UNITED NATIONS
ESCAP
Economic and Social Commission for Asia and the Pacific

ESCAP Multi-donor Trust Fund for
Tsunami, Disaster, and Climate
Preparedness in Indian Ocean and
Southeast Asian Countries

TERMINAL REPORT

PROJECT TITLE	"CAP on a MAP" - Improving Institutional Responsiveness to Coastal Hazards through Multi-Agency Situational Awareness		
ORGANIZATION	Geoinformatics Center (GIC), Asian Institute of Technology (AIT)		

Total project budget	US$ 300,040	Funding received to date	US$ 300,040
Percentage of total project budget spent	93.75%	Percentage of funding received to date that has been spent	100%

Interest earned on funding received from ESCAP	US$ 0.00		

Date of signature of Letter of Agreement for this project	02 Dec. 2014	Date of project completion	30 Nov. 2016

ANNEXES: The evaluation and audit reports will be submitted by Dec. 31 2016. All the expenditures incurred in the project are being sent to an external auditing firm.

I certify the accuracy of the substantive and financial information contained in this report.

Name: **Prof. Worsak Kanok-Nukulchai**
Title: President, Asian Institute of Technology (AIT)
Date: 30 November 2016

The terminal report is accepted.
I hereby certify that I satisfied with the delivery of the project from the funds ESCAP provided to partner and the expense reporting from IP reflects the realistic progress of the project

(Signature of Certifying Officer)   Date

1/02/17

Mr. Edward Turvill, Programme Officer
Trust Fund for Tsunami, Disaster and Climate Preparedness

CAP on a MAP - Improving Institutional Responsiveness to Coastal Hazards through Multi-Agency Situational Awareness

TERMINAL REPORT

December 2016

Submitted to:

ESCAP Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and Southeast Asian Countries

Asian Institute of Technology

SAHANA SOFTWARE FOUNDATION

OVERALL ASSESSMENT

- **Result 1 (Information Stocktaking and Stakeholder Consultations)**

Consultations with the stakeholders during the kick-off workshops in each country had provided us an opportunity to understand the existing early warning systems in their respective countries. Kick-off workshops were conducted in each country for information stocking and stakeholder consultations as follows:

Maldives - The kick-off workshop was organized on 15 April 2015 in Male, which was attended by 21 participants. Participating agencies in the workshop were the National Disaster Management Center (NDMC), Maldives Meteorological Service (MMS), Maldives National Defense Force, Ministry of Defence and National Security, Maldives Police Service, Communication Authority of Maldives, Ministry of Housing & Infrastructure, Land Survey Authority of Maldives, Maldives Red-Crescent, Local Government Authority, Ministry of Environment, Maldives Meteorological Service, Ministry of Health, Department of National Planning (Ministry of Finance), Ministry of Tourism Arts and Culture, Ministry of Education, Maldives Broadcasting Corporation, Communication Authority of Maldives, and Dhiraagu / Ooredoo (Major mobile phone companies in the Maldives). The following topics were discussed during the workshop: 1) Public broadcasting services for early warnings; 2) Priority calling and text-messaging; 3) Severity, Certainty, and Urgency alert levels and color codes; 4) Manageable set of events; 5) Hazard and risk maps; 6) Training of trainers.

Philippines - The kick-off workshop in the Philippines was organized on 19 May 2015 at PAGASA in Manila and 26 participants attended the event. Participating agencies in the workshop were Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA), Metro Manila Department Authority, Professional Regulation Commission, Department of Interior and Local Government, Philippine Disaster Recovery Foundation, Office of Civil Defense (OCD), Philippine Coast Guard, Department of Social Welfare and Development (DSWD), UNTV, ABS-CBN News, and DZMM Radio. The following topics were discussed during the workshop: 1) Shared and distributed servers; 2) Events to consider; 3) Data and Documents; 4) Mobile phones and apps; 5) Message priority; and 6) Training of trainers.

Myanmar - The kick-off workshop in Myanmar was organized on 15 July 2015 at the Department of Meteorology and Hydrology (DMH) in Nay Pyi Taw and it was attended by 29 participants. Participating agencies in the workshop were Department of Meteorology and Hydrology (DMH), General Administrative Department (GAD), Relief and Resettlement Department (RRD), Myanmar Red Cross Society, Directorate of Water Resources and Improvement of River Systems (DWIDR), Irrigation Department, Ministry of Livestock, Fisheries and Rural Development, Department of Fisheries, Planning Department (Ministry of Agriculture and Irrigation), Department of Agriculture, Post and Telecommunications Department, Ministry of Communications and Information Technology, Information Technology Central Services (Ministry of Communications and Information Technology), Information and Public Relations Department (Ministry of Information), Myanmar Post and Telecom, and Myanmar TV (MRTV). The following topics were discussed during the workshop: 1) Responsibilities of DMH; 2) Color coded warnings; 3) Early warning dissemination methods; 4) Public broadcasting services.

- **Result 2 (Training at AIT)**

A regional training at AIT was organized from 31 Aug. to 11 Sep. 2015 at AIT and eight (8) trainees from the three participating countries had joined the training. The trainees were drawn from the national agencies related to early warning dissemination or disaster management. The aim of the training was to develop in-country capacities and it was actually a "Training of Trainers" event. The number of trainees (Master Trainers) participated from each country were 2 from the Maldives, 3 from Myanmar and 3 from the Philippines. During the information stocking kickoff workshops, it was proposed to invite one computer system administrator as well as an official in-charge of early warning as trainees from each beneficiary country. However, DMH (Myanmar) had requested three officials to be trained each having responsibility on seismology, meteorology, and hydrology. DMH doesn't have any dedicated system administrator. However, the nominated officials learned the necessary technical skills to operationalize the system. On the other hand, PAGASA in the Philippines had sent one system administrator and one IT Engineer and one volcanologist from PHIVOLCSto participate in the training. In case of the Maldives, one system administrator was selected by NDMC and one official familiar with early warnings were selected by MMS (Maldives Met. Services).

Trainees were first trained in Geographic Information System (GIS), GIS data formats and structures, preparation of GIS Data for sending location-based early warnings. They were further trained in administrative as well as operational procedures of Sahana Alerting and Messaging Broker (SAMBRO) and Common Alerting Protocol (CAP) standards. Trainees were taken through learning, demonstration, and assessment processes. The learning component was comprised of theories, concepts, and case studies. It was important for the trainees to demonstrate how to apply the knowledge gained to their own situations. At the end of the each training module, short tests in the form of quiz were conducted to assess their knowledge. The training materials were shared with the trainees and they were requested to customize them to their respective country's requirements.

- **Result 3/4/5 (Implementing a Country CAP-Profile/ Installation of servers and software/ Simulation and Testing)**

Implementing a Country CAP-Profile:
A CAP Profile is a highly technical XML-based document that a machine can interpret with the customization parameters for each country. In the project proposal, the CAP Profile was implied to be a CAP Implementation Plan, which are defined in the Sahana BluePrint WIKI [1] [2] [3]. Developing country CAP Profile is hence a multiple steps. In-country trainings were conducted in Myanmar (25-26 Feb, 2016) Philippines (02-03 Mar, 2016), and Maldives (29-31 May, 2016) to develop skills in setting-up and using the system (SAMBRO) independently. This activity had helped all the stakeholders to understand the requirements in each country for carrying out activities as per the CAP implementation plan. Once the stakeholders got familiar with the system, they could customize the various parameters (like for example the Organisation OID, warning priorities, SMS, email templates, etc.) in warning templates in the CAP format.

The warning authentication was a major concern among the various stakeholders at National/Regional/Municipal/District levels in the beneficiary countries. With SAMBRO, the responsible authorities can craft, edit the message in a way best suitable for their audience. Moreover, audit, check and control over each step of the warning made the system very secure and information such as who issued the alert, when it was issued, who approved the alert, when it was approved, etc. were available to the system administrator. On the other

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[1] Maldives blueprint wiki: http://eden.sahanafoundation.org/wiki/BluePrint/CAPBroker/Maldives.
[2] Myanmar blueprint wiki: http://eden.sahanafoundation.org/wiki/BluePrint/CAPBroker/Myanmar.
[3] Philippines blueprint wiki: http://eden.sahanafoundation.org/wiki/BluePrint/CAPBroker/Philippines.

hand, individuals or groups subscribed to the alerts/early warnings can have a full view of the profile page of individual messages through the links provided therein. Thus, by rolling out the CAP implementation plans, issues related to authentications was addressed.

Installation of servers and software for operationalizing the system:
The system (SAMBRO) was installed and operationalized in the Maldives, Myanmar and the Philippines. SAMBRO was customized in accordance to the country specific requirements. Visualisation of hazard/risk maps was made possible through SAMBRO to provide early warnings according to certainty, urgency and severity of hazards/risks. Hazard specific early warning templates were developed for various media like Email, SMS, RSS, Twitter, etc., which simplified the early warning processes in each country.

Simulation and Testing:
Controlled-exercises were conducted in Myanmar (27-30 Jun, 2016), Philippines (11-14 Jul, 2016), and Maldives (03-06 Aug, 2016). In Myanmar, the system was tested in the capital city Nay Pyi Taw as well as Kunyangong and Nyaungdon townships in order to determine the system's usability as well as adaptability and practical implications in a real-world situation. The Departments of Relief and Resettlement, Government Administration, Fire Service, Police, Irrigation and Dam Safety, Health, Agriculture, Fisheries, and the Myanmar Red Cross Society participated in the simulation drills and testing. In the Philippines, the system was tested in central PAGASA office as well as Manila Bay and Subic Bay with local LGU, Fire, Police, Search and Rescue, Emergency Medicine, and other stakeholders in collaboration with our national implementing agency, PAGASA. In Maldives, the system was tested in Male and Thulusdhoo islands in collaboration with our national implementing agency NDMC. The Red Crescent Society, Health Protection Agency and local Council Members of Thulusdhoo island participated in the event.

- **Result 6 (Knowledge Management and Result Dissemination)**

Regional workshop and training on CAP and international CAP implementation workshop:
A regional workshop and training on CAP was organized at AIT on 22 Aug 2016 and an international CAP implementation workshop was organized back-to-back of the regional workshop (from 23 Aug to 24 Aug 2016). The objective of the regional workshop and training was to apprise the officials from the early warning related national agencies of the remaining member countries of the Tsunami Trust Fund (TTF) about the outcome of the project and encourage them to adopt the CAP standard in their respective countries. There were nine participants in the regional workshop from Bangladesh, Cambodia, Indonesia, Maldives, Myanmar, Philippines and Vietnam. Similarly other participants were from Australia, Micronesia, Italy, Germany etc. who also intended to attend the International CAP Implementation workshop.
The objective of the international CAP implementation workshop was to information sharing among experts coming from different parts of the world and provide exposure to the participants of the regional workshop and training on CAP.

Result dissemination workshops in the participating countries:
In order to disseminate the results from the project in each participating country, workshops were organized in Myanmar (02 Sep, 2016), the Philippines (14 Sep, 2016), and the Maldives (13 Oct 2016). The main objective of the workshop was to share the success story of CAP implementation with the relevant stakeholders in each country. Both technical as well as senior-level officials from relevant agencies in each country were invited to the result dissemination workshops. Number of participants joined the result dissemination workshops were: Maldives – 25, Myanmar – 24, and Philippines – 50.

- **Result 7 (Reporting, Evaluation and Audit)**:
Evaluation and Audit reports have been submitted separately.

ACTIVITY IMPLEMENTATION

No.	Activity	Time Frame	Trust Fund Contribution	Trust Fund Contribution Spent
1	Information Stocktaking and Stakeholder Consultations	Jan-Jul 2015	Staff and other personnel costs: **$28,200.00** Contractual Services (Overhead on service provided by the Joint Venture partner): **$0.00** Travel: $7,440.00 Transfers and grants to counterparts: **$4,500.00** General Operating and other direct costs: **$200.00**	Staff and other personnel costs: **$28,200.00** Contractual Services (Overhead on service provided by the Joint Venture partner): **$554.58** (**Note:** Ideally this amount should have been spent under expenditure head "Transfers and grants to counterparts"). Travel: $4,497.83 Transfers and grants to counterparts: **$2426.51** General Operating and other direct costs: **$0.00**

Description of Results/Outcomes

- **Awareness creation**:
  The kick-off workshops were helpful to bring the relevant stakeholders together in each country, understand to the process of disseminating early warnings in their country and apprise them about the advantages of the CAP-enabled SAMBRO system for disseminating the locations specific early warning

- **Stakeholder consultations**:
  A key element of the early warning and cross-agency situational-awareness is the introduction of the all-hazard all-media warning concept. The design and implementation of this concept requires that all disaster management agencies collaborate to develop the CAP implementation plan and strategy.

One of the important finding was the public and private partnership that was evolving for enhancing the early warning dissemination in the countries. Such initiatives were taken into account to avoid duplications. For example, Google Crisis Response unit had approached Myanmar to implement CAP feeds. However, having realized that the UN-ESCAP project was in progress in the country, they decided to integrate the SAMBRO RSS feed in to Google's public alerting system. Philippines had implemented their own system for generating CAP feeds but they did not have facilities to utilize those feeds to get a Common Alerting Picture or to integrate SMS, e-mails, or alerts to a Closed User Group. These gaps were recognized, addressed and integrated into the existing system in PAGASA through SAMBRO.

No.	Activity	Time Frame	Trust Fund Contribution	Trust Fund Contribution Spent
2	Training at AIT	Jun-Aug 2015	Staff and other personnel costs: **$20,400.00** Supplies, Commodities, materials: **$150.00** Travel: $19,450.00 General Operating and other direct costs: **$200.00**	Staff and other personnel costs: **$20,400.00** Supplies, Commodities, materials: $ **98. 75** Travel: $17,975.67 General Operating and other direct costs: **$211.91**

Description of Results/Outcomes

- **Introductory Training and Demonstration**:
Since the trainees had diverse background, therefore, it was important that before starting the training on the system (SAMBRO) to make sure that everyone is in the same page with basic knowledge and skills necessary for understanding the system. Therefore, an introductory training on GIS focusing on GIS data formats and structures as well as data sharing standards (WMS, WFS, etc.) were provided to the trainees.

- **Demonstration of SAMBRO System**:
  - Training and demonstration of CAP-enabled Sahana Alerting and Messaging Broker (SAMBRO) and Community Resilience Mapping Tools (CRMT);
  - Demonstration of examples on implementation of SAMBRO and CRMT;
  - Demonstration of CAP related workflows, for example, creating alerts, the way to providing updates on the latest situation for an already issued early warning, cancelling/clearing of the same early warning etc.

- **Lectures and Hands-on Exercises**:
  - Training on CAP standard and specifications including understanding each of the CAP attributes;
  - Introduced the policies and procedures for developing the country CAP-Profile;
  - Explained the protocol for using Object Identifiers (OIDs) for implementing a Register of Alerting Authorities;
  - Developed hazard specific CAP-enabled pre-populated alerts/warnings templates;
  - Developed and used predefined early warning areas based on the hazard/risk levels.
  - Created and edited qualifying elements (alerting/qualifying segment), filling out the detailed information (info. segment), drawing and importing areas for early warnings (area segment) and attaching informative documents (resource segment) for early warnings;
  - Created and sent out early warnings to closed user groups or individually;
  - Demonstrated the CRMT tools and its significance.

- **Evaluation of the Training**:
An evaluation of the training course was carried out through an on-line evaluation form. Evaluation was conducted in four main modules; i) GIS Module, ii) SAMBRO Module and iii) Multi-hazard Early Warning System (EWS) Module and iv) Multi-agency Situational Awareness Module. Participants provided their feedbacks on each module through five options; 1) Very Unsatisfactory, 2) Unsatisfactory, 3) Neutral (unbiased), 4) Satisfactory, 5) Very Satisfactory.. In GIS Module (Figure 8), 92% participants are satisfied (72% = Very satisfied and 20% = Satisfied) with Module and remaining 8% participants are either neutral or unsatisfied or didn't respond. Likewise, the Module-wise evaluation results are presented below in the pie charts.

GIS Module

- No Response 1%
- Very Unsatisfactory 1%
- Unsatisfactory 5%
- Neutral 1%
- Satisfactory 20%
- Very Satisfactory 72%

SAMBRO Module

- Neutral 6%
- Satisfactory 25%
- Very Satisfactory 69%

Multi-Hazard EWS

- No Response 6%
- Very Unsatisfactory 2%
- Neutral 4%
- Satisfactory 10%
- Very Satisfactory 78%

Multi-Agency Situational Awareness

- Neutral 11%
- Satisfactory 35%
- Very Satisfactory 54%
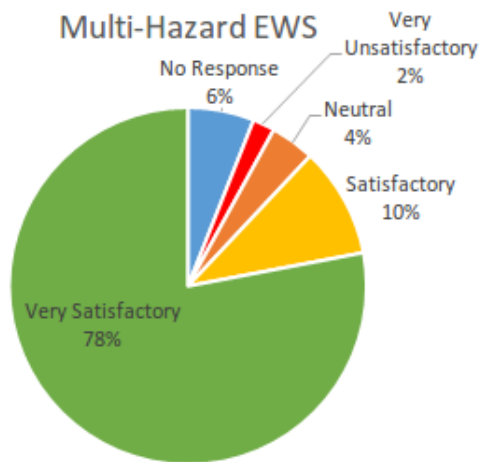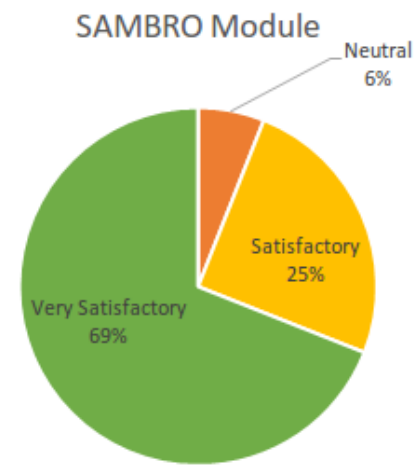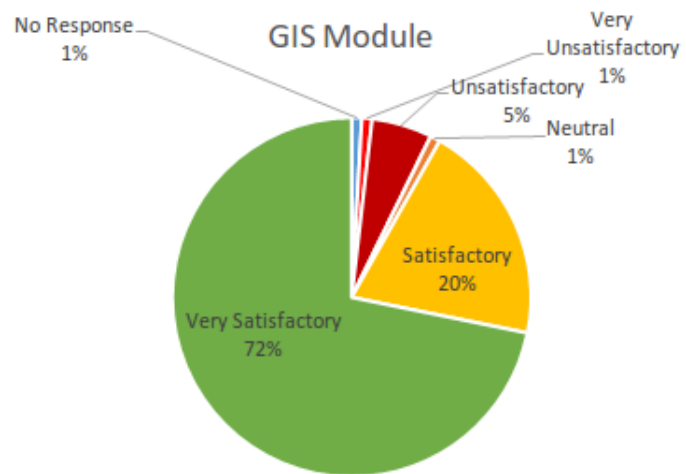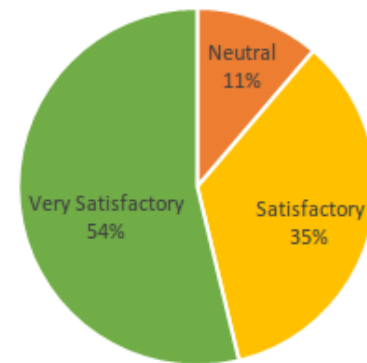
Following the ToT, the in-country trainings were organized. The trainings in the countries were not originally proposed, but it was later realized that in order to succeed, there was a need to create awareness among other stakeholders in the countries for using the SAMBRO system. Although the trainees showed a high level of competencies in learning the new concepts during the Training of Trainers (ToT), but trainees from Maldives and Myanmar were not very confident to deliver and organize the in-country trainings of their own. Accordingly, one consultant was deputed as a resource person to these two countries to help them in conducting the trainings. Trainees from the Philippines had prior experience in CAP to carry out the in-country training of their own with some supports provided remotely. The lead agency in each country was encouraged to carry out these in-country trainings as getting commitments from all the stakeholders to the training was easier for them. In total, 17 participants in Myanmar, 20 participants in the Philippines and 15 participants in the Maldives were trained.

3/4/5	Implementing a Country CAP-Profile/ Installation of servers and software for operationalizing the system/ Simulation and Testing	Sep-Aug 2016	Staff and other personnel costs: **$121,800.00** Equipment, vehicles and furniture: **$11,000.00** Travel: $8,400.00 Transfers and grants to counterparts: **$4,500.00** General Operating and other direct costs: **$200.00**	Staff and other personnel costs: **$121,800.00** Equipment, vehicles and furniture: **$7,359.57** Travel: $8,876.14 Transfers and grants to counterparts: **$5,121.58** General Operating and other direct costs: **$431.96**

Description of Results/Outcomes

- **Implementing a Country CAP-Profile**:
  The following results were achieved.
    - Prepared the CAP specifications for each country in consultation with various stakeholders;
    - Discussed and implemented the procedures for managing the Register of Alerting Authorities in each country;
    - Developed Standard Operating Procedures (SOPs) for CAP implementation in the relevant national agencies in each country;
    - Customized the CAP XML with various customization parameters like layers for email, SMS messages, warning priorities and classifications inclusions, event types etc.
    - Worked with Red Cross in Myanmar and the Philippines to get them subscribed to the RSS feeds so that they can further disseminate the early warnings to their officials and volunteers.

- **Installation of servers and software for operationalizing the system**:
  Servers were procured and shipped to Myanmar and the Maldives. They are currently serving as the main servers for hosting the SAMBRO. Philippines, had decided to use one of their existing servers, as their requirement was different from Myanmar and the Maldives and they wanted to procure the server locally, but failed to do so for some unknown reasons. The funds for this third server are being returned to ESCAP. The following activities were performed.
    - Installation and operationalization of the SAMBRO enabled server system in each country.
    - Customized the SAMBRO system according to the requirements of each country;
    - Defined the roles, responsibilities and associated permissions to edit, publish and implement specific alerts/ early warnings;
    - Generated polygons in GIS format to define areas to be used in alerting and warning task in each country, if location specific hazard/risk information is available;
    - Facilitated the visualization of hazard/risk information to provide alerts/early warnings accordingly;

- Prepared the alert/ early warning templates according to hazard types in each country;
- Made provisions for distinguishing Public, Private or Restricted alerts/early warnings and configured the system to sending private alerts/early warnings only within a Closed User Group (CUG);
- Developed messaging templates for various media like Email, SMS, RSS, Twitter, etc.;
- Created a CAP messages using SAMBRO and published in various media Email, SMS, RSS, Twitter, FTP etc. for testing.
- Databases of individuals are fed into the system for sending the alerts and early warnings. For example, more than 850 individuals belonging to various stakeholder department in Myanmar have been subscribed to the system as shown in the **Figure** below and now they receive alerts and early warnings promptly and from July 2016 to October 2016, DMH has issued more than 60 actual alerts using the system.

- **Simulation and Testing**:
  Following the training by the master trainers in their country, controlled-exercises were conducted in Myanmar[4] and the Philippines[5] and the Maldives and reports on the exercises are available at the link provided in the footnotes. The SAMBRO guide[6] provides the methodology for carrying out such exercises. The controlled exercises were carried out following the existing Standard Operating Procedure (SOP) in each country to set baselines and understand what they used to do before the SAMBRO was in place in each country. Upon simulation with the SAMBRO, a significant improvement over the existing system was observed in terms of efficiency, scalability, flexibility and use of available resources in all the three countries. Feedbacks from the users on controlled-exercises in Myanmar and Philippines were presented in Annex-I (Section 5)

  Notes:
  a) In case of the Maldives, the NDMC hired a System Administrator on a permanent basis, who was capable of managing the SAMBRO server. However, uninterrupted supply of power was a problem in the Maldives. In case of Myanmar, as mentioned earlier, DMH does not have any dedicated system administrator. However, the project participants learned the necessary technical skills to operationalize the system. Two officials were trained under this project for system administration. They are now planning to transfer their knowledge and skills to their fellow colleagues who are in-charge of operating several other servers in DMH and this will ensure the sustainability. In the Philippines, PAGASA has a dedicated and competent System Administrators to maintain and operate the system.

  b) In order to increase the user base of the SAMBRO, a mobile phone application was developed within allocated project budget. The stakeholders, especially the local authorities found the SAMBRO mobile app to be useful and versatile. The mobile app allowed for local authorities to prepare and disseminate alerts locally without using the desktop and can use the mobile application while they are out in the field as well. It improved the warning efficiencies as well as facilitated decentralization and local-level empowerment.

  c) Efforts were made to work with IFRC's Preparedness Center to feed their mobile app for each country to integrate the SAMBRO generated CAPalerts. Red Cross/Red Crescent Societies in each country had participated in all of the in-country activities and they were informed about the development and it is expected that IFRC's mobile apps in Myanmar and Philippines soon be able receive the SAMBRO generated CAP feeds and this will ensure to reach a wider audience.

  d) Example of actual deployment - the SAMBRO system in Philippines is being used as an alert hub during the recent typhoon events such as typhoon Nina, typhoon Ferdie, typhoon Gener and typhoon Haima. The SAMBRO picks up the geocodes from the PAGASA's existing system and help them visualize in a map as shown in the **Annexure-I** for super typhoon Haima (Lawin). This has been very helpful for PAGASA, which was not possible before implementation of the SAMBRO.

6	Knowledge Management	Aug-Oct 2016	Staff and other personnel costs: **$21,950.00** Contractual Services: **$3,000.00**	Staff and other personnel costs: **$21,950.00** Contractual Services: **$4658.06**

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[4] Myanmar evaluation report: https://sahanafoundation.org/myanmar-controlled-exercise-outcomes/myanmar_simulation_outcomes_report_20160830/
[5] Philippines evaluation report: https://docs.google.com/document/d/1XS2xqWSFNBh0tVN2wlI4nbSaN_t9__X4g4cnwkND2zE/edit?usp=sharing
[6] User guidelines: http://eden.sahanafoundation.org/wiki/UserGuidelines/SAMBRO

			Travel: $21,950.00 Transfers and grants to counterparts: **$4,500.00**	Travel: $11,627.21 Transfers and grants to counterparts: **$4,768.08**
and Result Dissemination				

Description of Results/Outcomes

- **Regional Workshop**
  - The participants of the regional training and workshop got to know about the Common Alerting Protocol (CAP) as well as with the SAMBRO system. Participants had appreciated the benefits of implementing the CAP for early warning and specific interests were shown from Bangladesh and the Philippines to implement/expand CAP. Some interests were shown by GIZ for implementing similar system in Philippines. RIMES were interested in using the system, and they discussed some ways to how they can encourage their member countries to implement CAP enabled system.

- **International CAP Implementation Workshop**
  - Eighty-one participants from 17 countries joined the workshop and shared their experiences of implementing CAP in their respective countries. Country specific presentations on the CAP-on-a-MAP Project were also made by the designated government officials from project implementation agencies from Maldives, Myanmar and Philippines.
  - A connection with the Finnish Institute of Meteorology and the Nepal Department of Hydrology and Meteorology was established to explore the possibility of implementing CAP at the Department of Hydrology and Meteorology (DHM), Nepal. This may provide an opportunity for integration of SAMBRO with DHM's existing early warning system for early warning dissemination to the last mile.

- **Result dissemination workshops in the participating countries**:

During the Philippines result dissemination workshop on14 Sep, 2016, GIZ continue to show their interest in implementing SAMBRO in the Cebu Metro area in the Philippines. However, there is a need to evaluate the feasibility of implementing SAMBRO for their situational-awareness information requirements. PAGASA is interested to support such CAP implementation initiatives in the Philippines.

PHIVOLCS is interested in implementing SAMBRO for tsunami early warnings. Further, NDRRMC is keen to collaborate with the PHIVOLCS to implement CAP using SAMBRO.

7	Reporting, Evaluation and Audit	Oct-Dec 2016	Staff and other personnel costs: **$9,200.00** General Operating and other direct costs: – Remuneration for an external evaluator: **$8,000.00*** – Remuneration for an external auditing firm: **$5,000.00**	Staff and other personnel costs: **$9,200** General Operating and other direct costs: – Remuneration for an external evaluator: **$6,229.86*** – Remuneration for an external auditing firm: **$4,891.43** (*This amount was spent for the traveling, accommodations and daily allowances of the external evaluator in the three countries)

Description of Results/Outcomes

Evaluation and Audit report are being done externally and reports are attached.

LESSONS LEARNED

1) The early warning systems in place in each participating country (Maldives, Philippines and Myanmar) are diverse in nature. Similarly, the level of technology used in each country and technical capabilities of the participating agencies are also different. To address this problem, country specific engagement was required to implement a state-of–the-art system like SAMBRO. This was in fact accomplished by working with the participating agencies in the countries in person as well as remotely (through the Internet) by providing necessary guidance and support to customize the system as per their country specific situations and needs.

2) In Myanmar and the Philippines, the national meteorological agencies were the leading the implementation of the project and the implementation process was quite smooth. SAMBRO being a highly technical system, we found that technical agencies like the national meteorological agencies (DMH in Myanmar and PAGASA in the Philippines) were best organizations for hosting SAMBRO form operation and maintenance point of view. In case of Maldives, the National Disaster Management Center (NDMC) was implementing the project and we found that they had limited technical knowledge and capabilities to implement the system. On the other hand, the Maldives Meteorological Services (MMS) were more familiar with early warning systems and they would have been a more suitable agency to lead the implementation the project. Accordingly, we are now convinced that technical agencies are in the best place for implementing such a highly technical project, while disaster management agencies can participate as a collaborative partner for disseminating the same to the last mile.

3) SAMBRO is operational now in all the three beneficiary countries, and Myanmar and the Philippines are actively using it. For example, PAGASA in the Philippines has used the system as an alert hub during the recent typhoon events like typhoon Ferdie, typhoon Gener, typhoon Haima, typhoon Marce and typhoon Nina (27-Dec-2016). Similarly, Myanmar issued several alerts during the progress of the recent tropical cyclone Vardha (12-Dec-2016) that made a landfall in Chennai, India. Although the cyclone was traveling in a direction away from the Myanmar coast, DMH still issued the alerts to serve as situational-awareness reports and provide the actual information on progression of the cyclone. On the other hand although the SAMBRO is operational in the Maldives since 13 October 2016, so far NDMC has not issued any alerts or early warnings. As discussed earlier, alerts and early warnings are generated by MMS, which goes to NDMC for further dissemination and it is important that MMS and NDMC cooperates closely to operationalize the system successfully.

4) The early warnings need to be customized according to the system and warning dissemination framework in place of each country. For example, in Myanmar, early warnings to public are mainly disseminated through national and regional languages. Therefore, it was important for us provide flexibility in adopting more than one languages in the system, and both English and the national language of Myanmar was incorporated into the system during the project implementation. However, if required, DMH can add regional languages to the system on priority basis. The multiple language is also included in the CAP XML as CAP country profile. Since there is no rigid rule for implementing multi-lingual information by the CAP working committee, some discussions around the same took place during the International CAP implementation workshop, where various organizations presented their workflow for handling the multi-lingual alerts.

5) To make an early warning system (like SAMBRO) more efficient and effective to the last mile, SMS gateway and possibly Cell Broadcasting facilities should be made available. In case of Maldives, NDMC was successful in convincing the main mobile phone operator in the Maldives (Dhiraagu) to provide a SMS gateway to send the early warnings. In Myanmar, the dialogue in on with the national mobile phone operators is ongoing for last several months, but no agreement has been reached yet. Similar dialogue is taking place in the Philippines, it is at a very early stage at this moment.

LESSONS LEARNED

6) In order to expedite the project implementation process, it is important to have the Memorandum of Understanding (MoU) with the lead agencies in each country. In fact we made attempts in the Maldives and the Philippines, but it could not be materialized in time due to lengthy bureaucratic procedures. In future, we will prioritize this for easy implementation of the projects in the countries.

SUSTAINABILITY

CAP being an international standard for early warning dissemination and the World Meteorological Organization (WMO) is officially promoting it to its member countries. Therefore, we found that all the participating countries took interests in implementing the project. The CAP-enabled SAMBRO system in the countries will also enhance the interoperability. For example, in case of Myanmar and Philippines, international agencies (like Red Cross) are subscribing to the system and since the early warnings are in CAP format, therefore, they can easily further disseminate the early warnings to their officials and volunteers. We also believe that implementation of the system in the countries will enhance the cooperation between the national disaster management agency and the other relevant technical agencies within a country.

A close collaboration between early warnings generating agencies and early warnings disseminating agencies is essential to succeed in this project. In Myanmar, our national counterpart, the Department of Meteorology and Hydrology (DMH) have been working with the Relief and Resettlement Department (RRD) for implementing this project and we expect that their collaboration will continue. In the Philippines, our national counterpart, the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) is currently in touch with the National Disaster Risk Reduction & Management Council (NDRRMC) for possible collaborations for disseminating early warnings. In Maldives, our national counterpart, the National Disaster Management Center (NDMC) has jointly implemented the project in collaboration with the Maldives Meteorological Service (MMS) and we believe that their collaboration will continue. Being an open-source system, the SAMBRO can be easily replicated to other agencies and the Philippine Institute of Volcanology and Seismology (i (PHIVOLCSs now considering to implement the SAMBRO for disseminating tsunami early warnings.

The SAMBRO is being used as an alert-hub by PAGASA in the Philippines and all the early warnings issued by the PAGASA are captured by the system and corresponding targeted areas are displayed in a map by retrieving the embedded locational information. This was not possible earlier in PAGASA and such routine use further confirms the sustainability of the system and efforts. We are also providing support to PAGASA to further customize the system, as they want to use it more in their day-to-day operations. Further, as discussed in Section 6, PAGASA is interested to support such CAP implementation initiatives in the Philippines, including one being proposed by GIZ in the Cebu Metro area. We believe that the Master Trainers in PAGASA in the Philippines are now capable of providing such supports nationally and if necessary, we shall be happy to support remotely.

The Master Trainers in all the beneficiary countries are equipped with all the training materials developed and provided to them during the training at AIT. The SAMBRO guide[6] is also available on-line and they have direct access to the experts available at AIT and Sahana Software Foundation through email, online chats, and telephone and they have been consulting with these experts from time to time. The experts are also monitoring the operations of the systems in all the three beneficiary countries and has been providing necessary guidance and suggestions to

SUSTAINABILITY

not only maintain them but also making further improvements.

Super Typhoon Haima (Lawin) SAMBRO Bulletin

sambro.meteopilipinas.gov.ph/eden/cap/alert/259/profile   C   Q Search

Home   Alerting   Alert Hub   Mapping   Manage Recipients   Persons   Organizations   Event Types   Administration ▾

MESSAGE ID :: 62a9ace4-588a-4369-ab7b-17f3967c902c

SOURCE :: None@http://sambro.meteopilipinas.gov.ph

🌐 AREA :: Cagayan, Isabela, Kalinga, Apayao, Ilocos No

HEADLINE :: **Tropical Cyclone Warning : Super Typhoon Lawin (HAIMA) Signal #5**

DESCRIPTION :: A super typhoon will affect the locality. Very strong winds of more than 220 kph may be expected in at least 12 hours. SUPER TYPHOON "LAWIN" HAS MAINTAINED ITS STRENGTH AS IT CONTINUES TO THREATEN CAGAYAN - ISABELA AREA. Location of eye/center : At 7:00 PM today, the eye of Super Typhoon "LAWIN" was located based on all available data at at 175 km East Northeast of Casiguran, Aurora (17.1, 123.5). Strength : Maximum winds of 225 kph near the centerand gustiness of up to 315 kph. Forecast movement : Forecast to move West Northwest at 25 kph Forecast position : • 24 Hour(Tomorrow afternoon): 270 km West Northwest of Laoag City, Ilocos Norte • 48 Hour(Friday afternoon):740 km West Northwest of Basco, Batanes (OUTSIDE PAR) • 72 Hour(Saturday afternoon): 960 km Northwest of Basco, Batanes (OUTSIDE PAR) • 96 Hour(Sunday afternoon):945 km North of Basco, Batanes (OUTSIDE PAR) • 120 Hour(Monday afternoon):1,265 km Northeast of Basco, Batanes (OUTSIDE PAR) Estimated rainfall amount is from moderate to heavy within the 800 km diameter of the Super Typhoon. It is expected to make landfall over Cagayan - Isabela Area late tonight (11:00 PM) up to tomorrow early morning (Oct. 20), (2:00 AM) then will cross Apayao and Ilocos Norte. Possible to exit PAR tomorrow evening (Oct. 20). Sea travel is risky over the eastern seaboard of Southern Luzon and the northern and eastern seaboards of Samar.

RESPONSE TYPE :: Prepare

INSTRUCTIONS :: The public and the disaster risk reduction and management council concerned are advised to take appropriate actions and watch for the next weather bulletin to be issued at 11 PM today.

INFORMATION EVENT :: Tropical Cyclone Warning

Category :: Met - Meteorological (inc. flood)
Urgency :: Immediate - Response action should be taken immediately
Severity :: Extreme - Extraordinary threat to life or property
Certainty :: Observed: determined to have occurred or to be ongoing
Effective Date :: 2016-10-24 03:46:47
Onset Date :: 2016-10-24 03:46:47
Expiry Date :: 2016-10-20 07:43:14
Information URL :: http://sambro.meteopilipinas.gov.ph/eden/cap/public/259
Sender :: PAGASA-DOST
Contact Info :: PAGASA DOST
Parameters :: layer:Google:Region:0.1: Northern Luzon, Public Storm Warning Signal Level: 5

ALERT QUALIFIERS

Sender ID :: PAGASA-DOST
Sent Date/Time :: 2016-10-19 20:06:25
Message Status :: Actual - actionable by all targeted recipients
Message Type :: Alert
Scope :: Public

Outcomes, expected changes, and performance indicators

Outcomes	Expected changes	Performance indicators
1) Awareness creation on CAP-enabled MASA and SAMBRO *(Information Stocktaking and Stakeholder Consultations)*	• Understand and follow CAP standards, policies, and procedures. • Prepare country CAP-Profile and develop policies and procedures. • Installation of Sahana software and applications for SAMBRO.	• Participatory evaluation of CAP-enabled MASA's strengths, weaknesses, opportunities, and threats (SWOT). • Participants' feedbacks on CAP-enabled MASA: ◦ Raising awareness level. ◦ Usefulness of SAMBRO.

Achievements

• Consultations with the stakeholders was carried out during the kick-off workshops in each country and workshop participants were invited to a SWOT analysis, through which they identified the real-needs and challenges for implementing the technologies facilitated through the project. Uncertainties and the dependence on the Internet were seen as challenges, however CAP and SAMBRO were perceived as useful ingredients for enhancing their warning capabilities. The all-hazard and all-media approach was proposed to implement on the countries, but given the time constraint, the stakeholders identified their priorities through participatory exercises. Through these exercises, it was also possible to map the stakeholder responsibilities to their respective National early warning systems. Identified priorities and responsibilities were documented in as blueprints, and publicly made available through the Sahana WIKI[1][2][3] to set the SMART (Specific Measurable Attainable Realistic and Timely) goals.

• The following feedbacks were received from the participants in each country:

  a) **Maldives**: Most of the early warnings are originated in MMS and they are disseminated by the NDMC to council members of the relevant islands as well as to the public. Hotlines (Phone calls) are usually used to send the early warnings to the stakeholders including the council members. NDMC also uses social media like Facebook and Twitter for disseminating the early warnings. VHF radio is also the main source of communication for the fisherman. SMS and email are rarely used for disseminating early warnings.
    − Public broadcasting services for early warnings – Stakeholders related to public broadcasting services in the Maldives were keen to integrating CAP feeds.
    − Priority calling/text messaging – NDMC emphasized that calling and text messaging related to early warning should get priorities.
    − Severity, Certainty, and Urgency – MMS uses color codes for early warnings based on severity, certainty, and urgency of the events.
    − Manageable set of events – It was suggested to focus in using CAP for important events like floods, tidal waves, storm surges, water shortages etc.
    − Hazard and risk maps - Hazard and risk maps are essential for issuing location specific early warnings and it was learnt that such maps were not available in a usable format, but some past reports were available. However, countries informed that early warnings/alerts based on lowest available administrative boundaries in each country would be sufficient. Therefore, available administrative boundaries were imported to the system from the open source platform, GADM and countries can also add their own

available boundaries as necessary.
- − Training of trainers – NDMC would discuss with the stakeholders through existing official mechanism to identify and nominate two officials to the training at AIT.
- − NDMC sought technical support for operationalizing the CAP-enabled SAMBRO system.

b) Philippines: All the early warnings related to hydro-meteorological early warnings are originated in PAGASA and it sends the early warnings to the stakeholders mainly through fax, social media, email and SMS.
- − Warnings are disseminated by the National Disaster Risk Reduction and Management Council (NDRRMC) to 17 Regional DRRMOs through Fax upon receiving from PAGASA. The Regional DRRMOs then further disseminate the warnings to 81 Provincial DRRMOs which in-turn relay the warnings to 1490 City/Municipal DRRMOs through Fax. The City/Municipal DRRMOs relay the final warnings to 42,028 Barangay DRRMOs through SMS.

c) Myanmar: DMH in Myanmar mostly used Fax, sometimes Phone as well as Single Side Band (SSB) transceiver for disseminating information to other stakeholders. DMH also uses media like TV, Radio and FM station to warn larger audience.
- − Responsibilities of DMH – DMH is responsible for issuing early warnings for natural hazards of hydrological, meteorological, and seismological origin such as tropical cyclones, heavy rains, floods, droughts, earthquakes, and tsunamis. This makes easier to implement the project in Myanmar as all the hazards are handled by a single agency (DMH), which is also our project counterpart in Myanmar.
- − Color coded warnings – DMH does the detection, monitoring, and warning of hazards. In case of a tropical cyclone, its warnings consist of yellow color (be vigilant, cyclone is forming), orange (threat is eminent, trajectory is known), red (3 hours to make landfall), brown (cyclone has made the landfall), and green (All Clear).
- − Early warning dissemination methods – DMH sends the early warnings through fax, phone calls and SSB radio. In addition DMH also uses its website, and Facebook to disseminate the early warnings. DMH has its own studio, where daily weather and bi-weekly outlook bulletins are produced to further send to the TV and Radio stations. The Relief and Rehabilitation Department receives the alerts from DMH for further dissemination to the lowest administrative units through the General Administrative Department.
- − Public broadcasting services - Daily weather and bi-weekly outlook bulletins received from DMH are aired by MRTV five times a day and four times a week respectively.

All the steps mentioned above in DMH for sending the early warning were done manually and they expected that the CAP-enabled SAMBRO system would help to automate the dissemination of early warnings at the end of the project.

2) Formation of a National working group on CAP-enabled MASA and SAMBRO	• Nomination of members to national working group by the stakeholders. • Selection of "Technology Stewards" by the stakeholders to lead the activities.	• Number of Stakeholders willing to participate in the working group.

Achievements
- The project emphasized the need to consider formulating a CAP Working Committee in each country and its importance was acknowledged

by the participating agencies in the countries and they had agreed to propose it to the competent authorities in their respective countries. The participating agencies had also agreed that it would be better for them to present the outcomes of the project first to the competent authorities in their respective countries, before pressing for the need of the CAP Working Committee.

- Selection of the Technology Stewards or Master Trainers were primary made by the lead agencies in each country. Originally, it was proposed to train one trainee in sever administration and another in early warnings from each beneficiary country. However, Myanmar requested three persons to be trained each having responsibility on seismology, meteorology, and hydrology. Myanmar's DMH does not have any system administrators, and as a consequence we had to make additional efforts to train them in system administration. On the other hand, PAGASA in the Philippines sent two system administrators and one early warning expert to participate in the training. In case of the Maldives, one system administrator was selected by NDMC and Maldives Meteorological Services (MMS) selected another official familiar with early warnings.

| 3) Developing the National CAP-Profile | • Initiation of stakeholders' discussion for developing the National CAP-Profile.
− Set internal policies for implementing the National CAP-Profile.
− Make operational changes for adopting National-CAP profile compliant alerting practices. | • Acceptability of the National CAP-Profile across the stakeholders.
− Number of design, development, and testing cycles the working group has to go through for accepting the National CAP-Profile (< 3 is good; 3-5 acceptable. > 5 unacceptable) |

Achievements

- A CAP Profile is a highly technical XML-based document that machines can interpret. In the project proposal, the CAP Profile was implied to be a CAP Implementation Plan, which is defined in the Sahana BluePrint WIKI[1, 2, 3]. Trainings were conducted in Myanmar, Philippines and Maldives to further develop the skills of the "Master Trainers" in their respective countries' set-up the system (SAMBRO) independently. This activity had also helped all the stakeholders to understand the requirements in each country for carrying out activities as per the CAP implementation plan.
  - Developed the CAP specifications for each country in consultation with various stakeholders;
  - Discussed and implemented the procedures for managing the Register of Alerting Authorities in each country;
  - Developed Standard Operating Procedures (SOPs) for CAP implementation in the relevant national agencies in each country;
  - Worked with Red Cross in Myanmar and the Philippines to get them subscribed to the system so that they can further disseminate the early warnings to their officials and volunteers.

| 4) Make Sahana Alerting and Messaging Broker (SAMBRO) operational | • Implement policies and procedures publishing and subscribing to alerts/warnings
• Prepare a Register of alerting authorities and designate a *National Editor* for managing the register.
• Develop hazard specific and reusable CAP message templates with pre-populated information to be used for alerting/warning
• Training of trainers (preferably the *Technology* | Measure the acceptability of the SAMBRO through:
• Ease-of-use
• Usefulness
• Efficiency |

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	Steward) to build institutional capacities.	

Achievements

- Servers hosting SAMBRO were setup in all the three beneficiary countries. All the required software including the dependencies were installed and the customization of the system took place progressively with the guidance from experts from AIT and SSF.
- Weekly meetings were conducted with the participating agencies from each country to discuss about their progress of work and problems in the system they were facing. Thorough guidance was given case by case for fixing the problems and operationalization the system.
- Experts from AIT and SSF guided the participating agencies for developing the message templates, predefined alerting areas, classification of warnings etc. and integrate those into the system. The alert subscribers and publisher data sheet were also imported into the system.

5) Simulation exercises	• Awareness creation on CAP-MASA through simulation exercises.	• Acceptability of the National CAP-MASA plans, policies, and procedures.

Achievements

- Following the installation and customization of the system in respective countries, the controlled-exercises were conducted. Alerts were issued to the individuals to test and verify the speed, efficiency and consistency of the system. Officials participated in the controlled exercises were divided into two groups: 1) Publisher (National Alerting Agency) and 2) Subscriber (First responders). They were requested to fill-up evaluation from to get feedbacks, which consist of Technology Acceptance Model (TAM), that describes 1) Users' perception of ease-of-use of the system (SAMBRO) and its usefulness and 2) Users' attitude in adopting the system. The ease-of-use and usefulness were given a score based on a scale of 1 to 5 (1 = strongly disagree, 2 = disagree, 3 = partial, 4= agree, and 5 = strongly agree). The attitude towards adopting the system was given a score from 1 to 7 (1 = extremely bad, 2 = very bad, 3 = somewhat bad; 4 = neutral; 5 = somewhat good, 6 = very good, 7 = extremely good). The Technology Acceptance Model results are shown in **Figure** below indicated that on average both the Publishers and Subscribers were closer to agreeing that the SAMBRO warning dissemination technology and it was easy-to-use.

Myanmar

Publishers and Subscribers (n = 34)
■ Publishers ■ Subscribers

Ease of Use — 3.72 / 3.76
Usefulness — 3.62 / 3.63

Score (1.0 - 5.0)

Philippines

Publishers and Subscribers (n = 41)
■ Publishers ■ Subscribers

Ease of Use — 3.95 / 3.73
Usefulness — 4.04 / 4.06

Score (1.0 - 5.0)

Maldives

Publishers and Subscribers (n = 13)
■ Publishers ■ Subscribers

Ease of Use — 4.61 / 4.10
Usefulness — 4.56 / 4.10

Score (1.0 - 5.0)

Figure below shows that the system (SAMBRO) was useful for them. Their attitude towards adopting SAMBRO was "very good".

| Myanmar	Philippines	Maldives
Attitude Towards Using SAMBRO (n = 34)	Attitude Towards Using SAMBRO (n = 41)	Attitude Towards Using SAMBRO (n = 13)
Publishers 5.73	Publishers 6.17	Publishers 6.25
Subscribers 5.76	Subscribers 5.97	Subscribers 5.59
Attitude Score (1 to 7)	*Attitude Score (1 to 7)*	*Attitude Score (1 - 7)*

6) Hazard, exposure and risk maps	• Use of hazard specific exposure and risk maps for alerting/warning.	• Success in providing location and hazard specific alerts/warnings.

Achievements
- The GIS module within Sahana can aggregate and visualize large geospatial datasets using web services like WMS, WFS etc.
- Geocodes were prepared and imported into the SAMBRO in CSV format and in addition, administrative boundaries such as state, province, district, sub-district etc. were also entered into the system to define areas to be used in alerting and warning task in each country, if location specific hazard/risk information is available.
- Facilitated the visualization of hazard/risk information to provide alerts/early warnings accordingly;
- Prepared the alert/ early warning templates according to hazard types in each country;
- Since island countries like the Philippines and the Maldives have hundreds of small islands, therefore, integration of these geocodes into the SAMBRO helped them to define and visualize the potential warning areas easily. **Figure** here shows a combination of using a geo-referenced map in the background to draw

warning areas (polygons) to demarcate affected areas (grey shaded polygons). The circle (in red color) is the demarcation of the warning area approximately using standard tools.
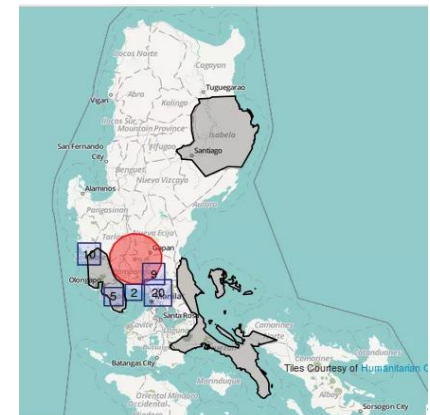
7) Make the Community	− Use hazard, exposure and risk maps developed by	• Implementation of community resilience mapping tool in

Resilience Mapping Tool (CRMT) operational	AIT or available from other sources (including those already developed by the grantees of the tsunami trust fund). − Capacity building in NDMOs and other stakeholders for using the Community Resilience Mapping Tool.	case study areas of each beneficiary country. • Replication of the same in other parts of each beneficiary country.
• CRMT is another module of Sahana suite of software and it was directly related to early warning. Therefore, only hands-on and demonstrations were given to the participants.		