, are these procedures automated or manual?
- Completely automated
 - Completely manual
 - Mostly automated with some manual procedures
 - Mostly manual with some automation
 - I don't know
7. Within your economy, are there formal policies and procedures for communicating alerts and/or warnings between economy level (central government) agencies and provincial or local level authorities?
- Yes
 - No
 - I don't know
8. If yes, how often are these policies and procedures followed?
- All of the time
 - Most of the time
 - Some of the time
 - Rarely
 - I don't know
9. If there are formal procedures for communicating alerts and/or warnings between economy level (central government) agencies to provincial or local level authorities, are these procedures automated or manual?
- Completely automated
 - Completely manual
 - Mostly automated with some manual procedures
 - Mostly manual with some automation
 - I don't know

10. Within your economy, what official methods are used to disseminate alerts and warnings to the public?

Check all that apply.

SMS

Social media

Mobile/smart phone applications

Telephone

Radio

Television

Internet (e.g., website)

Sirens / Loudspeakers

Runners / Messengers

Signal flags

Other: _____

I don't know

11. Within your economy, how are alerts and warnings disseminated in remote areas with limited communications infrastructure?

Check all that apply.

SMS

Radio

Sirens / Loudspeakers

Runners / Messengers

Signal flags

Other: _____

Not applicable

I don't know.

12. Within your economy, are risk assessments used to inform the design of warning systems?

Yes, consistently

Somewhat

No, not at all

I don't know

13. Within your economy, do warning methods consider the needs of potentially vulnerable groups?

Yes, consistently

Somewhat

No, not at all

I don't know

14. Please indicate which potentially vulnerable groups' needs are addressed by your economy's warning methods.

Check all that apply.

Elderly

Disabled

Children

Women

Tourists

Speakers of languages not commonly used in the economy

Religious or ethnic minorities

People living in remote communities

People with limited access to modern communications technologies

Other _____

Other _____

I don't know

15. Does your economy have arrangements to use private sector resources for disseminating alerts and warnings?

Yes

No

I don't know

If yes, please briefly describe these arrangements:

16. Does your economy have agreements to integrate alerting and warning systems across international boundaries?

Yes

No

I don't know

If yes, please briefly describe these agreements:

17. On average, how often are warning systems in your economy tested?

Once per month

Once every three months

Once every six months

Once per year

Less than once per year

I don't know

18. Does your organization conduct awareness programs to inform people about warning systems and messages?

Yes

No

I don't know

19. If yes, for which groups are these programs adapted?

Check all that apply.

Elderly

Disabled

Children

Women

Men

Speakers of languages not commonly used in the economy

Religious or ethnic minorities

The media

Local government

Businesses

Tourism industry

Civil society organizations

Schools

Other _____

Other _____

The programs are not adapted for different audiences.

I don't know

20. To what extent are you concerned that unofficial communication about alerts and/or warnings could create confusion among the people being warned?

Very concerned

Somewhat concerned

A little concerned

Not at all concerned

I don't know

21. How active are non-governmental organizations (NGOs) and civil society organizations in supporting community response to warning messages?

Very active

Somewhat active

Not at all active

I don't know

22. How confident are you that the general public will take appropriate action when a warning is issued?

- Very confident
- Somewhat confident
- Not at all confident
- I don't know

Please explain your answer to question 22:

23. Within your economy, do any government agencies systematically gather information on how the general public responds to alerts and/or warnings?

- Yes
- No
- I don't know

If yes, please describe how information is gathered:

24. Please describe the biggest challenges to effective monitoring, alerting and/or warning in your economy:

APEC PUBLIC ALERT AND EARLY WARNING SURVEY: HAZARD MONITORING AGENCY

Economy⁷⁸:

Agency/Organization:

Office:

Title:

Please answer each question by checking or making bold the appropriate choices. For text boxes, please provide a short explanation.

- I. Within your economy, which institutions have the legal authority to issue hazard alerts⁷⁹?

Check all that apply.

Central hazard monitoring agencies⁸⁰

Central Disaster Management Organization

Provincial/prefectural hazard monitoring agencies

Provincial/prefectural disaster management organizations

Local governments

Other _____

I don't know

⁷⁸ Select one from: Australia; Brunei Darussalam; Canada; Chile; People's Republic of China; Hong Kong, China; Indonesia; Japan; Republic of Korea; Malaysia; Mexico; New Zealand; Papua New Guinea; Peru; The Philippines; Russia; Singapore; Chinese Taipei; Thailand; United States; Viet Nam

⁷⁹ An alert is any text, voice, video, or other communication provided by an authorized official to give information to the general public about a potential or ongoing emergency situation. An alert does not necessarily require immediate actions to protect life, health, and property.

⁸⁰ A hazard monitoring agency is an agency with scientific or technical expertise responsible for researching, monitoring, and analyzing hydrometeorological, geological, or other environmental conditions.

2. Within your economy, which institutions have the legal authority to issue warnings⁸¹?

Check all that apply.

- Central hazard monitoring agencies
- Central Disaster Management Organization
- Provincial/prefectural hazard monitoring agencies
- Provincial/prefectural disaster management organizations
- Local governments
- Other _____
- I don't know

3. For which hazards does your economy maintain monitoring systems?

Check all that apply.

- Coastal flooding
- River flooding
- Heavy rain
- Tropical cyclones
- High winds
- Earthquakes
- Tsunamis
- Landslides
- Volcanic eruptions
- Extreme temperatures
- Wildfires
- Drought
- Dust/Sandstorms
- Air Pollution/Haze/Smoke
- Other _____
- Other _____
- I don't know

⁸¹ A warning is any text, voice, video, or other information provided by an authorized official to give direction to the general public about an ongoing emergency situation. A warning requires immediate actions to protect life, health, and property.

4. In general, are these monitoring systems automated or manual?

Completely automated

Completely manual

Mostly automated with some manual procedures

Mostly manual with some automation

I don't know

5. In general, how robust are the monitoring systems in your economy?

Very robust. The systems monitor all major hazards, have nearly complete spatial coverage, and there are minimal disruptions to information flow.

Moderately robust. The systems monitor most major hazards, cover major population centers, and disruptions to information flow are infrequent or short.

Minimally robust. The systems monitor only one or two hazards, have limited spatial coverage, and disruptions to information flow are frequent or prolonged.

Not at all robust. Systems are generally inoperable.

I don't know

6. From which sources does your institution regularly seek or receive hazard information?

Check all that apply.

Central hazard monitoring agencies

Central disaster management organization

Provincial/prefectural hazard monitoring agencies

Provincial/prefectural disaster management organizations

Local monitoring systems

Local governments

Private companies

Foreign government monitoring agencies

International monitoring organizations

Civil society organizations (CSOs)

Media

Other _____

I don't know

7. Do your central hazard monitoring agencies have a reliable communications connection to the World Meteorological Organization's (WMO) Global Telecommunications System Regional Telecommunications Hub
- Yes
 - No
 - I don't know
8. Within your economy, are there formal policies and procedures for communicating alerts and/or warnings from central hazard monitoring agencies to the central disaster management organization?
- Yes
 - No
 - I don't know
9. If yes, how often are these policies and procedures followed?
- All of the time
 - Most of the time
 - Some of the time
 - Rarely
 - I don't know
10. If there are formal procedures for communicating alerts and/or warnings from central hazard monitoring agencies in place, are these procedures automated or manual?
- Completely automated
 - Completely manual
 - Mostly automated with some manual procedures
 - Mostly manual with some automation
 - I don't know
11. Within your economy, are there formal policies and procedures for communicating alerts and/or warnings between economy level (central government) agencies and provincial or local level authorities?
- Yes
 - No
 - I don't know

12. If yes, how often are these policies and procedures followed?

- All of the time
- Most of the time
- Some of the time
- Rarely
- I don't know

13. If there are formal procedures for communicating alerts and/or warnings between economy level (central government) agencies to provincial or local level authorities, are these procedures automated or manual?

- Completely automated
- Completely manual
- Mostly automated with some manual procedures
- Mostly manual with some automation
- I don't know

14. Within your economy, what official methods are used to disseminate warnings to the public?
Check all that apply.

- SMS
- Social media
- Mobile/ smart phone applications
- Telephone
- Radio
- Television
- Internet (e.g., website)
- Sirens / Loudspeakers
- Runners / Messengers
- Signal flags
- Other: _____
- I don't know

15. Within your economy, how are warnings disseminated in remote areas with limited communications infrastructure?

Check all that apply.

SMS

Radio

Sirens / Loudspeakers

Runners / Messengers

Signal flags

Other: _____

Not applicable

I don't know

16. Within your economy, are risk assessments used to inform the development of hazard monitoring and warning systems?

Yes, consistently

Somewhat

No, not at all

I don't know

17. Within your economy, do warning methods consider the needs of potentially vulnerable groups?

Yes, consistently

Somewhat

No, not at all

I don't know

18. Does your economy have arrangements to use private sector resources for monitoring hazards or disseminating official warnings?

Yes

No

I don't know

If yes, please briefly describe these arrangements:

19. Does your economy have agreements to integrate monitoring systems across international boundaries?

Yes

No

I don't know

If yes, please briefly describe these agreements:

20. Does your economy have agreements to integrate alerting and warning systems across international boundaries?

Yes

No

I don't know

If yes, please briefly describe these agreements:

21. On average, how often are warning systems in your economy tested?

- Once per month
- Once every three months
- Once every six months
- Once per year
- Less than once per year
- I don't know

22. Does your organization conduct awareness programs to inform people about warning systems and messages?

- Yes
- No
- I don't know.

23. If yes, for which groups are these programs adapted?

Check all that apply.

- Elderly
- Disabled
- Children
- Women
- Men
- Speakers of languages not commonly used in the economy
- Religious or ethnic minorities
- The media
- Local government

Businesses

Tourism industry

Civil society organizations

Schools

Other _____

Other _____

The programs are not adapted for different audiences.

I don't know

24. To what extent are you concerned that unofficial communication about alerts and/or warnings could create confusion among the people being warned?

Very concerned

Somewhat concerned

A little concerned

Not at all concerned

I don't know

25. Please describe the biggest challenges to effective monitoring, alerting and/or warning in your economy:

APEC PUBLIC ALERT AND EARLY WARNING SURVEY: CIVIL SOCIETY ORGANIZATIONS

Economy⁸²:

Agency/Organization:

Office:

Title:

Please answer each question by checking or making bold the appropriate choices. For text boxes, please provide a short explanation.

- I. Through which mechanisms do you and/or your organization receive alerts⁸³ and warnings⁸⁴?

Check all that apply.

SMS

Social media

Mobile/smart phone applications

Telephone

Radio

Television

Internet (e.g., website)

Sirens / Loudspeakers

Runners / Messengers

Signal flags

Other: _____

I don't know

⁸² Select one from: Australia; Brunei Darussalam; Canada; Chile; People's Republic of China; Hong Kong, China; Indonesia; Japan; Republic of Korea; Malaysia; Mexico; New Zealand; Papua New Guinea; Peru; The Philippines; Russia; Singapore; Chinese Taipei; Thailand; United States; Viet Nam

⁸³ An alert is any text, voice, video, or other communication provided by an authorized official to give information to the general public about a potential or ongoing emergency situation. An alert does not necessarily require immediate actions to protect life, health, and property.

⁸⁴ A warning is any text, voice, video, or other information provided by an authorized official to give direction to the general public about an ongoing emergency situation. A warning requires immediate actions to protect life, health, and property.

2. From which sources do you and/or your organization regularly seek or receive hazard information?

Check all that apply.

- Central hazard monitoring agencies⁸⁵
- Central disaster management organization
- Provincial/prefectural hazard monitoring agencies
- Provincial/prefectural disaster management organizations
- Local monitoring systems
- Local governments
- Private companies
- Foreign government monitoring agencies
- International monitoring organizations
- Other civil society organizations (CSOs)
- Media
- Other _____
- I don't know

3. Within your economy, are there differences in the ways men and women typically obtain information on hazards? Differences might include social settings, sources, or technology.

Yes

No

I don't know

If yes, please describe any general differences:

4. Within your economy, do warning methods consider the needs of potentially vulnerable groups?

⁸⁵ A hazard monitoring agency is an agency with scientific or technical expertise responsible for researching, monitoring, and analyzing hydrometeorological, geological, or other environmental conditions.

Yes, consistently

Somewhat

No, not at all

I don't know

5. Please indicate which potentially vulnerable groups' needs are addressed by your economy's warning methods.

Check all that apply.

Elderly

Disabled

Children

Women

Tourists

Speakers of languages not commonly used in the economy

Religious or ethnic minorities

People living in remote communities

People with limited access to modern communications technologies

Other _____

Other _____

I don't know

6. Does your organization conduct awareness programs to inform people about warning systems and messages?

Yes

No

I don't know.

7. If yes, for which groups are these programs adapted?

Check all that apply.

Elderly

Disabled

Children

Women

Men

Speakers of languages not commonly used in the economy

Religious or ethnic minorities

The media

Local government

Businesses

Tourism industry

Other civil society organizations

Schools

Other _____

The programs are not adapted for different audiences.

I don't know

8. To what extent are you concerned that unofficial communication about alerts and/or warnings could create confusion among the people being warned?

Very concerned

Somewhat concerned

A little concerned

Not at all concerned

I don't know

9. How active are non-governmental organizations (NGOs) and civil society organizations (CSOs) in supporting community response to warning messages?

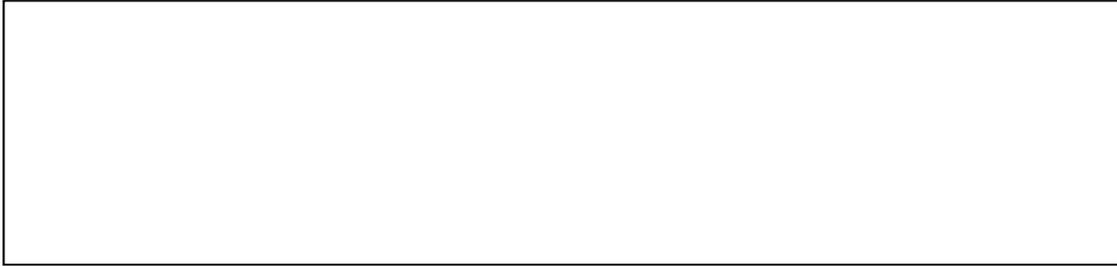
Very active.

Somewhat active.

Not at all active.

I don't know.

10. In your opinion, how can CSOs help improve warnings and community response in your economy?



11. How confident are you that the general public will take appropriate action when a warning is issued?

Very confident

Somewhat confident

Not at all confident

I don't know

Please explain your answer to question 11:



12. Within your economy, do any organizations systematically gather information on how the general public responds to alerts and/or warnings?

Yes

No

I don't know

If yes, please describe how information is gathered:



13. Please describe the biggest challenges to effective monitoring, alerting and/or warning in your economy:

