Innovations in Disaster Rapid Assessment:

a Framework for Early Recovery in ASEAN Countries

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The Economic and Social Commission for Asia and the Pacific (ESCAP) serves as the United Nations' regional hub promoting cooperation among countries to achieve inclusive and sustainable development. The largest regional intergovernmental platform with 53 Member States and 9 associate members, ESCAP has emerged as a strong regional think-tank offering countries sound analytical products that shed insight into the evolving economic, social and environmental dynamics of the region. The Commission's strategic focus is to deliver on the 2030 Agenda for Sustainable Development, which is reinforced and deepened by promoting regional cooperation and integration to advance responses to shared vulnerabilities, connectivity, financial cooperation and market integration. ESCAP's research and analysis coupled with its policy advisory services, capacity building and technical assistance to governments aims to support countries' sustainable and inclusive development ambitions.

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Preface

This handbook forms part of a series of knowledge products developed in collaboration with the Association of Southeast Asian Nations (ASEAN) institutions and ASEAN member countries. The series is designed to increase skills and promote institutional development for countries wishing to embrace innovative space-based information in disaster risk management. The products can be used as training manuals and reference guides, addressing the needs of both geospatial information providers and disaster decision makers.

This handbook provides an overview of innovations in disaster rapid assessment. It is aimed at disaster managers, post-disaster assessment analysts and field staff collecting data. While there is a robust long-term recovery and reconstruction framework in place for disaster-affected countries through formal post-disaster needs assessments (PDNAs), these assessments are often carried out only upon the request of governments and can take a number of weeks, if not months to complete. Rapid assessments can address these constraints.

The problem is that rapid assessments are somewhat sectoral and often lack standardization; many agencies and actors can be conducting such assessments at the same time, which poses additional coordination challenges for national disaster management authorities (NDMAs). Sectoral assessments carried out in isolation often lack the recovery and reconstruction considerations necessary to promote early recovery, in comparison to a well-coordinated, asset-based multisectoral assessment.

This handbook addresses these concerns by providing a methodology for performing rapid disaster assessment by using new and emerging methodologies for asset-based damage and loss estimates, while integrating innovations in technology, data and information for impact-based perspectives that can increase the precision of early estimates of recovery and reconstruction needs.

The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), collaborated with United Nations partners, the ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management (AHA Centre), space agencies and NDMAs in ASEAN countries, in compiling this handbook. The handbook was developed in close collaboration with operational staff during a series of workshops held over the course of 2016 and 2017, and it is based on emerging methodologies from a variety of sectors. The principles behind this handbook were refined through focused consultation with the AHA Centre and its Emergency Rapid Assessment Team.

It is our hope that this handbook and its innovative techniques, methodologies and best practices will significantly contribute to strengthening disaster resilience in the ASEAN region.

Acknowledgements

Under the overall guidance of Tiziana Bonapace, Director of the Information and Communications Technology and Disaster Risk Reduction Division (IDD) of ESCAP, development of the following handbook was coordinated by Syed T. Ahmed, Space Applications Section (SAS), IDD, ESCAP, through extensive consultation with experts from space agencies and NDMAs of ASEAN member countries. Initial background research was provided by an ESCAP consultant, Shweta Sinha, while Khaled Mashfiq, Regional Liaison Officer, United Nations Institute for Training and Research (UNITAR) Operational Satellite Applications Programme (UNOSAT) provided substantive inputs.

Substantive comments and contributions were received from Kaveh Zahedi, Deputy Executive Secretary for Sustainable Development, ESCAP; Sanjay Srivastava, Chief, Disaster Risk Reduction Section, IDD, ESCAP; Puji Pujiono, Regional Adviser, IDD, ESCAP; Werner Balogh, Chief, a.i., of SAS, IDD, ESCAP; Rishiraj Dutta, Consultant, SAS, IDD, ESCAP; John Marinos, Information Management Officer, United Nations Office for the Coordination of Humanitarian Affairs (OCHA); Luca Dell'Oro, Programme Specialist, UNITAR; Arnel Capili, Director of Operations, AHA Centre; and Jakrapong Tawala, Geo-Informatics and Space Technology Development Agency of Thailand.

The handbook also benefited from peer review by the national focal points of the ESCAP Regional Space Applications Programme for Sustainable Development (RESAP), partners across other United Nations agencies and the AHA Centre. ESCAP acknowledges the joint efforts of ESCAP, the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) and the AHA Centre in conceptualizing this initiative to support ASEAN countries through a series of workshops conducted over the course of 2016 and 2017.

The handbook has been cross-referenced with the PDNA framework and the Inter-Agency Standing Committee (IASC) Operational Guidance for Coordinated Assessments in Humanitarian Crises, as well as the IASC's Multisector Initial Rapid Assessment (MIRA) Guidance and framework, and emerging assessment methodologies introduced by the United Nations International Strategy for Disaster Reduction (UNISDR). Editorial revision was provided by Marnie McDonald.

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Acronyms and abbreviations

AADMER	ASEAN Agreement on Disaster Management and Emergency Response
ACDM	ASEAN Committee on Disaster Management
AHA Centre	ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management
ASEAN	Association of Southeast Asian Nations
ASEAN-ERAT	ASEAN-Emergency Rapid Assessment Team
COST	ASEAN Committee on Science and Technology
FACT	Field Assessment and Data-collection Team
FAO	Food and Agriculture Organization of the United Nations
GIS	Geographic Information System
DaLA	Damage and Loss Assessment
ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
HRNA	Human Recovery Needs Assessment
IASC	Inter-Agency Standing Committee
IDD	Information and Communications Technology and Disaster Risk Reduction Division (ESCAP)
MIRA	Multisector Initial Rapid Assessment
NDMA	National Disaster Management Authority
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
PDNA	Post-Disaster Needs Assessment
RAIF	Rapid Assessment Innovation Framework
RAM	Rapid Assessment Manager
RARR	Rapid Assessment for Resilient Recovery
RRC	Recovery and Reconstruction Costs
SAS	Space Applications Section (ESCAP)
SAT	Statistical Analysis Team
SASOP	Standard Operating Procedure for Regional Standby Arrangements and Coordination of Joint Disaster Relief and Emergency Response Operations
SCOSA	ASEAN Subcommittee on Space Applications
UAV	Unmanned Aerial Vehicle
UN-ASIGN	United Nations Adaptive System for Image Communication over Global Networks
UNECLAC	United Nations Economic Commission for Latin America and the Caribbean
UNISDR	United Nations International Strategy for Disaster Reduction
UNITAR	United Nations Institute for Training and Research
UNOSAT	United Nations Operational Satellite Applications Programme

Overview

Purpose, aims and objectives

The purpose of this handbook is to introduce the use of innovative technologies and space applications to enhance traditional rapid assessment methodologies and techniques in order to provide a hybrid methodology. The methodology is designed to bridge long-term recovery and reconstruction frameworks such as PDNA using smart tools and technologies.

The goals of this rapid assessment innovation handbook include adding value to member States to better manage disaster response, enhance effective operations and improve recovery and reconstruction efforts. The handbook provides a tool to bridge emergency response, recovery and reconstruction activities more seamlessly, to enhance evidence-based decision-making for disasters, and promote the use of smart tools and technologies for early cost estimates of recovery and reconstruction.

This handbook aims to make the process of PDNA more accessible to disaster assessment teams within ASEAN institutions, as PDNA is now also a part of the ASEAN-Emergency Rapid Assessment Team (ASEAN-ERAT) transformation plan. The handbook aims to complement, enhance and strengthen existing ASEAN-ERAT rapid assessment methods and improve the outputs of ASEAN-ERAT by upgrading its capacity. The handbook will also contribute to the ASEAN recovery framework as a knowledge product within its toolbox.

The objective of this handbook, and the rapid assessment innovation methodology and framework it outlines, is to provide NDMAs with an initial estimate of damage and losses where providing a more robust and timely initial assessment can contribute to a thorough PDNA. Its objectives are also to help establish new competencies for disaster assessment analysts, in line with Level 2 disaster responders of the ASEAN-ERAT transformation. It is hoped that the handbook can promote the setting of standard practices in the use of space applications for rapid assessment.

The target audience for this handbook is operational and technical staff such as disaster assessment analysts. The handbook can also be used as a reference by disaster managers and heads of operations supervising data and information gathering and analysis for disaster assessment, at NDMAs or relevant institutions coordinating disaster rapid assessment. Within the AHA Centre, this handbook is intended for use by a well-trained, ASEAN-ERAT Level 2 team member. The dissemination of, and invitation to use this handbook, also extends to ASEAN partners.

The scope of the handbook covers natural disasters and an assessment of their impacts on economic and social activities, extending across phases 1–3 of the IASC guidance on coordinated assessments and their associated timelines. The handbook cuts across the recovery framework, providing basic considerations towards recovery and reconstruction planning, as well as the development of capacity to understand impact, response and initial recovery needs post-disaster. It focuses on the use of space applications and other innovative technologies to estimate losses in addition to damage after a disaster, and how these innovative tools and technologies can contribute to formulating an evidence base for making informed decisions, using smart information and strategic data points. It specifically looks into a few sectors that have been identified as having long-term recovery characteristics.

Background

The concept of a rapid assessment innovation methodology for the ASEAN region was refined during the 'ASEAN Regional Workshop on Standardization of Methodologies for Multi-hazard Risk Assessment and Integration of Satellite Imageries for Rapid Assessment of Post-disaster Damage and Losses' held in Siracha, Thailand, 7–9 December 2016. The workshop was conducted with United Nations partners and the AHA Centre. It was convened to bring together representatives from NDMAs and space agencies in the ASEAN region to review and discuss the need for and purpose of developing a technical handbook for rapid disaster assessment which takes into account existing methodologies and processes while remaining rapid and adding value to overall coordinated assessment frameworks to provide evidence-based early estimations of disaster damage and loss.

A focus group held with the AHA Centre and ASEAN-ERAT helped further refine the key principles of the handbook's methodology and framework, modality of implementation and relevance to ASEAN institutions. The focus group session was conducted during the 'Joint Review of ESCAP-ASEAN Rapid Assessment Handbook' held in Jakarta, Indonesia, 30–31 May 2017. The following key principles were agreed by disaster management practitioners and operational staff during the aforementioned workshops:

- The handbook and its methodology and framework must remain 'rapid' in its considerations.
- Choices in data and information for the methodology must be smart and strategic.
- Overall assessments propagated in the handbook must be coordinated with NDMAs and other relevant actors in targeted sectors.
- Ideas and methods introduced in the handbook should be in synchronicity with existing methods and schemes in AHA Centre, ASEAN institutions and other global assessment frameworks.

- The handbook's procedures must ensure complementarity with existing practices for conducting assessments and ongoing efforts to reform such practices.
- The handbook should aim to provide non-prescriptive guidance on good practices, where institutions can adopt as many concepts as they wish and adapt others to their own specific assessment contexts.

Requirements and prerequisites for adopting innovative rapid assessment methodologies

While this handbook provides a new perspective on traditional rapid assessment activities through using innovative tools and technologies, there are a number of factors that need to be addressed in order to ensure the acceptance, adoption and integration of its methods. These factors are also associated with new ways of working that may confront existing working cultures and mindsets regarding data and information. The institutional and operational groundwork necessary for using and integrating such rapid assessment innovations must be addressed during non-emergency times as part of disaster preparedness for institutions. Some of the key factors that are prerequisites to support the use of such rapid assessment innovations are:

- Policy and mandate – establishing clear policies which promote the innovative use of technology and sharing of such data and information.
- Innovative technologies – investing in or using new tools and technologies that are currently available to support rapid assessment innovation.
- Access to satellite imagery – fostering partnerships with space agencies and data providers in order to gain access to data and information derived from satellite technologies.
- Institutional capabilities and capacity – enhancing capabilities through sharing resources, linking with other specialized agencies and developing institutional capacity.
- Methods and tools – enhancing understanding of tools and methodologies used in rapid assessment and developing and maintaining comprehensive baseline data sets.
- Skilled analysts to interpret the information – a pooled, cross-sectoral team of analysts and experts who can work together on complex data science and socioeconomic indicators to develop situational awareness using augmented data sets from a variety of information sources.
- Parameters and multipliers for extrapolation – identifying and gathering reference data that can be used to simulate damage at relevant scales and assign market values to determine estimated costs.
- Skills to link response and early recovery – understanding how and why combining response and early recovery activities can build resilience to disasters.

UN Photo/Kibae Park

Relevance to existing mechanisms

ASEAN disaster assessment context

Policy drivers for disaster management

Through subregional discussions on cooperation in disaster management, the ASEAN Committee on Disaster Management (ACDM) was established in 2003 under the ASEAN Secretariat. Furthermore, on 26 July 2005, foreign ministers of ASEAN member states signed the ASEAN Agreement on Disaster Management and Emergency Response (AADMER) in Vientiane, Lao People's Democratic Republic. AADMER aims to provide effective mechanisms to achieve substantial reductions in disaster-related loss of lives and of social, economic and environmental assets of ASEAN member states; and to jointly respond to disaster emergencies through concerted national efforts and intensified regional and international cooperation.

AADMER is a comprehensive agreement, covering the whole spectrum of disaster management from risk identification to assessment and monitoring, prevention and mitigation, preparedness, response and recovery. AADMER also promotes technical cooperation and scientific research. ACDM serves as the main subsidiary body responsible for overseeing the operational implementation of AADMER. It meets at least once a year, providing leadership and guidance towards fulfilling the goals and objectives of AADMER, pursuant to the vision of a disaster-resilient and safer ASEAN community. Various thematic working groups operate under ACDM to support and implement programmes on behalf of the Committee.

Institutional mechanisms

The Standard Operating Procedure for Regional Standby Arrangements and Coordination of Joint Disaster Relief and Emergency Response Operations (SASOP) is required under Article 9 of AADMER, where Parties, on a voluntary basis, shall identify and earmark assets and capacities which may be made available and mobilized for disaster relief and emergency response. SASOP outline the modalities for such an arrangement and procedures for coordination between agencies and NDMAs through their national focal points and other relevant arrangements.
AADMER also mandated the establishment of the AHA Centre as the engine for its operationalization (see figure 1). The AHA Centre was established on 17 November 2011, through the signing of the Agreement on the Establishment of AHA Centre by ASEAN foreign ministers, witnessed by ASEAN heads of states, during the 19th ASEAN Summit in Bali, Indonesia.

Figure 1: Processes defined under the AADMER agreement
Source: www.ahacentre.org

AHA Centre currently focuses on disaster monitoring alongside preparedness and response. It works with NDMAs and national focal points, acting as a common platform for information exchange and sharing its products among ASEAN member states and partners. The terms of reference of AHA Centre is an annex to AADMER. ACDM functions as the Governing Board for the AHA Centre.

ASEAN-ERAT was established by ACDM in 2007, in line with Article 11 of AADMER and provisions under ASEAN-SASOP. ASEAN-ERAT is designed to respond quickly to a major, sudden-onset disaster within the region. The main role of ASEAN-ERAT is to support the NDMAs of affected member countries in the initial phases of a disaster to:

- Conduct rapid assessment
- Coordinate mobilization and deployment of regional disaster management capacity, and
- Facilitate incoming relief assistance from ASEAN member countries.

ASEAN-ERAT is composed of experienced and trained individuals who have responded to disaster incidents in the region and is managed by the AHA Centre. It serves as the coordination hub and operations centre for mobilization of resources to disaster-affected areas in the region. In November 2013, ACDM decided that the role of ASEAN-ERAT should be expanded to include support to emergency response operations. In additional to rapid assessments, the current scope of ASEAN-ERAT includes supporting logistics, emergency communications and coordination, among others.

Links with coordinated assessments

There are a variety of disaster assessments developed and in use. Although largely developed by the international community, many have been adapted by countries to form their own assessments (in most cases for smaller and medium-sized disasters) which do not require a large-scale international response. Assessments can be considered as a 'set of activities necessary to understand a given situation'. This includes 'the collection, updating and analysis of data pertaining to the population of concern (needs, capacities, resources, etc.), as well as the state of infrastructure and general socioeconomic conditions in a given location/area.' [1]

Coordinated assessments are those planned and carried out with other actors and partners, where results are also shared with relevant authorities and agencies. They can include joint assessments across sectors or harmonized assessments carried out by single agencies. Different coordinated assessments are conducted at different phases of the disaster response timeline, and these can often feed into one another or provide independent validation of results. Such assessments can be largely grouped into four phases relative to their positioning within the phased disaster timeline. [2]

IASC has an Assessment Framework for each phase of a disaster, including the recommended types of assessments and their purposes, the methodology for data collection and the link to funding proposals and key outputs, including the approach to follow during each of the phases (see figure 2). These include:

- The first 72 hours – initial assessments carried out during Phase 1
- First and second weeks – rapid assessments carried out during Phase 2
- Third and fourth weeks – in-depth assessments carried out during Phase 3
- Fifth week onwards – in-depth assessments carried out during Phase 4, including on recovery and reconstruction needs.

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1 United Nations High Commissioner for Refugees, UNHCR Master Glossary of Terms (June 2006, Rev.1).

2 IASC, Operational Guidance for Coordinated Assessments in Humanitarian Crises (2012).

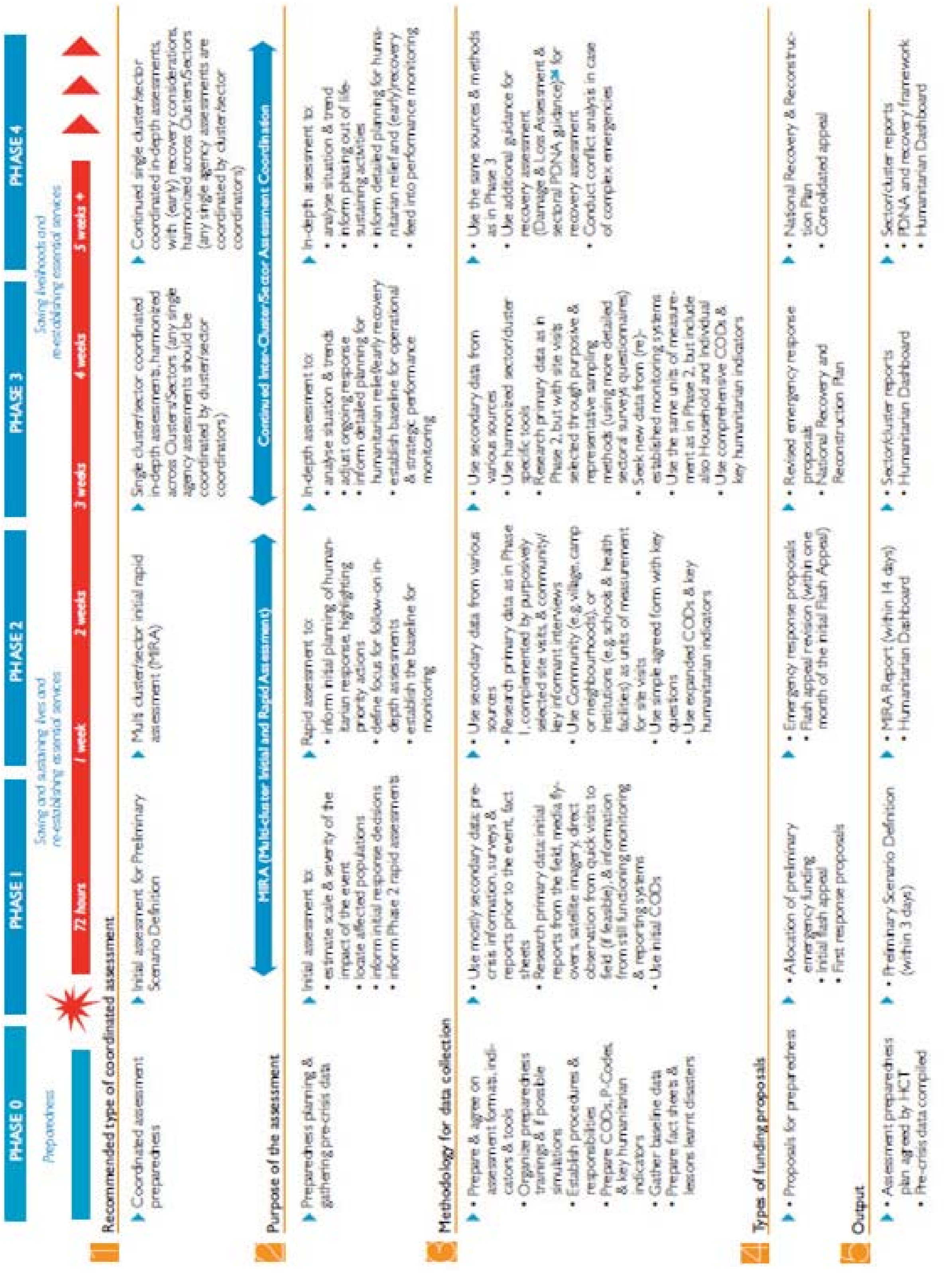

Figure 2: IASC assessment framework

Phase 1: Preliminary scenario assessment (first 72 hours)

The focus of this phase is on determining the scale and severity of an impact and forecasting areas expected to be impacted further or as an evolution of a dynamic hazard. The time frame is often the first three days. However, preliminary impact assessments and forecasting can also begin days before a disaster strikes, as in the case of cyclones and typhoons that have a predicted track and increased lead time through early warning. The sources of data used during this phase include mainly secondary data sources, where primary data can be obtained from satellite imagery and earth observation systems. The use of baseline data as a pre-disaster reference is particularly helpful during this phase, as information can often become scarce during the initial days after a disaster.

Figure 3 shows a typical map of damage assessment during September 2016 floods in Indonesia carried out by the Indonesian National Institute of Aeronautics and Space, with support from UNOSAT, using satellite imagery analysis and remote sensing techniques.

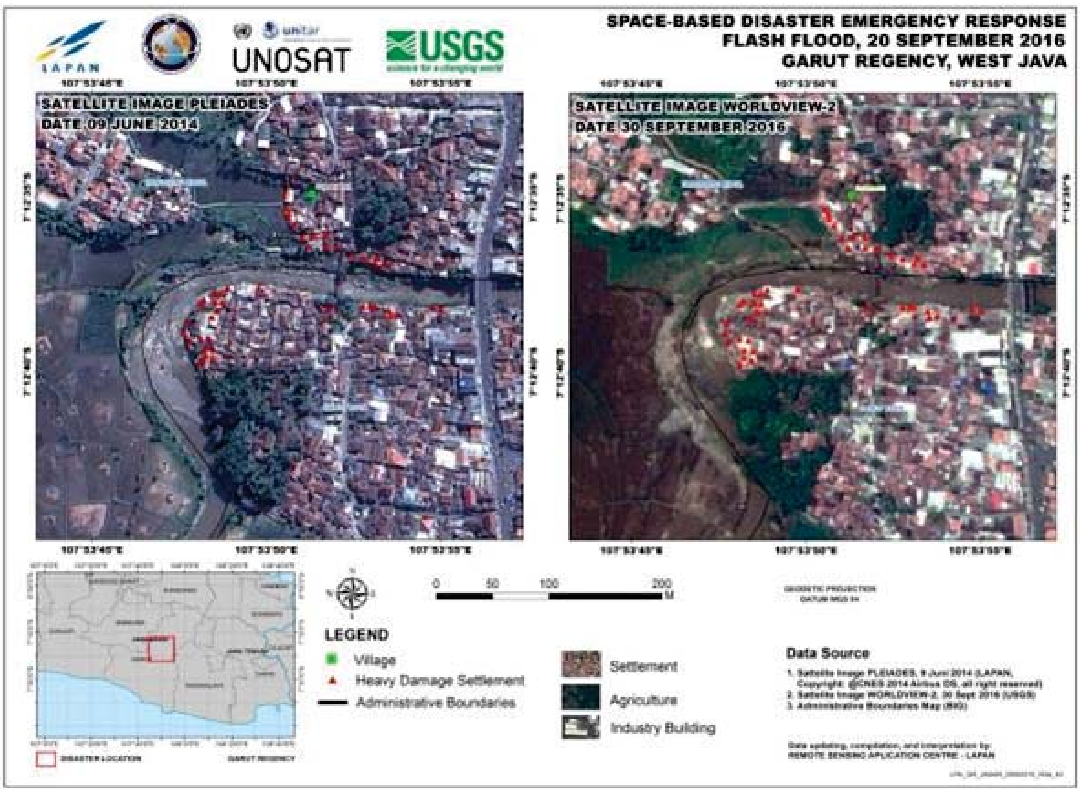

Figure 3: Example flood damage assessment map using high resolution satellite imagery

Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Phase 2: MIRA (weeks 1 and 2)

The focus of this phase is on understanding the overall impact of the crisis and strategic humanitarian priorities. The time frame is often within the first 14 days of a disaster. Assessments carried out in this phase use a mixture of secondary and primary data sources. This is often supplemented by primary data collected from the field, from selected locations which are ideally spread across different affected areas but are often selected based on access, timing, resources and the purpose of the actual assessment being carried out. One of the main assessments carried out for humanitarian purposes is MIRA.

OCHA and partners developed MIRA as a coordinated means of informing immediate humanitarian priorities. MIRA is a joint needs assessment tool that can be used in sudden-onset emergencies, including IASC System-Wide Level 3 Emergency Responses (L3 responses). It is a precursor to cluster/ sectoral needs assessments and provides a process for collecting and analysing information on affected people and humanitarian needs for informed strategic response planning.

Key results from humanitarian sectors/clusters can be used to understand the overview of the situation. Using MIRA data sets with additional information such as government data, other assessments, satellite imagery, crowdsourced data, etc. can improve damage estimates and provide a broader understanding of the impact in the region. Using satellite technologies and scientific tools, particularly in physically inaccessible areas, further improves identification of areas in need.

Box 1: Case study of MIRA for Myanmar floods, 2015

On 30 July 2015, Cyclone Komen made landfall in Bangladesh, bringing strong winds and additional heavy rains to Myanmar. This resulted in widespread flooding across 12 of the country's 14 states and regions (Ayeyarwady, Bago, Chin, Kachin, Kayin, Magway, Mandalay, Mon, Rakhine, Sagaing, Shan, Yangon). On 31 July, the President declared Chin and Rakhine states, and Magway and Sagaing regions, natural disaster zones. According to the National Natural Disaster Management Committee, 125 people were killed and about 1.7 million people were temporarily displaced by floods and landslides.

On 31 August 2015, the National Disaster Management Committee reported that over 1,616,000 people had been severely affected by floods and landslides over the previous two months (July and August). At least 117 people were confirmed to have been killed due to floods and landslides since June. According to the Ministry of Agriculture and Irrigation, more than 1.4 million acres of farmlands had been inundated, with more than 972,000 acres destroyed. In collaboration with the Government, MIRA was conducted in 280 locations of 34 townships in Ayeyarwady, Bago, Chin, Magway, Rakhine and Sagaing, covering close to 200,000 people (12.3 per cent of the affected people). [3]

The preliminary findings indicated that more than 128,000 people had been displaced in those locations. Figure 4 indicates the number of people affected per township. Identification of assessment areas was based on disaster areas declared by the Government (Chin, Sagaing, Magway and Rakhine). MIRA included areas that were physically accessible, which does not reflect the conditions of inaccessible areas that may have suffered from worse conditions than those reported. MIRA presented a comprehensive overview based on the data available, although some would argue that it did not provide detailed information. In Chin State, villages were assessed in all townships except for Thanglang. This resulted in a higher sampling rate than other regions. In Magway townships, particularly Sidoktaya and Pwintbyu, in addition to the inter-agency MIRA, three NGOs assessed affected townships using MIRA, representing one-third of the overall assessment coverage.

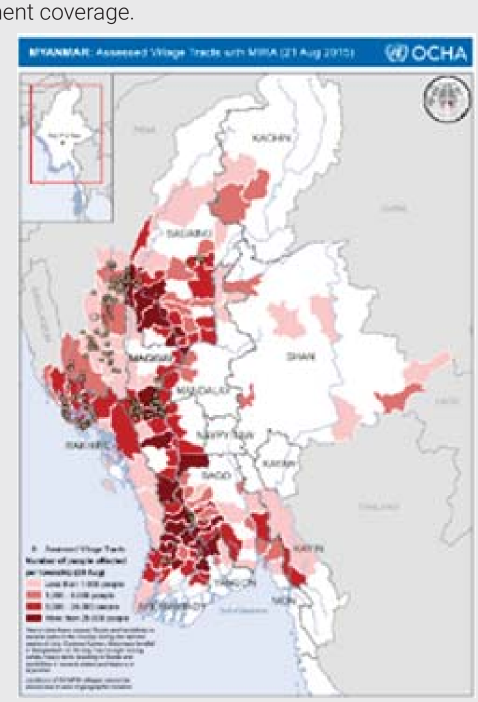

Figure 4: MIRA for Myanmar floods, 2015

Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

3 OCHA, Myanmar: Floods and Cyclone Response Multi-cluster/sector Initial Rapid Assessment (MIRA) Report (as of 03 September 2015).

Phase 3: In-depth sectoral assessments (weeks 3 and 4)

The focus of this phase is on providing situation updates and trends analysis, as well as information for operational planning in each sector. Most sectoral assessments take place during this phase. The time frame for the phase is within the first 30 days of a disaster. Data sources used during this phase often include largely primary data sources, including information from monitoring systems and joint assessments. There is often an increase in field data collection as well, providing a more representative sample of data from a wider cross section of disaster-affected areas and sectors.

Many of the sectoral rapid assessments which take place during this phase can lack standardized methodology, due to competing or overlapping assessments being carried out by different authorities and actors within sectors, thus presenting greater challenges to coordination. Many countries have also taken assessment methodologies and customized them for their own purposes, where many take a rapid assessment approach based on other PDNAs which are discussed further in the following section. Box 2 presents an example assessment carried out for agriculture and livelihoods in Myanmar in 2015.

Box 2: Case study of Agriculture and Livelihood Flood Impact Assessment for Myanmar floods, 2015

The Agriculture and Livelihood Flood Impact Assessment was requested by the Ministry of Agriculture and Irrigation and the Ministry of Livestock, Fisheries and Rural Development of Myanmar. It focused on assessing the disaster impact of a cyclone on agriculture and the rural-based livelihoods of affected populations. The assessment was conducted in the six most-affected regions of Ayeyarwady, Bago, Chin, Magway, Rakhine and Sagaing, and co-led by the United Nations Food and Agricultural Organization and the United Nations World Food Programme, under the framework of the Food Security Sector in partnership with UN Women, World Vision, Cesvi, CARE, the Japan International Cooperation Agency and the Livelihoods and Food Security Trust Fund. [4]

This rapid assessment was carried out in 15 days, during September 2015, in the six most-affected regions. The assessment was based on a review of secondary data as well as the collection and analysis of field data to allow triangulation and validation. Reports, publications, newspaper articles and additional informative materials produced by NGOs, international organizations and development/humanitarian agencies were collected and analysed. Additional secondary data were collected from various ministries, particularly the Ministry of Agriculture and Irrigation and the Ministry of Livestock, Fisheries and Rural Development. The majority of documents used were statistical yearbooks, briefs and outline reports containing baseline information on crops, livestock and fishery production as well as irrigation. These ministries also produced post-disaster fortnightly reports on damage and losses which were additional sources of information for this report. Further primary data were collected by six teams led by the World Food Programme, the United Nations Food and Agricultural Organization and UN Women.

Figure 5: Agriculture and livelihood flood impact assessment, Myanmar 2015

Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

4 United Nations Food and Agricultural Organization, Agriculture and Livelihood Flood Impact Assessment in Myanmar (2015). Available from www.fao.org/fileadmin/user_upload/emergencies/docs/Final_Impact_Assessment_Report_final.pdf.

While the above assessment was carried out at township, village and market levels, key findings from the assessment showed that the disaster had a severe impact on the livelihoods of families that relied on agriculture. Limitations of such assessments can include:

- Purposive sampling of the most-affected townships and villages allows for comparisons between each region; however, results do not give a representative overview as a whole.
- The compilation of such reports relies heavily on the consistent use of qualitative information, due to a lack of more reliable quantitative information. While data provided by the government can be very useful, there is a need to enhance national information systems in order to ensure proper data collection, analysis and dissemination as well as storage and management.
- While static data from government agencies may be regularly updated, post-disaster figures often evolve. In addition, data provided can often be in the local language and will need to be translated, which can be time-consuming. Translation errors can also lead to delays in the processing of data and report writing.
- A more in-depth assessment to verify the data on affected population will be required to complement information provided from mostly qualitative data.
- Timing of the assessments can affect the inclusion of realistic harvest estimates. Assessments should be undertaken to assess agricultural production for upcoming seasons and the impact on food availability, accessibility and utilization at national, regional and state levels.
- Data collected may not fully quantify the response requirements. Therefore, further quantification will be needed to prepare region-specific and local responses.

Phase 4: In-depth recovery assessments (week 5 onwards)

This phase is essentially a continuation of the previous, where early recovery considerations become more explicitly integrated into sectoral assessments and as such are taken into account in sector analysis. In terms of the time frame, the need for recovery-related data will increase, particular for government activities in recovery and reconstruction. Therefore, sector assessments should remain forward-looking while maintaining focus on emergency response. While early recovery considerations are often a part of the in-depth assessments which take place during Phase 3, Phase 4 represents a more pronounced shift in attention to assessments which focus on recovery and reconstruction. However, there is no clear definition between the response and recovery periods.

In some cases, a government can request a formal PDNA. When this happens, a dedicated PDNA report is produced including a recovery framework and post-disaster plan. Such reports are often used to develop national plans as well as for resource mobilization towards recovery and reconstruction activities. In principle, recovery considerations need to be integrated into humanitarian programme cycles. In the aftermath of disasters, national governments estimate the cost of reconstruction based solely on the value of destroyed physical assets— mostly buildings, roads, bridges, etc. Until a decade ago, little attention was paid to social and human development impacts caused by disasters and the cost of achieving a 'building back better' model of recovery and reconstruction.

The Damage and Loss Assessment (DaLA) methodology first developed by United Nations Economic Commission for Latin America and the Caribbean (UNECLAC) in 1972 – and improved over the years through the assistance of the World Health Organization, the Pan American Health Organization, World Bank, Inter-American Development Bank, the International Labour Organization and the United Nations Educational, Scientific and Cultural Organization – has been used to capture the closest approximation of damage and losses caused by disasters in an affected area. DaLA is founded on a quantitative inventory of 'what' has happened. It is largely based on secondary data from government agencies and requires confirmation and validation through field visits. Since 2001, many cases of disasters in the ASEAN region have been analysed using the UNECLAC methodology. The Global Facility for Disaster Reduction and Recovery, [5] in cooperation with the United Nations System and the European Union, has assisted national governments in estimating disaster impacts and the financial requirements for post-disaster recovery and reconstruction.

5 The Global Facility for Disaster Reduction and Recovery is a global partnership, managed by the World Bank and funded by 25 donor partners, to help high-risk, low-capacity developing countries better understand and reduce their vulnerabilities to natural hazards and adapt to climate change.

In order to address the shortfalls of the DaLA approach to quantitative damage and loss, the Human Recovery Needs Assessment (HRNA) process was developed to assess the perceptions of people and communities in order to better inform recovery and reconstruction efforts. It provides a more qualitative focus to field assessments, considering 'how' recovery can take place based on both perceptions and implications of the damage and losses, and identifies needs related to such activities. The HRNA methodology is designed to obtain direct qualitative feedback from communities and households to understand their immediate recovery needs.

Taken in combination, HRNA and DaLA form the PDNA. Both HRNA and DaLA can provide information on why a disaster occurred and how to avoid a repetition of its devastating impacts, in order to reduce future disaster risk when considering recovery and reconstruction policies and strategies. The UNECLAC DaLA methodology, duly supplemented to cover macro-social as well as personal and household loss estimates, is able to produce an assessment of disaster effects and to estimate post-disaster recovery and reconstruction needs. Furthermore, due to UNECLAC´s unique feature of relying on baseline information available through national accounts, it is feasible to adapt it to the specific social, economic and environmental characteristics of any country.

As a result of a 2008 tripartite agreement between the heads of the European Commission, the World Bank and the United Nations Development Group, [6] the scope of assessments for disaster effects and impacts, and for estimation of the financial requirements for post-disaster recovery and reconstruction, have been agreed upon. Under this arrangement within the Hyogo Framework for Action, joint PDNA tools were created and launched for an objective, comprehensive and government-led assessment of post-disaster damage, losses and recovery needs, to pave the way for a consolidated recovery framework. It is important to note that the sectors typically included in the comprehensive PDNA are decided by the government and always driven by the severity of the disaster's impact on those sectors.

Challenges and opportunities within existing mechanisms

Many countries have their own frameworks and individual methodologies for performing rapid disaster assessment. While the rationale for such assessments often includes the need to earmark and allocate initial funds for recovery and reconstruction, the purpose of such assessments can sometimes go unrecognized by those operating in relevant fields. As a result, disaster assessments are sometimes not standardized across regions within a country. Many agencies may even be unaware that such an assessment is taking place, which can often cause confusion. Based on the collective experience gained over time in conducting PDNAs, many lessons have been learned by ASEAN countries. These include the need to:

- Introduce scientific assessment methods to reduce subjectivity in analysing multisectoral post-disaster effects;
- Provide a quick estimate of damage to mobilize relief and early recovery as soon as possible;
- Have provisions for validation of the assessments;
- Produce an evidence-based assessment in order to foster transparency and trust in financing recovery and reconstruction;
- Have analytical and graphical descriptions of pre- and post-disaster scenarios in order to highlight their effects and impacts.

6 See Joint Declaration on Post-Crisis Assessments and Recovery Planning, signed by the European Commission, the United Nations Development Group and the World Bank, 25 September 2008.

For example, a detailed PDNA process takes months to complete. [7] In conflict-stricken countries, the PDNA process has taken even longer: 6–12 months. Moreover, there are examples of PDNAs that remain incomplete even a year later. In such cases, a rapid disaster assessment is a practical way to address these challenges and ensure a speedy, accurate and evidence-based based scientific assessment.

Evolution of thinking in rapid disaster assessment

Rapid assessment, as adapted from DaLA and other forms of longer-term recovery and reconstruction assessments, has become more asset-based over the years, where damage is calculated based on specific assets within a sector. To be classified as rapid, techniques have been introduced that help to quickly quantify overall damage for different assets. Such techniques are increasingly being integrated with the use of multiple sources of data and information, especially the use of satellite and earth observation data to extrapolate and triangulate estimations. Once such example is the standardized methodological framework for rapid assessment of the agricultural sector, developed by Food and Agriculture Organization of the United Nations (FAO).

This framework is designed to support the process from collection and sharing of relevant global, national and subnational data to calculate damage and losses in the agricultural sector (see figure 6). This framework includes the selection and use of multiple sources of information at different levels, including country-level observation data (e.g. agricultural surveys), earth observation data (e.g. satellite, drone imagery) and data on threshold/stressors (e.g. climatic and environmental indicators), among others. Where primary data is gathered and organized to develop relevant information on the post-disaster situation, a reliable baseline provides robust comparative analysis. The assessment stage consists of methods which are designed to attribute monetary values to damage and losses in each agricultural subsector.

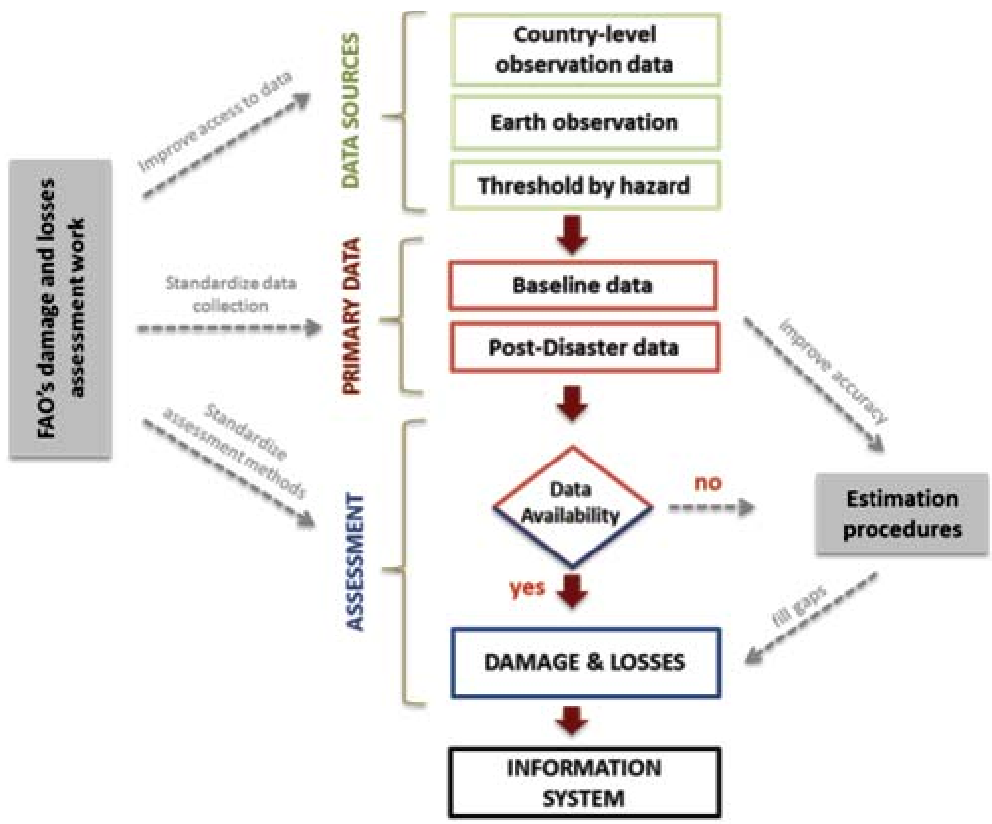

Figure 6: Concept for a standardized methodology and information system for agriculture

Source: Food and Agriculture Organization of the United Nations, 2016 [8]

7 A time frame of 6–14 weeks is considered an ideal duration to complete a PDNA as per the recent PDNA Guidelines developed by the United Nations, European Union and World Bank. However, this is often impractical due to technocratic restraints and other limitations.

8 Stephan Baas and Food and Agriculture Organization of the United Nations, "Impact Of Disasters On Agriculture

Furthermore, UNISDR proposed an aggregate sector-wise assessment methodology to the Open-ended Intergovernmental Expert Working Group - based on research and analysis from DaLA, UNECLAC and PDNA and adapted by UNISDR [9] - through which losses from each sector could be aggregated to provide overall damage and loss estimations (see figure 7). The methodology proposed the conversion of physical damage into economic value using replacement costs to determine direct economic loss.

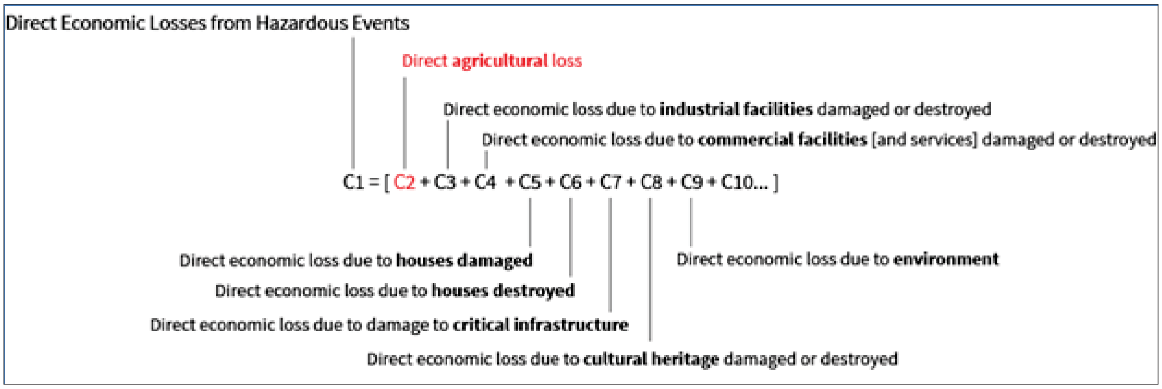

Figure 7: Direct Economic Losses from Hazardous events

It also stated that assets can be either totally or partially damaged. Subsequently, damage, or the cost to repair, can be considered as a ratio of an asset's overall replacement value. Therefore, damage ratio can be used as a proxy value to estimate the dollar value of direct economic losses. This can then be used as a multiplication factor, together with unit quantity to ascertain estimations for loss (see figure 8).

Figure 8: calculations using damage ratio as a proxy value

Source: UNISDR, 2015

Building on this evolution of thinking, from an asset-wise sector-based approach, it is possible to introduce an additional parameter which can potentially increase the precision of damage and loss estimations. This includes impact-based zonal estimations where assets and sectors can also be analysed across high, medium and low impact zones. This would change the proxy values used to assign a dollar value to assets depending on their location, where the damage ratio would be different per impact zone.

And Food Security: Achievements And Challenges", study and report presented at Expert Consultation: Establishing an Information System on Damage and Losses from disasters In Crops, Livestock, Fisheries, Aquaculture and Forestry, Rome, 9–10 June 2016

9 United Nations Office for Disaster Risk Reduction, Concept note on Methodology to Estimate Direct Economic Losses from Hazardous Events to Measure the Achievement of Target C of the Sendai Framework for Disaster Risk Reduction: A Technical Review (11 November 2015).

UN Photo/Mark Garten

Augmented data sets

Augmenting data and technology innovations

Decisions related to emergency relief, recovery and reconstruction are made at high levels of political leadership that require rapid assessments to obtain financial support quickly. Immediate relief provisions are critical and delays in such decisions have not only economic but also huge social and human consequences. A rapid damage and loss assessment using innovative technologies within a short time frame can provide a much-needed shift in response and recovery efforts, while simultaneously providing a substantial information base for PDNA processes.

While an enormous amount of data is generated across all sectors, in line with big data initiatives and as part of the data revolution, much of this data is often not used, as challenges remain in understanding and applying that data to relevant areas of concern. Therefore, in order to better understand the possibilities of data application, it is important to first consolidate existing and novel data sources into an augmented data set. This essentially requires a change of mindset in how data is perceived, taking a 'reverse-engineering' approach where key decisions are broken down into their information segments – i.e. what information is or was required to make a certain decision – and then the information segments dissected into the data sources: i.e. data which is or was necessary to compile those information segments. Through this approach, it is possible to fuse data sources into a dynamic and augmented data set necessary for evidence-based decision-making. Figure 9 illustrates a typical augmented data set necessary for rapid assessment using innovative tools and technologies.

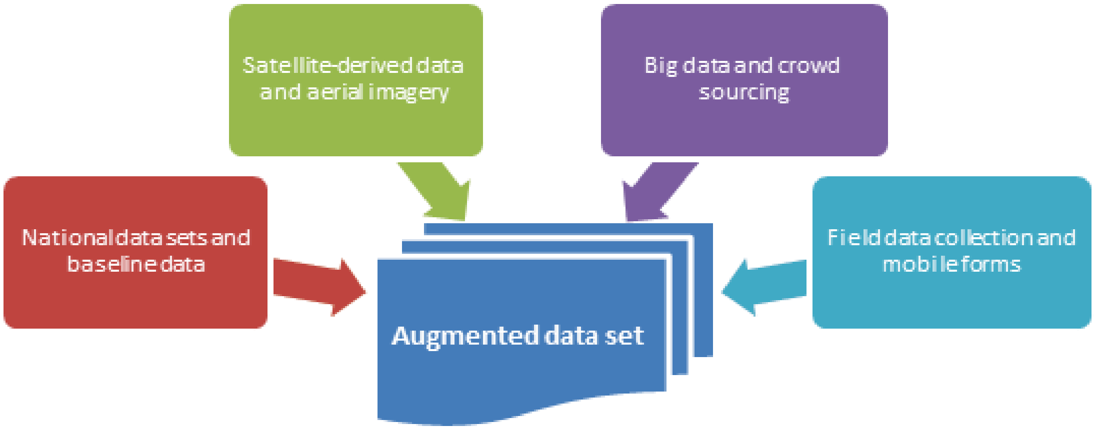

Figure 9: Developing an augmented data set from a variety of data sources

Augmented data as an evidence base

Disaster impact assessment supported by technology and evidence-based assessment facilitates faster and more accurate decision-making (see figure 10). It enables governments to immediately plan, take decisions and act upon them by allocating financial and administrative support for recovery and reconstruction more quickly. Swift action with the highest possible accuracy is the key purpose. It is therefore critical that the estimate of post-disaster damage is made in an objective and reliable manner with evidence-based quantitative information that results in a quick response and kick-starts timely recovery.

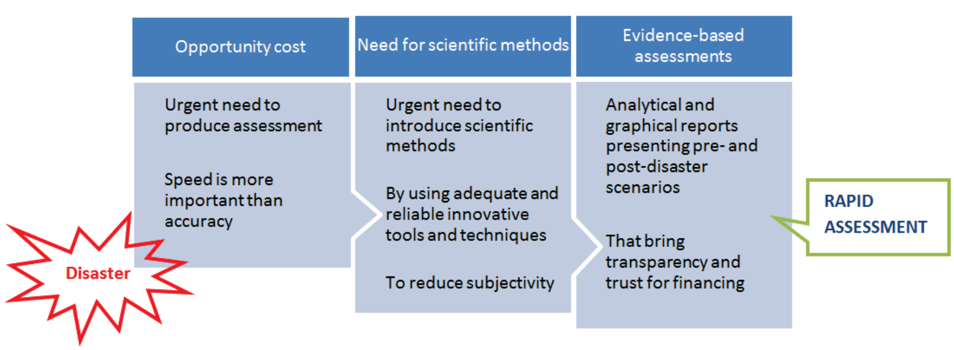

Figure 10: Technology needs for rapid assessment

In the case of emergencies, it is crucial to identify and determine the most pressing recovery needs in the most-affected areas, such as emergency shelter, food and livelihood support. Having access to information through technologies such as crowdsourcing can display the extent and magnitude of damage (classified as high, medium and low) in disaster-hit areas, providing a solid foundation for targeted, effective response and recovery efforts to begin. While a detailed PDNA is important, producing just-in-time damage and needs assessments using geospatial products adds greater value to the recovery process. A detailed PDNA generally takes months, followed by a year or more to start recovery and reconstruction (see figure 11).

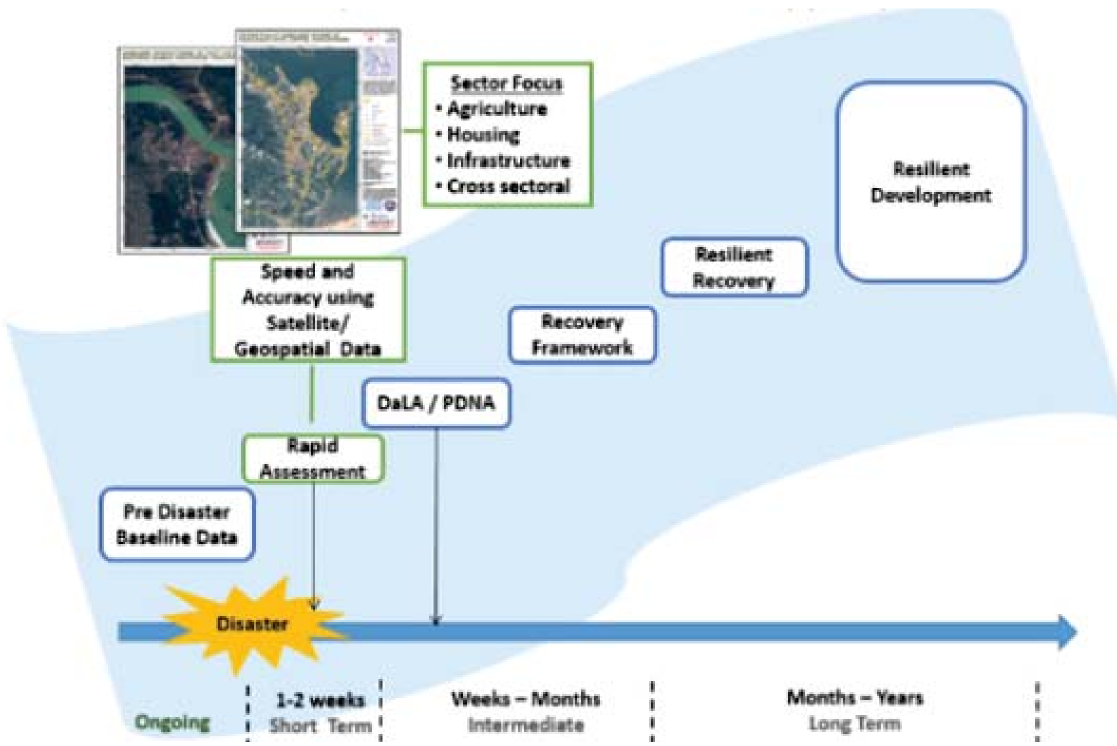

Figure 11: Position of rapid assessment in recovery timeline

Geospatial information systems and satellite imagery have massive potential and hold the key to developing new methods, tools and modules of rapid assessment. Obtaining timely, relevant and accurate information on geographic locations is extremely advantageous in seeing the extent of areas affected by a natural disaster (including preliminary estimates of damage). The use of satellite imagery can be a very cost-effective way to collect disaster damage information. Often satellite imagery is the only source of synoptic information available within remote and less-developed areas in the immediate aftermath of a disaster. The process of rapid assessment must include an analysis of exposed assets based on baseline information. This should be combined with near real-time information showing changes from this baseline based on user-driven damage extent maps while grading the damage and spatial distribution, which will then facilitate sectoral and asset impact assessments.

ASEAN countries have the opportunity to make the best of their institutional and organizational ties and take advantage of the experience and expertise of other ASEAN members. Such collaboration based on the use of technologies for rapid assessment of damage and loss would help foster greater resilience in recovery and reconstruction activities.

Data and technology innovations to fuse into an augmented data set

National data sets and baseline data

The key to determining the overall impact of a disaster across all sectors such as agriculture, housing, infrastructures, etc. is availability of reliable updated baseline information across all sectors. Pre-disaster baseline information includes national, socioeconomic, demographic and geographical data relevant to the affected areas, including development indicators such as literacy rates; malnutrition and food insecurity; poverty levels; access to potable water and sanitation facilities; education facilities and school enrolment; and the incidence of communicable diseases, among others. Hazards are location-based, and to correctly evaluate the impact of hazards it is necessary to maintain and integrate national baselines in geospatial formats (table 1).

Demographic, housing and agricultural censuses can be easily integrated with administrative boundaries and converted into geospatial data sets. Different sectoral agencies as well as city authorities also maintain housing, road, lifeline and critical facilities data in various formats. For uniformity and homogeneity, it is imperative to have national standards for managing and sharing relevant data with the actors involved in damage and loss evaluation. Data-collection aggregation must be done in the preparedness phase, because during the disaster there will be very little time to carry out stocktaking and clean-up of baseline data sets.

Table 1: List of typical sources for national baseline data sets

Thematic baseline	Typical source	Typical format	Transforming into geodata
Demographic	National census, Bureau of Statistics	Tabular	Link to administrative zones
Poverty	The Demographic and Health Surveys (DHS), national census	Tabular, Geographic Information Systems (GIS)	Link to administrative zones
Housing census	National census, Bureau of Statistics	Tabular	Link to administrative zones
Agricultural census	National census, Bureau of Statistics	Tabular	Link to administrative zones
Topographic survey, ordnance survey	National census, Bureau of Statistics, city authority, national mapping agency	Tabular, GIS	Already in GIS format
Transportation network	Road and highways authority	Tabular, GIS	Already in GIS format

Box 3: National Geospatial Baseline Data for Tonga

ESCAP, through the project 'Strengthening multi-hazard risk assessment and early warning systems with applications of space and GIS in Pacific island countries', provided technical and analytical support for Pacific island countries to collect and use geospatial data for more effective disaster risk management. Figures 12 and 13 are from the geoportal of the Tonga National Emergency Management Office, which was developed during the project and hosts and maintains national baseline data in geospatial formats.

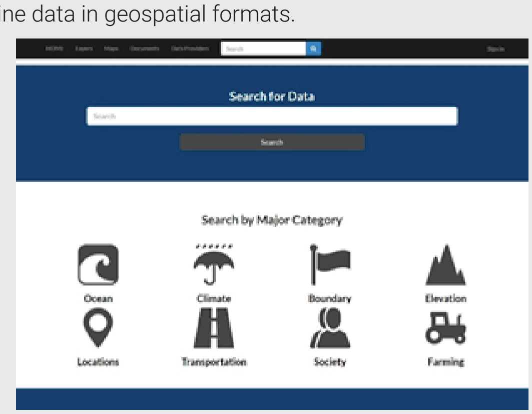

Figure 12: Geoportal of the Tonga National Emergency Management Office (Baseline Data)

Source: Tonga National Emergency National Office (NEMO)

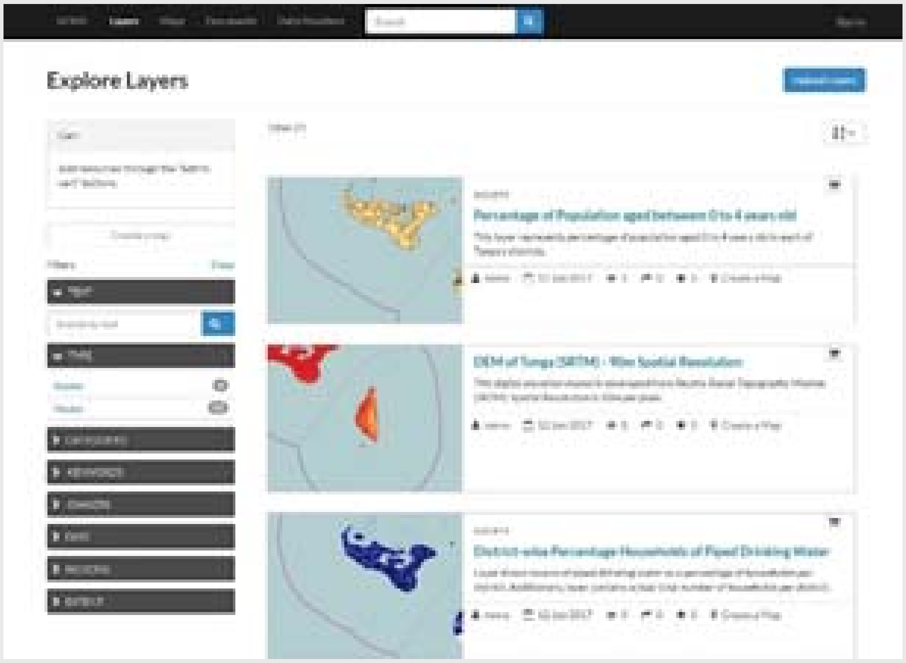

Figure 13: Geoportal of the Tonga National Emergency Management Office (Data Access)

Source: Tonga National Emergency Management Office (NEMO)

Earth observation

The early stages of disaster are characterized by limited, incomplete and contradictory information, so operational uncertainty is highest during the response stage. This scarcity of data seriously hampers any emergency response or early recovery operations and imparts greater uncertainty to the initial estimates of disaster losses. With modern technological advancement, easily accessible geospatial information generated from satellite-based information can help create evidence-based situational awareness for better decision-making. Using geospatial baseline and satellite images, it is possible to analyse the extent of damage and also provide preliminary exposure analysis.

With more and more earth observation satellites in orbit, use of satellite imagery is becoming the norm rather than exception for rapid monitoring of disaster-affected zones. Using freely available low-to-medium resolution optical, radar satellite imagery, it is possible to detect inundations caused by flooding for large regions. It is possible to monitor flooding irrespective of cloud conditions, especially with free access to Sentinel 1 radar satellite imagery. On the other hand, using very high-resolution satellite images it is possible to identify building and infrastructure damage rapidly. These images are also available free of cost through the International Charter on Space and Major Disasters and regional mechanisms such as the ESCAP RESAP network.

Box 4: Flooding in Bangladesh, 2017

Figure 14 illustrates satellite-detected surface water extent in the central and northern parts of Bangladesh using a Sentinel-1 satellite image. The total analysed area is about 4,284,431 ha. In this analysed area, 1,099,369 ha (39 per cent) of the land is likely affected. These areas are mainly cropland, irrigated and rain-fed lands and are estimated at 1,039,350 ha. The population exposure analysis using WorldPop data shows that ~10,000,000 people are potentially affected by floods in the analysed zone: ~5,400,000 are located in Dhaka Division and ~2,750,000 in Rajshahi Division.

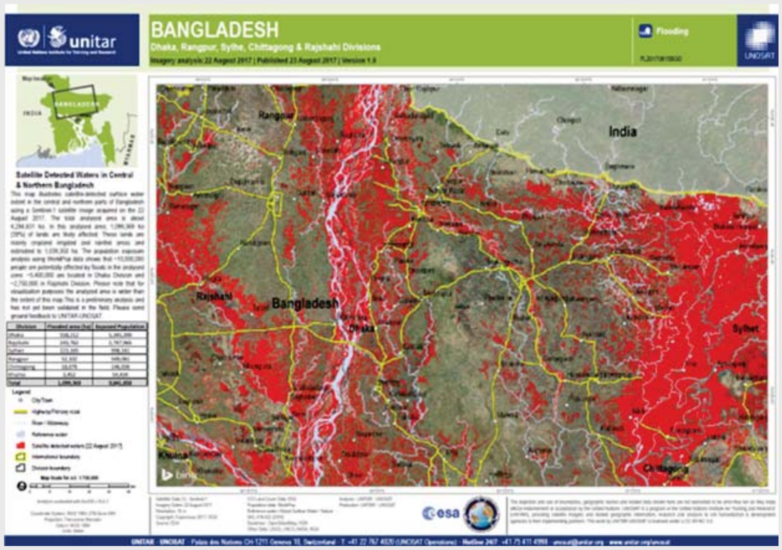

Figure 14: Flood inundation mapping using radar imagery, UNITAR-UNOSAT, Bangladesh 2017,

Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Box 5: Hurricane Maria, Dominica, 2017

Figure 15 illustrates potentially damaged structures and buildings in Marigot (Saint Andrew Parish), as detected by satellite images acquired after the landfall of Tropical Cyclone Maria. UNITAR-UNOSAT analysis identified 1,345 potentially damaged structures. Taking into account the pre-disaster building footprints provided by Humanitarian OpenStreetMap, this represents about 83 per cent of the total number of structures within the analysed area.

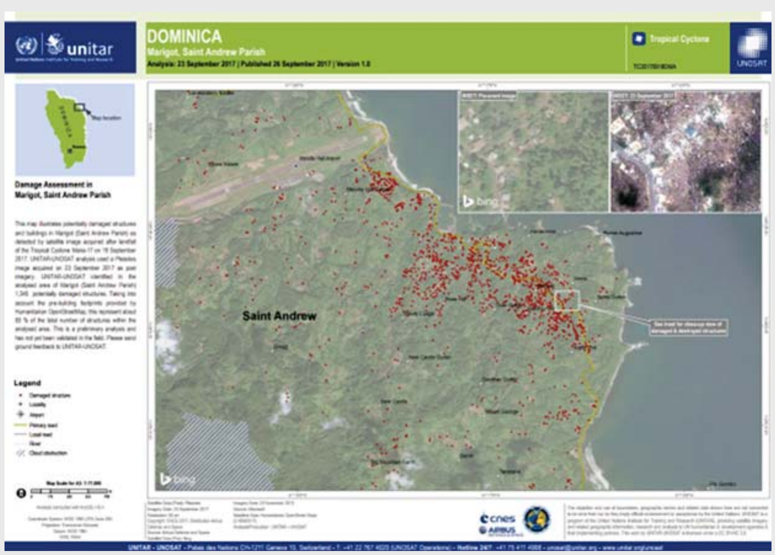

Figure 15: Comparing pre- and post-disaster very high-resolution satellite imagery to detect damage to housing, Cyclone Maria-17, Dominica, 23 September 2017, UNITAR-UNOSAT

Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Unmanned aerial vehicles

The rapid development of unmanned aerial vehicle (UAV) technology has enabled greater use of drones as imaging platforms to complement the visuals produced by satellites and manned aircraft. Drones have the advantage of being small, low-cost and able to observe with much higher detail compared with satellite imagery (see figure 16). Damaged areas sometimes cannot be seen by satellites and manned aircraft, for example due to cloud cover, or may be inaccessible for first-hand human inspection due to contamination or physical blockages after a disaster. Drones can also survey objects from the side rather than just from above and can facilitate 3D reconstruction of an environment using stereoscopic cameras. [10] These are valuable inputs for accurate damage assessment even for inaccessible areas. However, due to poor public perception of UAV safety in recent years, the use of UAVs is currently fraught with legal and regulatory challenges. Initiatives like the Humanitarian UAV Network and OpenAerialMap not only promote safe use of UAVs but also provide free imagery and on-request aerial survey missions.

Figure 16: 3D Model by UAV observation for damage diagnosis, Gorkha earthquake, Nepal, 2015

Source: https://irevolutions.org/

10 Swiss Re, Natural catastrophes and man-made disasters in 2015: Asia suffers substantial losses (2016).

Box 6: Example of UAViators

UAViators is a humanitarian UAV network that has close to 3,000 members in 120+ countries. Its mission is to promote the safe, coordinated and effective use of UAVs for data collection and cargo delivery in a wide range of humanitarian and development settings. With a roster of 500+ UAV pilots in 70+ countries, it can mobilize at the request of established aid and development partners during humanitarian situations.

Figure 17: Crisis Mapping Location as shown in http://uaviators.org

Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Big data and crowdsourcing

Geospatial information

Use of satellite imagery and location-based information can provide greater insight about the exposure and localization of disaster impact. Different initiatives such as Humanitarian Data Exchange, WorldPop and Global Urban Footprint already maintain different, freely available sets of secondary data related to demographics, administrative boundaries, transportation networks, critical facilities and building footprints in GIS-ready format (table 2). These can fill the gaps in national baselines and can also be used to generate localized impacts from disasters.

Table 2: Freely available geospatial data sources

Data source	Description	Data type	Access	Provider
WorldPop	Estimates of numbers of people residing in each 100x100m grid cell for every low and middle-income country	GIS raster	Free www.worldpop.org.uk/	WorldPop
Humanitarian Data Exchange	Common Operational Data Set and Fundamental Operational Data Set for over 200 countries and territories	GIS vector	Free https://data.humdata.org/	OCHA
GAR 2015	Past hazardous events, human and economic hazard exposure, and risk from natural hazards	GIS raster vector	Free http://risk.preventionweb.net	UNISDR
Global Urban Footprint	Worldwide map of settlements with unprecedented spatial resolution of 0.4 arcsec (~12 m)	GIS raster	Free through Urban-TEP https://urban-tep.eo.esa.int/	German Aerospace Centre
UNOSAT Rapid Mapping	Disaster extent, sectoral impacts, damage analysis	GIS-ready data	Free www.unitar.org/unosat/maps	UNOSAT
European Space Agency Climate Change Initiative	Annual global land cover mapping at 300m and characterization for climate modelling	GIS raster	Free with registration www.esa-landcover-cci.org/	European Space Agency

Crowdsourcing

Collaborative mapping, social networking and crowdsourcing are fast evolving and interconnected domains of development where changes are rapid and innovation continues to occur. Easier access to the Internet and peoples' collective effort in assisting the distressed has proven to be a powerful resource for generating a huge amount of contextual information quickly through analysis of satellite images or collecting field data.

Box 7: Gorkha Earthquake, Nepal, 2015

The 2015 Nepal earthquake struck on 25 April with a magnitude of 7.8, followed by aftershocks including a magnitude 7.3 quake on 12 May. The epicentre of the initial earthquake struck was to the northwest of Kathmandu and aftershocks occurred around the city of Kathmandu. The later 7.3 earthquake struck to the northeast of Kathmandu towards Mount Everest and affected regions in southern China. The quakes killed at least 8,000 people and left many in desperate need of shelter, medical help, food and other aid. More than 4,300 volunteers from the Humanitarian OpenStreetMap Team and Kathmandu Living Labs made 86,000 edits to the map in figure 9, adding up to 30,000 roads and 240,000 buildings, providing invaluable insight into the disaster damage and humanitarian needs.

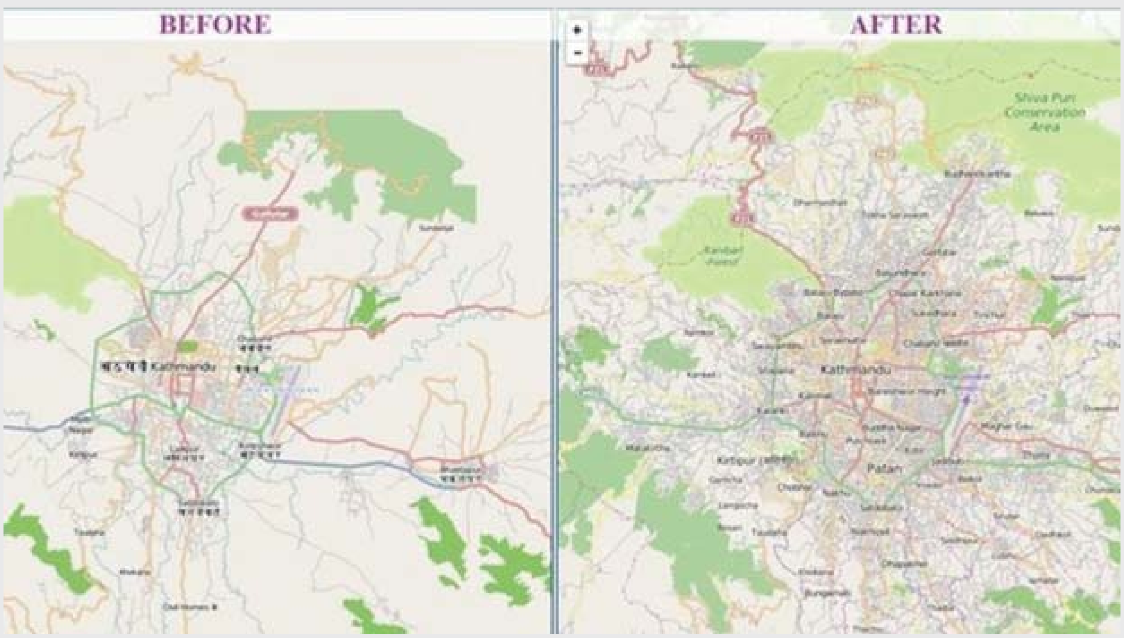

Figure 18: Kathmandu and nearby areas before and after mapping efforts were ramped up

Source: www.bbc.com/news/world-asia-32603870,
http://wiki.openstreetmap.org/wiki/2015_Nepal_earthquake

Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

- **Humanitarian OpenStreetMap Team** - when a major disaster strikes anywhere in the world, the Humanitarian OpenStreetMap Team rallies a huge network of volunteers to create, online, maps that enable responders to reach those in need. Many of the poorest and most vulnerable places in the world do not exist on any map. To date over 3,500 Missing Maps volunteers have collectively made 12 million edits to OpenStreetMap and put 7.5 million people on the map.

- **Tomnod** - uses the power of crowdsourcing to identify objects and places in satellite images. Millions of volunteers use Tomnod to explore satellite images of the Earth and solve real-world problems. Tomnod is part of DigitalGlobe, the world's leading provider of commercial satellite imagery.

Field data collection and mobile forms

Pocket-sized smartphones can capture a wide range of data – including audio, video, camera, text and forms with geolocation – making them incredibly versatile and removing the need to carry lots of expensive, specialist equipment. Modern data-collection tools yield better quality data and provide real-time and direct integration with a central database. Many of these data collection tools are provided free of charge by KoBoToolbox, the United Nations Adaptive System for Image Communication over Global Networks (UN-ASIGN), EpiCollect and Open Data Kit (ODK).

Box 8: UN-ASIGN

UN-ASIGN Crowd is a free application offered by UNOSAT to the humanitarian community to facilitate the collection of photos, assessments and geo-located text messaging in the field. It is specifically designed to work over low bandwidth connections, reducing bandwidth consumption by close to 90 per cent. Custom forms can be designed to collect required information very rapidly without the need for paper forms and expensive global positioning system devices.

In the aftermath of Lao flooding in 2017, the World Food Programme country team used the UN-ASIGN mobile application to take geo-referenced photos to validate satellite observations and collect first-hand information on food security. The UNITAR-UNOSAT team developed a UNOSAT LIVE map to support the response efforts in the country and with the aim of supporting real-time monitoring of field assessments undertaken by the World Food Programme. The joint rapid flood assessments were undertaken in Borikhamxay, Oudomxay and Xayabury Provinces, which demonstrated a holistic approach of combining remote sensing and ground observation to develop a reliable operational picture.

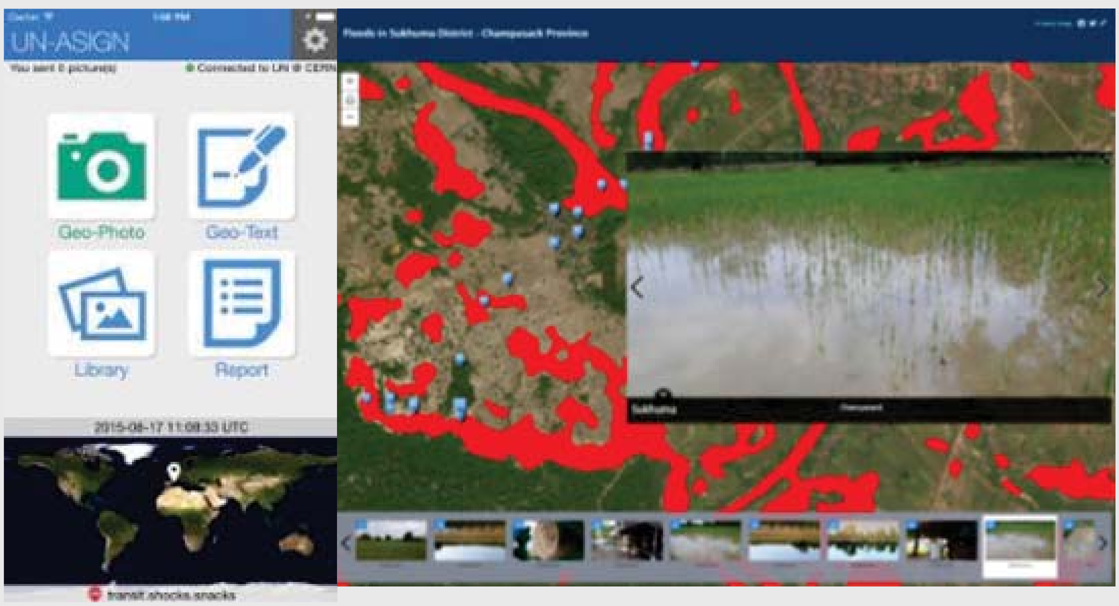

Figure 19: UN-ASIGN Data Collection, Lao People's Democratic Republic flooding 2017

Source: https://www.unitar.org/un-asign-free-crowdsourcing-application-application-support-emergency-responses-and-disaster-risk-re

Rapid assessment innovation framework

While it is important that all sectors be assessed for comprehensive recovery and reconstruction needs, only critical sectors such as agriculture, housing, infrastructure and cross-cutting sectors are considered in rapid damage and needs assessment. This section outlines the methodology for rapid assessment innovation, including variables which need to be determined and the corresponding calculations needed to determine recovery and reconstruction costs. A Rapid Assessment Innovation Framework (RAIF) is also introduced which covers how the methodology fits into existing procedures for damage assessment, as well as the responsible authorities and teams who would play a part in the overall rapid assessment innovation methodology.

Methodology for rapid assessment innovation

The methodology below is for asset and impact-based recovery and reconstruction estimates. It has been developed based on emerging methodologies in asset damage and loss estimation, and advocated by the FAO with regard to using earth observation data to fill data gaps for the agriculture sector, and UNISDR and the Open-ended Intergovernmental Expert Working Group, with regard to the use of damage ratios and a sector approach. Through consultations with the AHA Centre and experts in rapid assessment in the ASEAN region, ESCAP has adapted this methodology to extend across other critical sectors, incorporate the use of innovative data and information, and introduce impact zonation in order to improve the accuracy of estimates. Table 3 outlines the variables identified in this methodology and their corresponding elements of information that need to be aggregated for rapid assessment innovation calculations.

Table 3: Variables to determine for RAIF calculations

Element	Description	Possible source of information
An =	**Asset n** (where there can be many assets per sector and each asset can have a different purpose i.e. as a stand-alone asset, for consumption or production)	Select priority assets based on an assessment mandate and preliminary findings
Zi =	Impact **zone i** (of three impact zones including **high**/**medium**/**low**)	From satellite-based earth observation, aerial imagery and other preliminary assessments of damage extent
VAn =	Unit **value** of the asset **An** (which can vary for one asset depending on the purpose of the asset)	Sectoral census and other commodity price indices
QAnzi =	**Quantity** of the asset **An** in each impact zone **Zi**	Based on baseline data overlayed with impact zone maps
RAnzi =	Damage **ratio** of the asset **An** in each impact zone **Zi**	Combination of field data collection, aerial imagery and earth observation
Sn =	**Sector n** of three priority sectors including: Infrastructure, Housing, Agriculture	Select the depth of sectoral assessments based on assessment mandate and preliminary findings
RRC =	Recovery and Reconstruction Costs	Calculated as below based on the above aggregated information

Description of each variable

A = Asset classification based on type (by sector)
Examples of assets for each sector have been identified in the next chapter of this handbook. Depending on time and funding priorities, it may be necessary to prioritize assets for each sector, based on an identified assessment definition mandate or equivalent national or sectoral prioritization framework or preliminary impact assessments. By grouping assets and performing asset assessment, it is possible to place a dollar value on recovery and reconstruction costs of assets for a particular sector within a specific impact zone to provide average estimates. Assets can refer to both stand-alone assets, assets for consumption and assets that contribute to the production of income.

Z = Impact zone classification (High, Medium, Low)
Impact zone definitions are a preparatory step for RAIF assessment. During this process, damage assessment experts can divide entire areas that have been impacted by disasters into different categories (high, medium or low). This will allow the application of ratios of damage for each asset type within a sector for the specific impact zone. To perform the classification, experts can use the latest satellite-based damage impact maps and preliminary damage reports from various reliable sources. A damage zonation approach enables the most representative damage ratio for each zone instead of a gross ratio, making the overall statistics more robust and allowing for further zonal statistics as part of analysis.

V = Unit value to repair, rebuild or replace an identified asset by province or country ($ value)
Unit value or price can be obtained from sectoral censuses or market research. Ideally these prices must be collected and updated regularly. The values for sectoral assets, identified during the assessment mandate definition, can be verified and updated during the field mission phase of rapid assessment. The unit value will vary depending on the purpose of

an asset. For example, the value of stand-alone assets will be different from that of assets for consumption or assets which contribute towards the production of income. Unit value will thus need to be determined based on asset purpose, which can be identified during field data collection.

Q = Quantity of assets in each classified damage zone
The numbers of assets is usually extracted from national census databases. However, census data are aggregated to administrative level and exposure is sporadic or concentrated on specific areas within an administrative boundary. Also, in many cases censuses are updated every 5-10 years, which may render uncertainty in generating statistics if the data is outdated. However, fusing the national census data sets with other sources of geospatial data such as WorldPop demographics, Global Urban Footprint, European Space Agency Climate Change Initiative land cover data sets, etc. can complement and improve the location elements of sectoral baselines. Data for quantity of assets can also be collected during field assessments and extrapolated based on factors such as size of house, area of land and other units to provide a general multiplication factor to determine quantity per unit. The determination of quantity will depend on the purpose of assets, i.e. stand-alone assets, assets for consumption or assets that produce income, which will in turn effect the unit value (V).

R = percentage of damage as a ratio per asset per damage zone
Field assessment must be designed to have statistically valid samples (30) for each impact zone. Once data is collected using smartphone-based forms, it is automatically aggregated in a tabular format. Using the field data, statistical models can be established to identify an asset mean damage ratio and standard deviation to account for the variability. This will allow damage ratios to be attributed to each asset type within a specific impact zone per sector.

How to aggregate variables in order to calculate recovery and reconstruction costs

Taking the variables described in the above section, it is now possible to calculate recovery and reconstruction costs. These must be aggregated according to each asset type, each sector and then as a whole, for all identified sectors. Table 4 outlines the necessary calculations to determine recovery and reconstruction costs.

Table 4: RAIF calculations to determine recovery and reconstruction costs

Aggregation level	Aggregation framework for calculating recovery and reconstruction costs (RRC) e.g.	Notes
Per asset per sector	RRCS1A1 = (**QA1,Zhigh x VA1 x RA1Zhigh**) + (**QA1Zmedium x VA1 x RA1Zmedium**) + (**QA1Zlow x VA1 x RA1Zlow**) RRCS1A2 = (**QA2,Zhigh x VA2 x RA2Zhigh**) + (**QA2Zmedium x VA2 x RA2Zmedium**) + (**QA2Zlow x VA2 x RA2Zlow**) **…** RRCS1An = (**QAnZhigh x VAn x RAnZhigh**) + (**QAnZmedium x VAn x RAnZmedium**) + (**QAnZlow x VAn x RAnZlow**)	Impact zones = (**high**/**medium**/**low**)
Per sector	RRCS1 = RRCS1A1 + RRCS1A2 + RRCS1A3 + …RRCS1An RRCS2 = RRCS2A1 + RRCS2A2 + RRCS2A3 + …RRCS2An RRCS3 = RRCS13A1 + RRCS3A2 + RRCS3A3 + …RRCS3An	For three sectors = Infrastructure Housing Agriculture
Total	RRC = RRCS1 + RRCS2 + RRCS3	

Putting this methodology into practice can be somewhat difficult and tedious, as it requires a systematic review of all key assets in each sector. In order to make this process as rapid a possible, while still covering critical asset groups and sectors, it is necessary to prioritize assets within a sector and only select those that are relevant for the assessment and identify those that have short-term and long-term recovery and reconstruction characteristics. Figure 20 provides an example of the variables identified for the housing sector and concrete building asset type.

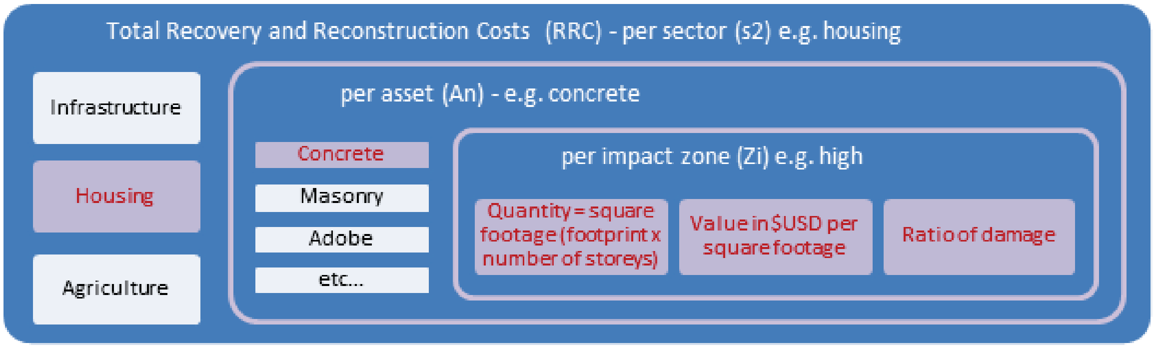

Figure 20: Example of variables for the housing sector and concrete building asset type

UN Photo/Nugroho Nurdikiawan Sunjoyo

Procedures for a rapid assessment innovation framework

The proposed rapid assessment innovation methodology falls within an overall framework which requires aggregation and valuation of different variables such as quantity of assets, damage ratio, impact zonation, etc. to be collected and calculated at different stages of the disaster cycle. Taking a phased approach, it is possible to ensure that relevant variables are collected during the most appropriate phase of the disaster.

The overall procedures are broadly divided into pre-disaster, predeployment, staging and field, post-deployment and early recovery phases, which mimic the traditional phases used within ASEAN institutions and the broader international disaster assessment community, where pre-disaster is considered as a normal operating time in which preparedness activities can take place, while the other phases are event-triggered phases, which each have their own objective-driven processes.

To effectively carry out different activities for each process of RAIF, a focused, specialized and cross-sectoral team has to formed which also includes sectoral experts for infrastructure, housing and agriculture (see figure 21). The focused team should consist of a Rapid Assessment Manager (RAM) being supported by a specialized Statistical Analysis Team (SAT) and a cross-sectoral Field Assessment and Data-collection Team (FACT). The overall team would ideally be mandated and coordinated by an NDMA, which would also be responsible for appointing the RAM, or agency acting as manager. The RAM, on behalf of an NDMA, would coordinate the relevant rapid assessment innovation activities.

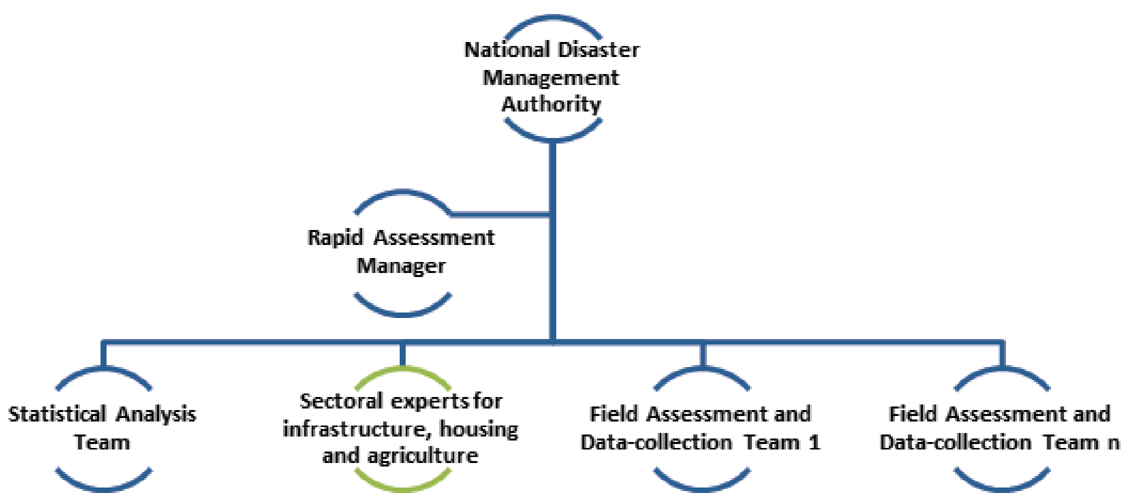

Figure 21: RAIF team formation

Pre-disaster (during normal operations)

The efficiency and effectivity of RAIF largely depends on the assessment preparedness. Unless all the baseline data are collected and sufficient capacities are developed for rapid assessment innovation prior to a disaster, it will be highly challenging to collect necessary information and transform it into the statistics and figures supporting early recovery.

Under the leadership of NDMAs or a regional disaster management institution such as the AHA Centre, there is a need to establish some form of Rapid Assessment Working Group, with members from different line ministries within the national disaster management framework. Based on recommendations by such a working group, the following activities can be carried out:

- Collection and maintenance of baseline data, socioeconomic indicators and sector-specific reference data on local markets and economic value of assets, ideally through national data portals or by setting up national geoportals where they do not exist.
- Identify and subscribe to expert agencies working on earth observation and rapid damage analysis using satellite and UAV imagery.
- Customize the rapid assessment innovation methodology to the country context and relevant actors, for example, with reference to the ASEAN Joint Disaster Response Plan.
- Formation of a roster of experts to compose RAIF teams, including the NDMA, RAM, FACT, SAT and sectoral experts.
- Capacity development of the SAT on calculating statistics necessary for RAIF using geospatial techniques.
- Simulation of disaster scenarios using RAIF to prepare or to improve the methodology within the country context.
- The development of mobile forms for data and information capturing which include the minimum set of key and strategic data points that can be easily adapted for each disaster context.

The swim lane matrix in figure 22 shows how the rapid assessment innovation methodology fits into existing procedures to form an overall RAIF. It further highlights the different levels of data collection and aggregation necessary at each phase and the teams responsible during those phases. It outlines the steps and procedures necessary to formulate a recovery framework through RAIF, where the lettered variables (already outlined in the previous methodology section) include:

- A = Asset classification based on type by sector (where n is differentiated by different types of assets)
- Z = Impact zone classification (where i is differentiated as High, Medium, Low)
- V = Unit value to repair, rebuild or replace an identified asset by province or country ($ value)
- Q = Quantity of assets in each classified damage zone
- R = percentage of damage as a ratio per asset type per damage zone.

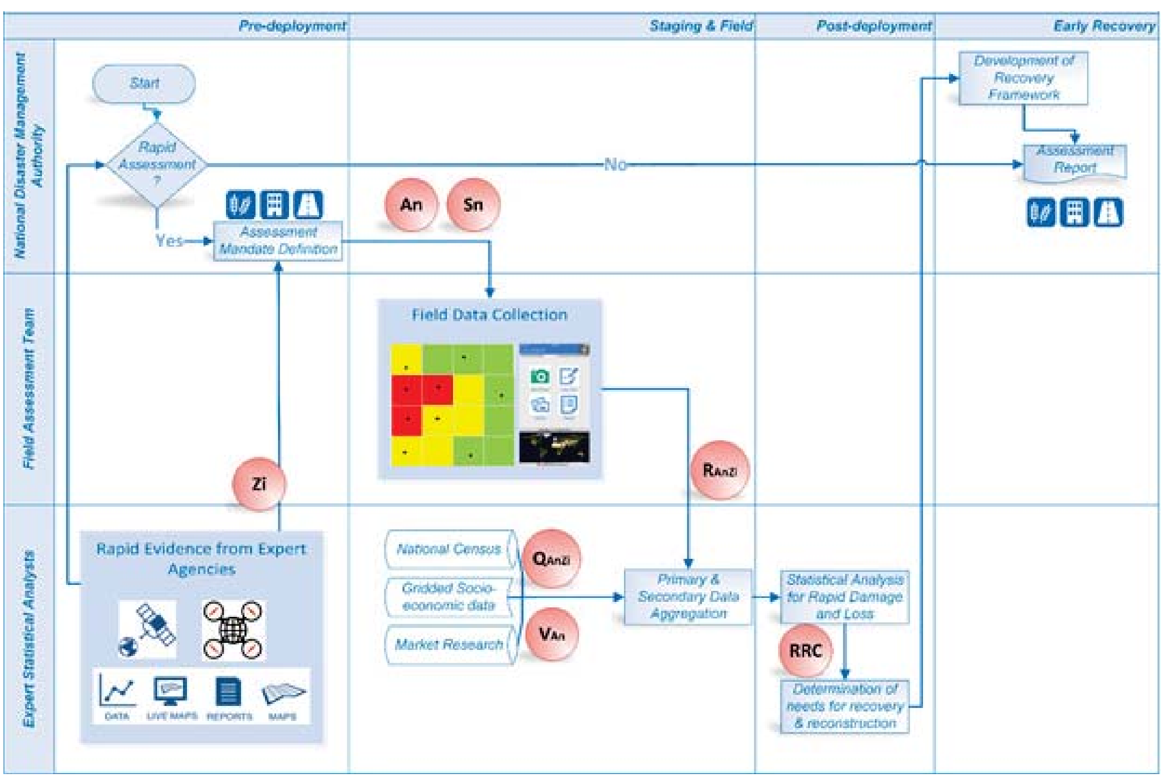

Figure 22: The RAIF developed by ESCAP

Predeployment

During the predeployment phase, there is a need to determine if rapid assessment is required, depending on evidence-based information on the scale and impact of the disaster as well as the coping capacity of the disaster-affected country. Activities to be carried out further by each team within RAIF have been outlined below, including the role of sectoral experts supporting those teams. Key outputs during this phase include evidence from expert agencies, a decision on whether RAIF is required and an assessment definition mandate outlining the scope and focus of RAIF as well as assigning a RAM if RAIF is necessary.

NDMA

During this phase, NDMAs are largely responsible for reviewing existing disaster situation reports to determine the scale of the disaster. They also need to check national disaster management directives to ensure that necessary protocols are triggered and put into motion. This can include sending activation requests to specialized international and national expert agencies for satellite-based rapid impact assessment as well as, for example, cross-referencing and seeking guidance from the ASEAN Emergency Response Action Plan. Based on this evidence and information provided from preliminary impact assessments, the NDMA would need to determine if RAIF is necessary on a case-by-case basis. If RAIF is necessary then the NDMA would also need to consult with relevant line ministries to develop an assessment definition mandate covering the legitimacy, scope and limitation of authority, purpose and processes of the mission and ensuring the use of results (Assets – An, Sectors – Sn).

The assessment definition mandate can also include the identification of priority sectors as well as the identification and prioritization of assets within each sector. Sectoral experts can provide further guidance on which assets to focus on for an effective rapid assessment. Preliminary impact analysis can also provide definition and identification of impact damage zones to be classified as high, medium or low areas of damage. At this stage, the NDMA should assign a RAM who would form the assessment team from an existing pool of experts defined during the preparedness phase. The RAM would coordinate assessment team members and convey the preparatory brief from the assessment definition mandate and identify locations and durations of deployment for FACTs with the support of the SAT.

SAT

The SAT would be required to review satellite-based impact assessments to define and identify high, medium and low areas of damage (Zi), and define data-collection standards and sampling techniques. It may also be possible to collect and aggregate existing baseline information (Quantity – Q, Value – V) during this phase in order to inform the assessment definition mandate and to identify missing data and values for Q and V that need to be gathered from the field as primary data. Sectoral experts can provide guidance on where to obtain such market data. Once this has been identified, the team can begin to design smartphone-based data-collection forms (using KoBoToolbox, UN-ASIGN and OpenDataKit, as highlighted in the previous chapter) for each priority sector. In order to save time, the team can also set up live field data-collection monitoring dashboards using real-time maps and develop an assessment plan for statistical (stratified) sampling based on high, medium and low areas of damage that can guide the FACT.

FACT

Upon receiving the directive of a RAIF deployment from NDMAs, the FACT can begin activation. Activities to be carried out during this phase can include installing and testing necessary data-collection applications and online and mobile forms. Furthermore, FACTs can review the brief from the RAM and prepare necessary logistical arrangements as defined in the assessment definition mandate. The FACT can work with the SAT to identify Q and V values that may be missing and require further samples from the field as well as begin making plans on how they will verify Q and V values through field validation by taking samples from different damage impact zones (Z) in order to support extrapolation of the results by the SAT and according to identified baseline multipliers. Sectoral experts can provide further guidance on sampling for specific sectors.

Staging and field

During the staging and field phase, data and information needs to be gathered from various sources for all assets (An) and sectors (Sn), in order to determine the damage ratio (R) as well as the quantity (Q) and value (V) of damaged assets. This can be done through field data collection and data from national censuses, gridded socioeconomic data and market research. Key outputs during this phase include the aggregation of primary and secondary data to inform statistical analysis in the subsequent phase. Guidelines on field deployments and data collection can be used during this phase, including, for example, the ASEAN-ERAT guidelines.

NDMA

During this phase, NDMAs can provide logistical support to the FACTs, in terms of access to, and movement across, disaster-affected areas or comparable areas for the purposes of market research. This is possible through monitoring and guiding field assessment missions and can be enhanced using live web maps, live feeds and real-time communication. The NDMA can also review the initial assessment plan, making any necessary changes depending on updated satellite imagery and maps on hazard extent and impact assessment. This can inform guidance and provide specific briefs to the assessment teams covering necessary software, forms, mission plans and a preferred sampling strategy and technique. These decisions can also be supported by sectoral experts who can advise on prioritizing strategic data points to gather during this process. The RAM is expected to coordinate all activities and teams during this phase and address any challenges which may arise during data collection and research.

SAT

The SAT is responsible for aggregating primary and secondary data in order to determine damage ratio (R), quantity (Q) and value (V) of damaged assets for each sector. A damage ratio (R) needs to be attributed to each asset type within each impact zone, which can be developed through statistical models taking mean damage ratio and standard deviation to account for the variability. Value (V) can be determined through market research; for example, using existing commodity price indices for average retail or wholesale prices as well as through market data obtained by the FACT to validate market research from different impact areas or comparable areas, and obtain average unit pricing for assets. The value (V) of assets will also vary depending on the purpose of the asset, such as stand-alone assets, assets for consumption and assets that generate income, which may affect production losses. Using visual interpretation, change detection and other geospatial overlay techniques, the SAT can also prepare quantity (Q) by overlaying impact extent maps with baseline data taken for assets within each sector, for example:

1. Infrastructure – to identify damage to critical infrastructure, public infrastructure and commercial/economic infrastructure, baseline GIS data on infrastructure – i.e. roads, bridges, hospitals, etc. – can be overlaid onto impact extent maps.
2. Housing – to get an estimation of total assets inside different impact zones (low/medium/high), you will need to determine the number of houses within an impact zone and then determine the average assets across those houses.
3. Agriculture – to estimate damage to current crops, you can use land cover or agriculture distribution maps overlaid across different impact zones (low/medium/high) in order to make estimations according to the crop cycles for crops being grown in those areas.

Sectoral experts can provide further information on the most appropriate way to determine quantity, using proxy indicators, average information and multiplication factors, in order to extrapolate results to represent an appropriate quantity of damaged assets per sector, per impact zone.

FACT

The FACT needs to review the briefing note and mission plan provided by the NDMA. Based on this, a strategy needs to be identified to determine the most efficient way to gather identified missing primary data from the field or equivalent data in comparable areas. Sectoral experts can provide more information on comparable areas and markets. The purpose of field visits is to gather enough samples and data from the field for statisticians to either support a normal distribution of values or cross section of the affected population, depending on what type of information was missing, for them to determine quantity (Q), value (V) and damage ratio (R) variables. Field data collection can be carried out using data-collection tools such as KoBoToolbox, UN-ASIGN, OpenDataKit, etc., preferably with Internet connectivity to ensure real-time updates of gathered data. This may mean training for local actors used during data collection or as a refresher for team members. The FACT must communicate to the RAM challenges encountered due to missing information, inaccessibility or the need to obtain additional observations in order to have enough samples, so that they can be acted upon in order to ensure efficient and successful field visits.

Post-deployment

During the post-deployment phase, calculations and analysis are performed in order to quantify damage and loss as well as determine the costs of recovery and reconstruction. Key outputs during this phase include statistical analysis of rapid damage and loss, which would be provided by the SAT, and the determination of needs for recovery and reconstruction to be compiled by the RAM, taking into account information provided by the SAT. Sectoral experts would play an important role in supporting the RAM when identifying post-disaster projects for recovery and reconstruction that would meet the identified needs, and outline the modalities of such projects and their economic and social impacts.

NDMA

Under the guidance of the NDMA, the RAM would need to debrief the FACTs and consult with the SAT on the completeness of data and findings and also address any additional information requirements which may arise. The RAM would also need to review draft damage and loss statistics developed by the SAT. It is necessary to share findings from this phase with other stakeholders including relevant line ministries, operational agencies, local communities and those sectoral actors operating on the ground, in order to verify, validate and revise findings. Sectoral experts can help to identify sectoral actors and address any anomalies or major deviations in quantification based on their impressions, including any calculations of damage and loss they may have also carried out, as a subset of overall RRC and to harmonize findings. For example, if there are IASC clusters operating within the affected country then these findings need to be checked with cluster leads in order to get their initial impression and verify results with their preliminary findings. Once the findings are considered robust, it is necessary to draw up a determination of needs for recovery and reconstruction which will feed into an overall development recovery framework during the next phase.

SAT

It should now be possible to perform aggregation of RRC as outlined in table 4 for all relevant assets (An) and priority sectors (Sn), as the required values for the variables Q (quantity), V (value) and R (damage ratio) would have been largely determined by this stage. Variables can be substituted into the formula identified for rapid assessment innovation with aggregation performed per asset, per sector, per impact zone. If there are any remaining values for each variable that are either missing or not considered robust for estimate calculations then additional data may be required from the field. Sectoral experts can work closely with the SAT to identify missing variables that they may need to resample through data collection. Assigning an appropriate variable for value (V) is important because one asset may have different value groups depending on the purpose of the asset. For example, if the asset is a stand-alone asset, used for consumption or contributes to income generation then this will affect asset losses, consumption losses or production losses. It is therefore necessary to also determine the quantity (Q) for each asset type (An) based on the purpose of the asset. Information on the purpose of assets can be determined during field visits by the FACTs.

FACT
It is necessary to provide a mission debrief to the RAM and SAT, based on findings during data collection and lessons learned. FACTs may be required to perform additional data collection, depending on data confidence levels provided by the SAT. Sectoral experts can work closely with FACTs to identify how to gather this additional data to supplement statistical analysis.

Determination of needs for recovery and reconstruction and their impacts
Recovery needs are those intended to return normalcy to all affected areas and sectors as soon as possible, while reconstruction needs are generally long-term in nature (three years or more) and are intended to 'build back better' from the devastation of disaster. In determining the needs for recovery and reconstruction, projects that can directly address the needs identified during RAIF – including priority sectors, assets, damage impact zones and their economic costs for recovery and reconstruction – need to be recommended. Based on these estimated and prioritized recovery and reconstruction needs, the RAM can propose post-disaster projects, and there should be a rough schedule of implementation outlining at the very least the activities, timing and budget required for all programmes and projects. In doing this, the following techniques can be considered:

- Identify specific projects according to their relative urgency or priority in relation to recovery.
- Plot the timeline of activities for all projects, with urgent projects at the top, in a Gantt chart with the corresponding annual funding requirement. This will assist the national government with budget allocation over a certain time period, such as a quarterly or annual basis.
- Identify and include in the list projects that need further feasibility studies and which may be funded by outside grants and foreign aid.
- To the extent possible, a logical framework (logframe) should be created for each of the projects proposed for inclusion in the recovery plan. Logframes are normally required by foreign donors to consider project proposals.

The recovery and reconstruction needs of each sector can be summarized in a table enumerating proposed post-disaster projects and identifying their financing requirements over the years. The potential impacts of these recommended projects should also be evaluated. Among the projects identified, relative priorities can be set in order to determine which ones are the most important. Based on the broad strategies for recovery, the RAM should select priority projects/activities among the identified needs. The prioritization can be made by using a set of impact indicators and determining the ability of each project to achieve those impacts. The following criteria can be used, among others, to prioritize or rank proposed post-disaster projects:

- Economic impact, which can be evaluated in terms of the relative cost to the government of not undertaking reconstruction or rehabilitation.
- Equity and social impact, which can be determined in terms of the number of beneficiaries who are poor and destitute and who could not afford to rebuild on their own without outside support, so that assistance to poorer villages will be given a higher priority than projects located in better-off villages.
- Sustainability, which can be evaluated in terms of reduction of risks and the vulnerability of people and economic assets to future disasters, and whether there is a strong likelihood that an adequate budget and appropriate provisions will be made to cover the operation and maintenance of the reconstructed infrastructure item.

These criteria can be placed in a matrix where impacts are ranked according to low, medium or high. This matrix can show the relative benefits of proposed projects to people in the affected areas, which, in turn, will inform and assist the government in determining priority projects within a sector.

Early recovery

Key outputs during this phase include the development of a recovery framework, which would normally come from the RAM responsible for overseeing RAIF. Another output of this phase is the final assessment report, which can be developed by the NDMA based on initial assessments where RAIF was not needed; or combining all information and evidence compiled in previous phases, if RAIF was carried out. The assessment report should highlight all the steps taken during RAIF as well as detailing the processes, methods and procedures along with all relevant findings.

While there is minimal responsibility required during this phase for the SAT and FACTs, they may be required to support the RAM in developing the recovery framework and assessment report. Sectoral experts would play an important role during this phase, working closely with the RAM to develop a tailored recovery framework taking all sectoral concerns into consideration. The assessment report should take into account considerations raised by stakeholders; and it should provide estimates and projections as ranged figures together with data confidence values, and state any assumptions made and additional validation or follow-up that may be required. Dissemination of the report should also be considered carefully, as disaster damage and loss estimates can sometimes hold political weight and address public expectations.

Development of a recovery framework
The post-disaster projects outlined in the determination of needs for recovery and reconstruction must be based on integrated policies and strategies, where, ideally, the central government should develop the overall policies for recovery and reconstruction, while provincial governments should develop overall strategies. These strategies can be considered before field data collection is undertaken, to provide guidance to the teams. After field data collection, the FACTs must identify or validate the strategies to be followed for recovery and reconstruction of the sector. There are certain policies that can be adopted which can provide incentives to the private sector to reconstruct damaged facilities with higher standards of resilience over a limited period. Examples of some general policies to consider are:

- Exemption from payment of building permits and other related fees;
- Duty-free importation of construction materials and equipment during the recovery and reconstruction phase; and
- Bank guarantees on loans may be extended by the government to enable the local government to rebuild immediately.

Some of the general strategies that could be considered for priority sectors include the following:

- **Building back better** – Designing recovery activities based on 'building back better' principles will promote longer-term disaster risk reduction and management. The building back better principle should also look at the advantages of resettlement in disaster-safe areas instead of rebuilding in the same disaster-prone areas.
- **Focus on the most vulnerable and socially disadvantaged groups such as children, women and the disabled** - Recovery programming needs to give priority to the most vulnerable groups, including female-headed households, children and orphans, people with special needs and the poor.
- **Community participation and use of local knowledge and skills** - The participation of the community in all the elements (identification, planning, design and implementation) of recovery activities will help ensure the acceptability of projects and optimize the use of local initiatives, resources and capacities.
- **Secure development gains** - Although recovery strategies may be a separate set of activities, they must be supportive of existing development plans and must attempt to re-establish and secure previous development gains.

- **Coordinated and coherent approaches to recovery** - Projects for disaster recovery must have full and effective coordination among all involved agencies based on comprehensive information exchange, flexibility in administrative procedures and uniformity of policies. In some instances, a special new agency may be needed to oversee, coordinate and monitor complex disaster recovery programmes. Under this strategy, capacity-building activities for the local public administration may be part of recovery activities, including a well-defined monitoring and evaluation system for the overall implementation of the recovery plan.
- **Efficient use of financial resources** - The overall strategy should also include the identification of fund sources that are suited for the recovery activities. It should be clear how assistance to private sector recovery would be delivered. Also, some cheaper sources of funds from international donor partners should be initially identified for longer-term expensive projects.
- **Transparency and accountability** - The overall planning and implementation of projects for recovery must be transparent, especially to those affected, through open and wide dissemination of information on all aspects of the recovery process.
- **Rapid rebuilding of people's livelihoods and accelerated revitalization of the local economy** - After a disaster, there is a critical need for an early revival of production, trade and the creation of income and employment opportunities in support of people's own initiatives. The immediate restoration of livelihoods will avert food shortages and lessen the dependency of the population on outside aid.

UN Photo

Institutional arrangements for sustainability

In order for a RAIF to be introduced and used within ASEAN institutions, various institutional arrangements have been identified as necessary to sustain it. These range from high-level policies and mandates to partnerships, mechanisms, capacity and resources. From an institutional perspective there is a need for such an assessment framework to be acknowledged or even endorsed at the highest levels, including the ACDM and relevant subcommittees including the ASEAN Subcommittee on Space Applications (SCOSA) under the ASEAN Committee on Science and Technology (COST). NDMAs, which act as focal points for regional institutions such as the AHA Centre, also need to acknowledge RAIF and begin to use RAIF during post-disaster assessments, through the support of AHA Centre and other coordination and analysis partners. AHA Centre can act as a facilitator for RAIF while NDMAs remain the principle clients setting priorities for different sectors.

There is also a need for a core team of analysts and data collectors who can act as the 'engine' behind RAIF. United Nations agencies such as ESCAP, UNOSAT and OCHA can respectively provide regional cooperation services, technical support and backstop and act as lead United Nations agencies during disaster response. There is also a need to develop partnerships with satellite data providers who can remain on standby and work closely to support analysts. These can include national space agencies, the International Charter on Space and Major Disasters, Sentinel Asia, other United Nations mechanisms etc.).

In terms of capacity, there is a variety of skills and techniques that will be required to carry out RAIF. These can include:

- GIS training on using geospatial tools and techniques
- Practical remote sensing training
- Data analysis, quantification and interpretation
- Statistical methodologies, sampling and modelling
- Sectoral damage valuation and loss estimation (elementary econometrics/economic analysis)
- Recovery framework and strategy (orientation to early recovery and PDNA)
- Overview of big data, analytics and new technological advancements
- Problem solving, logic and finding patterns – design thinking.

The resources required to sustain RAIF fall into different areas for consideration. These can include:

- Software for processing and analysing data
- Data collection – mobile device data collection
- Storage and security of data
- Server – cloud or local server implications
- Virtual working spaces
- e-learning platforms
- Knowledge management, good practices, document management and sharing mechanisms.

While there can be various assessments taking place after a disaster, RAIF attempts to harmonize some of these attempts in order to provide a rapid quantification of damage and loss in the preliminary phases of a disaster. RAIF has been designed to complement processes such as MIRA and PDNA but those carrying out RAIF must remain mindful of additional assessments taking place and the potential for information scarcity and fragmentation during post-disaster phases. Using data and information from multiple sources including disaster reports from the international disaster management community, international and local media, civil society organizations and historical disaster situations, it is essential that those carrying out RAIF remain well informed so that they can make considerations for the wider context of a disaster situation, including transboundary concerns that may affect any form of rapid assessment.

While RAIF and other emerging assessment methodologies are becoming more robust in terms of calculating damage (or direct losses), it is still somewhat difficult to calculate losses (indirect losses) which are cross-cutting and multidimensional. Therefore, assigning a value to such losses and extrapolating across a population will not yield accurate results where inequalities are high and there are large disparities in wealth and other socioeconomic factors. In such cases, different population groups must also be considered within the sampling strata of the methodology and extrapolation attempted based on numbers of populations living in certain conditions i.e. the poor and non-poor.

Annex 1: Considerations for priority sectors

Infrastructure

There are various assets to consider for the infrastructure sector. These can be largely grouped into critical infrastructure, public infrastructure and commercial/economic infrastructure. As an example, the types of assets to consider for the infrastructure sector can include:

Critical infrastructure
- Power lines – i.e. cabling, screws, bolts, etc.
- Gas pipe lines – i.e. piping, screws, bolts, etc.
- Electricity grids – i.e. cabling, masts, transformers, etc.
- Dams – i.e. generators, transformers, concrete blocks, etc.
- Sewage treatment plants – i.e. filters, turbines, generators, pumps, etc.
- Communication lines – i.e. cabling, switches, routers, repeaters, etc.
- Communications masts – i.e. dishes, receivers, transmitters, etc.

Public infrastructure
- Roads – i.e. lights, tarmac, paint, reflectors, etc.
- Bridges – i.e. structural, non-structural, etc.
- Schools – i.e. books, tables, chairs, equipment etc.
- Hospitals – i.e. beds, equipment, medicine, air conditioners, etc.

Commercial/economic infrastructure
- Malls and shopping centres – i.e. lighting, glass, tiles, etc.
- Restaurants – furniture, foods, equipment, etc.
- Cinemas – seats, carpet, screens, tiles, etc.

In order to determine the quantity of infrastructure assets, the number of infrastructure developments within an impact zone must be obtained first. This should be easier than for other sectors as there are a limited number of types of infrastructure within an area, with the exception of commercial and economic infrastructure. This information can be obtained from company registries maintained within different government agencies related to business and trade.

Market value data can be obtained through direct interviews with private contractors or government officials involved in the construction and repair of facilities. Interviews can also be conducted during field trips in order to validate unit costs of repair and reconstruction (which should already be contained within baseline data as part of preparedness).

The values in the baseline information should be used in estimating damage. For example, if 20 square metres of a roof are damaged, the repair cost will be the cost of roofing per square metre multiplied by 20. On the other hand, if the whole structure is totally destroyed, the value of damage will be its replacement cost at post-disaster prices.

FACTs must be able to analyse potential impacts of the damage and losses to the services that are provided to people and the economy. These impacts can include:

- Delays in services and the economic activities of the clients they serve
- Losses to government revenues if the fees they collect will be adversely affected
- Any issue created by the disaster, such as an increase in the vulnerability of an agency's structure/s.
- Possible losses of contractual jobs within the agency.

Other costs can include foregone income, cleaning up debris, higher operating costs and other unexpected expenses. These should all be determined per infrastructure type during field visits.

Housing

The post-disaster assessment of housing units should be done on a per district basis, which can be totalled to create a provincial assessment. This can be carried out by counting broadly the number of houses damaged according to type, as well as a general assessment of the parts of the houses that were damaged, such as the roof, walls, fences, electrical installations, plumbing, etc. As an example, the types of assets to consider for the housing sector can include:

- Structural – i.e. concrete, masonry, adobe, others
- Non-structural – i.e. plumbing, wiring, plastering, paint, others
- Contents – i.e. television, fridge, washing machine, microwave, furniture, others.

Generally, houses are privately owned. However, if there are housing units in the affected district owned by the government, they should be assessed in the same manner. They should be segregated later in the summary of damages and losses. FACTs must be able to analyse potential impacts of the damage and losses to houses in relation to, among others:

- The future safety and health of the population who lost their houses, especially vulnerable groups such as pregnant women, lactating mothers, children, the elderly, etc.
- The additional costs to families if they have to stay in temporary shelters or rent temporary houses.

In terms of market value, the total values should include both the cost of replacement (or repair) of the houses and their contents. The values in the baseline information should be used in estimating damages, as in the roofing example given for commercial/economic infrastructure on the previous page. Foregone income will be losses from the non-payment of rent for the houses that were destroyed. These can be derived by estimating the average rent of houses multiplied by the number of houses for rent that were damaged or unusable after the disaster multiplied by the number of months before they can be used and rented out again. Debris is usually cleaned up by house owners, especially after flooding.

The housing sector is one area which can severely affect the displacement of populations if not addressed early. Some of the possible early recovery activities for the housing sector include:

- Food-for-work, possibly combined with cash-for-work, to rehabilitate/reconstruct damaged houses.
- Direct subsidies for housing materials, especially for the poorest.
- Credit programmes for housing repairs.

Possible reconstruction activities in the housing sector can include:

- Relocation of housing areas to safe areas, as necessary. In this case, the additional costs of land acquisition and basic services provision (water, sanitation, electricity, etc.) should be included.
- Assistance in reconstructing and repairing housing structures under a building back better strategy to ensure future disaster resilience through the adoption and enforcement of improved construction standards.
- Structural retrofitting of undamaged or partially damaged houses so that they are not affected by future disasters.
- Soft-term credit for reconstruction and repair of houses. Such schemes can be accompanied by technical assistance for improved disaster-resilient standards of construction.
- Other mitigation measures such as construction of support infrastructure to prevent serious landslides and floods affecting houses.

It should be noted that assistance to houses owned by the private sector, which can be extended as direct assistance or through credit, is purely based on the decision of the government.

Agriculture

Both public and private damage and losses must be included in the assessment. Agricultural lands can be totally damaged, such as when they become permanently submerged in water after a disaster, making them unavailable for farming. Subsequently, the assessment must be able to account for all the permanent crops that have been destroyed or uprooted. Various techniques are available to estimate this, including, for example, estimating the number of trees by the average number of trees per hectare. Additionally, an irrigation facility can either be partially damaged or totally destroyed – to be indicated in metres. Assets in agriculture can be categorized by purpose, which would also affect the value assigned to the asset. For example assets for consumption would have a different value from assets for production.

Assets to consider for asset and consumption losses:

- Physical assets – agricultural land, storage buildings, animal pens, etc.
- Equipment and machinery – tractors, hand tractors, threshers, weeders, ploughs, etc.
- Stocks and raw materials – rice, corn, seeds, fertilizer, pesticides, veterinary supplies, etc.
- Forestry and plantations – trees (enumerate), pasture, etc.
- Other equipment – honey production, milk production, egg production, etc.
- Fisheries – boats, engines, nets, traps and cages, ponds, gear, etc.
- Livestock – buffalo, cattle, goats, pigs, etc.
- Poultry – chickens, ducks, etc.

The estimated losses in agriculture are the differences between the expected pre-disaster and post-disaster production levels of various agricultural products within the year that the disaster occurred.

Asset to consider for production losses:

- Crops – rice, corn, vegetables, etc.
- Permanent crops – coconut, coffee, fruit trees, etc.
- Forestry – timber, pine, etc.
- Fisheries – fishery A, fishery B, etc.
- Livestock – buffalo, cattle, goats, pigs, etc.
- Poultry – chicken, ducks, etc.
- Others products – eggs, milk, honey, etc.

FACTs must be able to analyse the broad impacts of the damage and losses to the local people, economy and environment, among others. Assessment of impacts if no assistance is provided to the agricultural sector can take the following into consideration:

- More people are engaged in agriculture and the poorest groups are dependent on this sector. Delays in assisting these groups will exacerbate their socioeconomic status.

- Without assistance, a planting season may be missed by farmers, which will result in a shortage of basic food supply that can cause inflation not only in the disaster-affected area but also in other districts or even nationwide.

- Delay of assistance may put farmers further in debt. It must be remembered that poor farmers usually incur debts for their production inputs. Without assistance from the government, they will be unable to meet their financial obligations.

- Some agricultural products are major inputs of other industries. For instance, if corn is the basic ingredient of animal feeds, a reduction in supply will increase the prices of feeds, which will eventually inflate the prices of animal products, affecting a greater number of people.

- Previous disasters may have created new hazards such as a landslide threats caused by extensive rains or potential flooding of rice and corn lands brought about by destroyed irrigation systems or dikes.

- Some environmentally sensitive areas within the sector may have been affected. For instance, some watershed areas may be put at risk by landslides or the destruction of the forest that sustains them. Environmental concerns must be included in the criteria for prioritizing programmes and projects for recovery.

- The condition of women may be severely affected by a disaster and particular attention should be paid to its impact on women. Examples include consideration of their possible new roles as breadwinners for their families; double burden or additional work on farms or in the house; potential abuse; health hazards; etc.

- Food supply stabilization. The destruction of crops, livestock and other agricultural outputs may adversely affect the balance of food supply within the affected region as well as outside of it. The assessment team must be able to assess the gaps in food supply within the disaster year and beyond in order to enable the government to stabilize the food supply and prices. The cost of stabilizing food supply will be the value of the supply gaps multiplied by the unit costs of the respective food items over a specified period. It should be noted, however, that in estimating food requirements, the donations of food aid donors should be factored in – including those that are integrated with food-for-work schemes.

- The various agencies must be able to estimate the food supply gaps. The assessment team must be able to consolidate the overall food requirements needed to stabilize food supply.

One of the devastating impacts of natural disasters in agriculture and fisheries is the long-term damage they can cause to agricultural lands and bodies of water. This damage can result in reduced production, loss of livelihoods and the reduction of future supplies of agricultural produce. For example, landslides and floods can alter the topography, render lands unsuitable for crops for a long time or can result in the reduction of grazing lands for livestock.

There are other unexpected expenditures that will add to losses in agriculture, such as clearing of land, investment losses (higher production costs), etc. As previously mentioned, an important type of loss is the investment loss of farmers when their standing crops or livestock are totally destroyed by a disaster. If this happens and the farmers (or growers) are not able to replant (or replace stock) in time to harvest within the year, the value of investment put into the destroyed crops or plants (or livestock) will be considered a loss.

On the other hand, if the farmers (or growers) replant (or replace stock) in time to harvest within the year, it will be as if the farmers (or growers) incurred a higher production cost to produce the same volume of harvest within the year. The total cost of production for the same volume of output within the year will be the normal production cost plus the investment losses they incurred due to the disaster.

Other losses can include the cost of additional veterinary medicines if livestock suffered injuries, greater fertilizer requirements, etc. If irrigation facilities charge fees, their destruction will result in the loss of income from fees. The losses beyond the disaster year can be calculated by comparing estimated production in future years had the disaster not occurred and estimated production after the disaster.

The agriculture sector is a critical sector that will expedite a quick recovery. Considering that a great number of people, especially the poor, are engaged in agriculture, it is one of the sectors that should be prioritized. Some possible recovery activities are:

- Food-for-work or a combination with cash-for-work to rehabilitate/reconstruct damaged irrigation systems, town halls, public schools, health centres and other off-farm sources of income that can provide temporary employment while farmers are waiting to plant and harvest.

- Additional production credit to enable farmers to buy inputs and enable them to replant.

- Direct subsidies for fertilizers, seeds and pesticides.

- Dispersal of livestock to replace the depleted stocks of growers.

- Urgent repairs of agriculture-related facilities such as irrigation, storage, markets, etc. and access to such facilities.

The impacts of the damage and losses in agriculture can be long-term and need to be addressed through reconstruction activities. These impacts must be assessed according to their severity and possibility of occurrence and can include, among others:

- Increased poverty among farmers and their families
- Increases in food prices
- Food shortages
- Job losses
- Loss of raw materials for industries.

Possible reconstruction activities to address these potential long-term impacts in the agriculture sector can include:

- Reconstruction and repair of irrigation systems, post-harvest facilities, markets and other structures under a building back better strategy to ensure future disaster resilience through the adoption and enforcement of improved construction standards.

- Structural retrofitting of undamaged or partially damaged farm facilities so that they are not as affected by future disasters.

- Relocation of vital agricultural facilities to safe areas, as necessary. In this case, the additional costs of land acquisition and basic services provision (water, sanitation, electricity, etc.) should be included.

- Soft-term credit for reconstruction and repair of private businesses. Such schemes can be accompanied by technical assistance for improved disaster-resilient standards of construction.

- Other mitigation measures, such as the construction of support infrastructure to prevent serious landslides and floods affecting farms, or common storage facilities where farmers can safely stock their produce, etc.

It should be noted that assistance to vital agriculture assets and facilities owned by the private sector, which is normally extended as credit, is purely based on the decision of the government.

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