German Red Cross

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DMPTC

PARTICIPATORY MULTI-HAZARD RISK MAPPING METHODOLOGY

FOR URBAN AND PERI-URBAN CONTEXTS

Module 1 – Methodology Guidelines and Training Materials

November, 2017

INTRODUCTION

Hazard risks mapping is a tool generally used by local government and communities to identify risks, vulnerabilities and disaster risk management capacities. Thus, the hazard risks mapping provides the necessary basis for developing Disaster Risk Reduction plans at the different administrative levels from commune (or ward in cities) to district, and province.

The National Societies of Red Cross Red Crescent have a long tradition in providing technical support to this process through the promotion of community engagement and inclusiveness. In a rural context, risk maps are usually hand-sketched during community meetings as part of the Vulnerability and Capacity Assessment approach (VCA).

In 2015, the German Red Cross and the Vietnam Red Cross conducted an evaluation of the VNRC Vulnerability and Capacity Assessment (VCA) and of the governmental Community-Based Disaster Risk Assessment (CBDRA) methodology with financial support of ECHO[1]. The evaluation revealed that the precision and reliability of information from those hand-sketched maps is questionable in an urban context, as VCA and CBDRA reports fail to represent local complexity. Therefore, thistly to support this reduces their relevance for Disaster Risk Reduction (or Disaster Prevention and Control) planning and more specifically for Preparedness and Response, post-disaster Damage and Needs Assessment, and their potential use in support to socio-economic development planning.

Thus, **an innovative and participatory multi-hazard risk mapping methodology adapted to the urban context was needed**.

As part of the project "**Building urban resilience in South East Asia**", funded by European Union humanitarian aid and coordinated by the International Federation of Red Cross and Red Crescent Societies (IFRC), the German Red Cross (GRC) and the Vietnam Red Cross (VNRC) have taken the lead in the development of this new methodology. Being improved from the participatory risk mapping method developed by GRC[2], the new methodology has been then piloted in three countries (Cambodia, Philippines and Viet Nam) by the Red Cross National Societies with the support of their Partner National Societies (Finnish Red Cross, German Red

[1] GRC. Final Report: Evaluation of the VCA and a comparative analysis with the CBDRA by Nguyen Thi Phuc Hoa and Melanie Miltenburg; 10/2015

[2] GRC. Guideline on participatory risk mapping using QGIS software in urban context (internal circulation). Project "Flood Proofing And Drainage for Medium-sized Coastal Cities in Vietnam for Adaptation to Climate Change"; 2015

Cross, Spanish Red Cross). With this new methodology using Quantum Geographic Information System, **QGIS multi-hazard risks maps have been developed** in nineteen urban areas and tested through simulation exercises. Those maps are easy to understand to local authorities and people; they provide geo-referenced information on hazard risks and vulnerability with attention to the most at risk groups; they provide information on ward capacity in DRM including early warning coverage, evacuation sites and routes; and they can be updated by local staff with limited GIS mapping capacity.

The new methodology aims to be used by local government authorities and local Red Cross and is described in two documents, which are logically linked together. The documents provide guidance on the development of multi-hazard risk maps in urban and peri-urban contexts using Quantum Geographical Information System (QGIS). The documents are designed in a way that they can be used as training materials.

- **Module 1: Methodology Guidelines and Training Materials**

  The contents of this module will provide DRR practitioners a **step-by-step approach for developing, updating and using multi-hazard risk maps for Disaster Risk Reduction in urban context**, and basic knowledge in QGIS (concepts, purposes of using QGIS in for developing multi-hazard risk map).

  Main parts of Module 1:

  - Overview of the methodology
  - Phase 1. Develop base maps for multi-hazard risk mapping
  - Phase 2. Participatory data collection and consolidation
  - Phase 3. Develop and verify the multi-hazard risk map with stakeholder participation
  - Phase 4. Share and update maps annually
  - Phase 5. Use multi-hazard risk maps for disaster risk reduction

- **Module 2: Technical Instructions on the use of QGIS for the development and updating of multi-hazard risk maps**

  The contents of the Module 2 will provide DRR practitioners the detailed instructions for using QGIS for the development and update of multi-hazard risk maps

  Main parts of Module 2:

  - Part 1: Installation of QGIS software and administrative boundary identification of the mapping areas.
  - Part 2: Using of QGIS for the development of multi-hazard risk maps at urban areas.

- Part 3: Updating information and data using the QGIS
- Part 4: Collection of information and data on field with GPS, smartphone and updating the risk map using the QGIS.

To illustrate the different steps for the development and update of multi-hazard risk maps at local level using QGIS, this guideline and training material provide examples in the context of Vietnam. Specifically, cities in this context are divided administratively in two levels: ward and hamlet (at each city there will be wards, under which will be hamlets). Generally in South East Asia, DRR related activities at the lower government level (such as ward and hamlet in Vietnam) are supported by dedicated staff (or group of staff) but with limited capacity. Despite this limitation, through the experience gained during the piloting of this methodology in Vietnam, Philippines and Laos it has been demonstrated that mapping can be done (and have been done) by local government staff if they have been clearly tasked by their leaders for this role. In this guideline, those dedicated local government staff in charge of mapping will be referred as Technical Support Group or TSGs.

It is to mention that some of the sections of this new methodology have been developed based on a guideline on Disability inclusive Community based Disaster Risk Management developed by Malteser International[3], based on the Community-Based Disaster Risk Assessment methodology[4] from the Vietnam Ministry of Agriculture and Rural Development, and based on the Guidelines for Gender Integration[5] by National Center for Disaster Management.

[3] Disability inclusive Community based Disaster Risk Management developed by Malteser International: https://drive.google.com/file/d/0B-zyTobUfIjLUkpibWpDSDZUUFU/view?usp=sharing

[4] Developed by the Disaster Management Center, Ministry of Agriculture and Rural Development (funded by UNDP Vietnam); 2015

[5] Developed by the Disaster Management Center, Ministry of Agriculture and Rural Development (funded by UN Women Vietnam), in publication process

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ABBREVIATIONS

CBDRA	Community based disaster risk assessment
CBDRM	Community based disaster risk management
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
GIS	Geographic Information System
GPS	Global Positioning System
MARD	Ministry of Agriculture and Rural Development (in Vietnam)
PWDs	People with disabilities
QGIS	Quantum Geographic Information System
TSG	Technical support group
VCA	Vulnerability and Capacity Assessment

TERMINOLOGIES

DISASTER RISK MANAGEMENT (DRM)

a) Capacity

The UNISDR[6] defines capacity as the combination of all the strengths, attributes and resources available within an organisation, community or society to manage and reduce disaster risks and strengthen resilience. Disaster Risk Management capacity consists of all the resources available in the community (facilities, human and financial resources) to be used for disaster risk reduction.

Example:

Area with storm resistant permanent houses, disaster risk reduction plan developed by both local DRM authorities and community; solidarity and mutual support of community, local people having experience in disaster response and recovery etc.

b) Vulnerability

The UNISDR[5] defines vulnerability as the conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards. Vulnerability means the characteristics of a community that make it less able to resist, absorb, accommodate, adapt to and recover from the effects of a hazard.

Example:

Many potholes on the village roads cause difficulties for people with visual impairments during evacuation; un-trained first-aid and rescue teams; people do not evacuate in proper time manner as a consequence of their subjectivity; many riverside houses are vulnerable to landslide.

c) Vulnerable people

Vulnerable people indicate groups of people whose characteristics and circumstances make them vulnerable to a hazard and more difficult to recover than others in the community.

[6] UNISDR Terminology - https://www.unisdr.org/we/inform/terminology#letter-v

Vulnerable people[7] include children, the elderly, pregnant women or women nursing a baby, people with disabilities (PWDs), people with serious diseases and the poor.

d) Community-based disaster risk management (CBDRM)

Community-based disaster risk management promotes the involvement of potentially affected communities in disaster risk management at the local level. This includes community assessments of hazards, vulnerabilities and capacities, and their involvement in planning, implementation, monitoring and evaluation of local action for disaster risk reduction[8]. Community-based disaster risk management is a process in which the local community, including vulnerable groups, actively engages in defining the problem, analyzing the causes, planning, implementing, monitoring and evaluating the implementation of disaster risk reduction plans in order to reduce vulnerability and enhance resilience to cope with disasters.

e) Disaster risk assessment

Disaster risk assessment is the process of gathering, synthesizing and analyzing information on the capacity and vulnerability with the participation of local people.

f) Disaster risk reduction plan (DRR plan)

Disaster risk reduction is aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development[7]. DRR plan is a set of activities to be implemented in the phase of disaster preparedness, prevention, response and recovery to minimize the damages, and contribute to sustainable social-economic development.

GENDER

a) Sex

Sex means the biological characteristics of men and women[9]; differences in biological characteristics expressed through body composition and reproductive function of women and men. These characteristics are available upon birth and cannot be changed.

Example:

Women have ovarian with the ability of pregnancy and childbirth. Men have sperm.

[7] Law No. 33/2013/QH13. Law on on Natural Disaster Prevention and Control in Vietnam; 2013
[8] UNISDR Terminology - https://www.unisdr.org/we/inform/terminology#letter-v
[9] Gender Equality Law: Article 5 (Words explanation), 73/2006/QH11, approved by Vietnam National Assembly dated November 29 2006.

b) Gender

Gender means the characteristics, the positions and roles of women and men in all social relationships[6]. These characteristics, locations, and roles are:

- Prescribed by the society;
- Formed through the process of education and nurturing; different in each country, region; depending on each specific culture, changed along with the socio-economic development.

Example from the Vietnam context:

In the feudal period, women were prescribed only to do housework, get pregnant, give birth and bring up children, while men (considered as the family's backbone, having the powers) participated and decided all the key matters in the family and society. Nowadays, the economic and social development has lessened the gender gaps especially in leadership positions, which were mostly male-dominated occupation in the past. In rural areas, the roles of women also have been empowered, for example, women participate in making important decisions in the family, being able to use technical means at fields etc., while man starts doing housework and taking care of children etc.

In recent years, women involvement in DRR activities has also increased, i.e. coordinating CBRDA, organizing evacuation drills, DRR planning, being members of the rescue team. Meanwhile, men also participate in logistics preparations and support administrative tasks in the CBDRA meetings, DRR planning or communication events.

c) Gender equality

Gender equality refers to the equal rights, responsibilities and opportunities of women and men and girls and boys[10]. Equality does not mean that women and men will become the same but that women's and men's rights, responsibilities and opportunities will not depend on whether they are born male or female. Gender equality implies that the interests, needs and priorities of both women and men are taken into consideration, recognizing the diversity of different groups of women and men. Gender equality is not a women's issue but should concern and fully engage men as well as women. Equality between women and men is seen both as a human rights issue and as a precondition for, and indicator of, sustainable people-centered development.

[10] UN WOMEN- Concepts and Definition. http://www.un.org/womenwatch/osagi/conceptsandefinitions.htm

Example:

- *Men and women participate in DRM committees at all levels. Thus, women are involved in decision-making processes in DRR planning as men;*
- *Women are given the equal opportunities for capacity strengthening by attending in training course of CBDRM.*

d) Gender roles

- Roles of gender mean the specific jobs and activities that women and men are doing in reality[4].
- The roles of gender can change either fast or slow depending on the job characteristics and requirements; production tools, the development level of economy, science and technology; the progress in the elimination of gender prejudice in society. These roles need to be shared equally between the two genders.

Example from the Vietnam context:

In the feudal period, as the head the family, men were responsible for family income and community and society activities while women's roles were mainly non-income tasks such as childcare, housework etc. However, the gender roles have changed nowadays as results of economic and social development.

PEOPLE WITH DISABILITIES (PWDs)

"Disability results from the interaction between people with impairments and attitudinal and environmental barriers that hinder their full and effective participation in society on an equal basis with other."[11]

- Impairment is referring to the functions or changes in body composition. There are 5 main types of impairment: physical, vision, hearing - speaking, intellectual and mental health.
- Barriers are factors (from the PWDs themselves or their family and the society) preventing the PWDs from effective and equal participation in social activities. Barriers can visible or invisible.

There are 4 main types of barriers:

- *Physical barriers* (visible):

Example:

There is no special access for wheelchairs in village cultural houses, which cause difficulties for PWDs using wheelchairs to participate in the DRR planning process.

[11] United Nations Convention on the Rights of People with Disabilities

- *Informational and communication barriers (visible):*

> ***Example:***
>
> *The early warning information reaches villagers through loudspeakers, but this system does not work with deaf person living alone.*

- *Attitudinal barriers (invisible):*

> ***Example:***
>
> - *PWDs are not involved in the DRR planning process as local DRM authorities considered them as people need supports during disasters rather than contributors.*
> - *PWDs do not want to participate in the DRR planning meetings due to their feeling of inferiority.*

- *Policy and Institutional barriers (visible):*

> ***Example:***
>
> *There is no legal document requiring having PWDs representative in technical support groups (TSG) in National CBDRM Program.*

Disability is the interaction of two factors: (1) the impairment of a person and (2) barriers from that person himself/herself or his/her families and society. Removing the barriers will help PWDs participate effectively in DRR mapping.

PARTICIPATION (IN A MEETING CONTEXT)

a) Definition of participation

- Participation is the presence and contribution of opinions to the decision-making process during the meeting.
- Attendance is the presence but not contributing opinions to decision-making process.

b) Indicators of a participatory meeting

A participatory meeting has the following criteria:

- All the opinions and feedbacks from members are listened and respected by facilitator, before the final decisions have been made together.
- Members are confident to raise their voices and request to get the feedbacks on their opinions.

GIS AND MAPPING

a) Disaster risk mapping

Disaster risk mapping is a tool used to gather specific information on the capacity, vulnerability and disaster risks of the community with respect to (i) public safety; (ii) production and business; (iii) health, sanitation and environment. The information gathered from this tool helps the TSGs at all levels to build a realistic DRR plan; especially the information on prioritized early warning and early evacuation.

b) Base map (for drawing the multi-hazard risk map)

Base map provides basic information of a map (such as rivers, roads…) to help the local people and related stakeholders easily imagine and draw the remaining information required for a multi-hazard risk map.

c) Geographic Information System (GIS)

Geographic information system is a tool for mapping and analyzing information and data, phenomena on the earth. GIS can be applied to: analysis, forecast of the impacts of natural hazards and for support for making DRR plans.

d) Open Source Software - QGIS

Quantum Geographic Information System, or also known as QGIS is an open source software of GIS. QGIS can support most of basic functions of a GIS software including: data management, reading many data formats, editing and publishing maps, exporting - importing data and spatial analysis functions.

Compared to conventional mapping tool such as hand-drawing in the Vulnerability and Capacity Assessment (VCA), QGIS software application has the following advantages:

- Ensure the accuracy of the information on the map;
- Manage a variety of information and publish different types of maps as required;
- Easily edit, add and update information when necessary;
- Easily share the map to the stakeholders involved.

With these benefits, QGIS mapping will be a strong tool for the development of DRR plan (besides other collecting tools of CBDRA or VCA). In additions, it will support the local authorities to develop social economic development plan incorporating with DRR plan.

The information displayed on the map can also be a useful source of information for different stakeholders as reference to select areas for damage assessment or to compare damage levels with data from previous years.

OVERVIEW OF METHODOLOGY

Drawing the participatory multi-hazard risk maps at ward level using QGIS needs to go through 5 phases with 15 steps in total:

- Phase 1. Develop base maps for disaster risk mapping
- Phase 2. Participatory data collection and synthesis
- Phase 3. Develop multi-hazard risk map at ward level with stakeholder participation
- Phase 4. Share and annual update multi-hazard risk maps
- Phase 5. Use multi-hazard risk map for DRR activities

The overview of these phases is shown in the Figure 1 below.

Note:

TSGs/DRR practitioners should consider planning GIS mapping as part of the disaster risk assessment at ward level and not in addition to it. For localities that already have paper-based DRR maps from previous VCA/ CBDRA, TSG can use them together with additional information collected to make the multi-hazard risk map using QGIS.

In addition, appropriate time for mapping should be considered so that the required information can be timely provided for local DRR planning and for other relevant uses. If it is done too late, multi-hazard risk mapping will no longer be as meaningful as expected as it will be disconnected from other the DRR planning process.

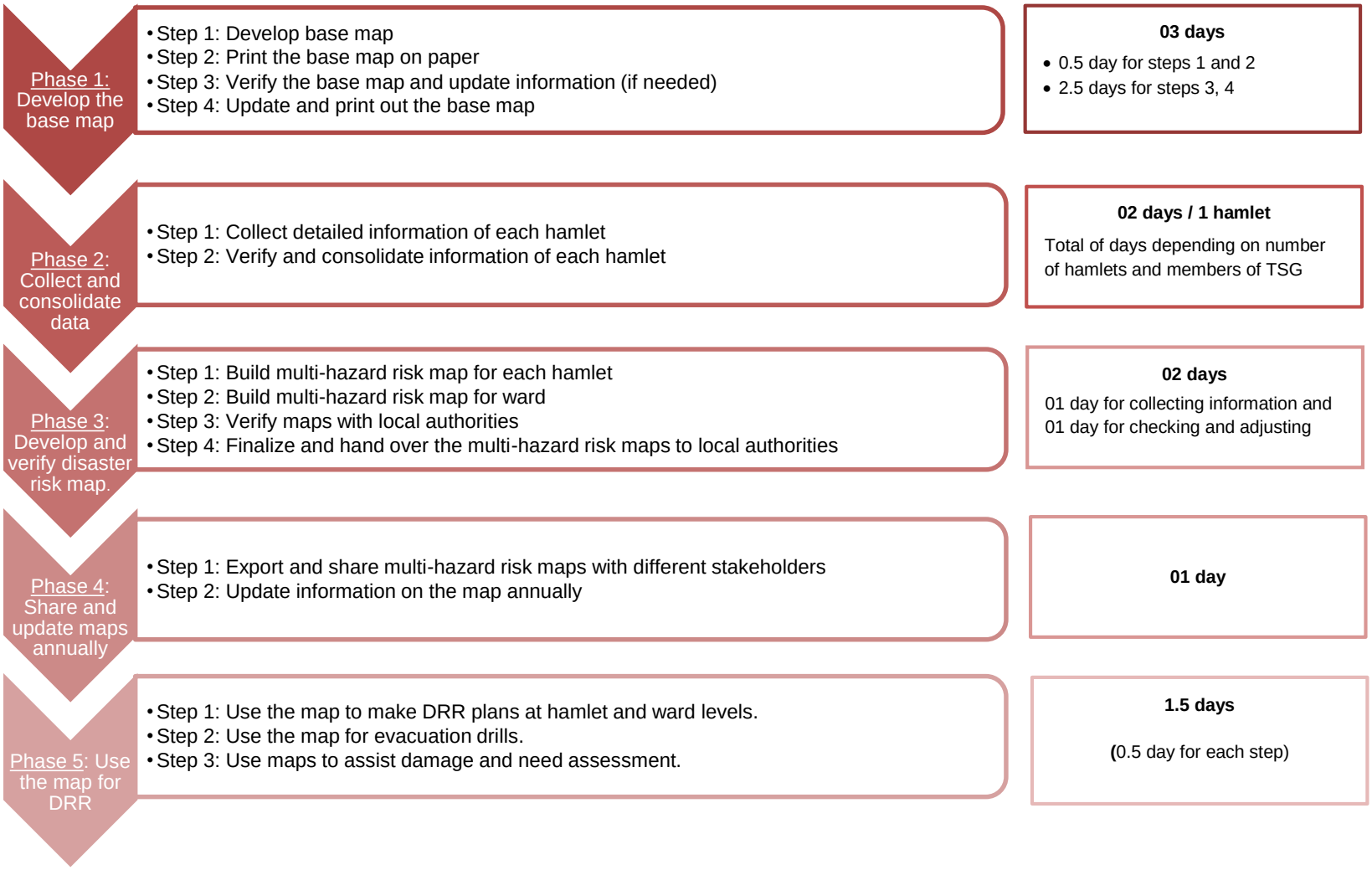

Figure 1. Phases of multi-hazard risk mapping methodology

PHASE 1. DEVELOP BASE MAPS FOR MULTI-HAZARD RISK MAPPING

Phase 1 consists of four key steps with the aim of developing base maps at hamlet and ward levels, which will be used in meetings with different stakeholders in **Phase 2**. To develop these base maps, QGIS need to be installed from **Phase 1**. Please refer **Module 2 - Part 1**.

STEP 1. DEVELOP BASE MAP

1.1. Expected results

Base map for hamlets and ward are created with basic information. A base map of a hamlet or a ward usually consists of the following information:

- Name of the map
- Direction of the map
- Adminstrative boundaries of hamlet/ward
- Main streets
- Rivers, mountains (if any)
- Basic infrastructures in the hamlet/ward such as schools, hospitals…
- Cultural houses of local people in the hamlet/ward

1.2. Participants

TSG members at ward levels are the ones who will develop base maps.

1.3. Implementation

In this step, TSG will follow steps mentioned in **Module 2 – Part 1** and **Part 2** to build a draft of base map before printing for verification with related stakeholders.

The information to create a base map can be found from:

- Free international sources: Google Map, Open Street Map, and satellite image.
- Local source: Administrative maps; maps from programs and projects; thematic maps available in the locality.

Note:

Other sources of information will also come from the local people and stakeholders, especially those who have deep understanding of the topography of the regions. Their contribution is shown in **Step 3** of this phase.

STEP 2. PRINT THE BASE MAP ON PAPER

2.1. Expected results

The draft version of base maps built in **Step 1** is printed and ready for next step.

2.2. Participants

Members of TSG of the ward

2.3. Implementation

The TSG will print the base map on large-scale paper to prepare for next step – verify information with related stakeholders (detailed instructions shown in **Module 2 – Part 2**).

The purpose of this step is to verify information and update it on base map (for example: roads, offices, schools etc.). To help hamlet leaders, land officials and related participants to verify and provide accurate information, TSG needs to show the base map on large scale. Depending on conditions, the base map can be printed on A0 paper or be presented via a projector. In case the there is only 1 or two people participating, TSG can show the map on their computer and make immediate update.

STEP 3. VERIFY THE BASE MAP AND UPDATE INFORMATION

3.1. Expected results

Information of the draft of the base map is verified, updated (if necessary).

3.2. Participants

Members of ward's TSG, land officials and hamlet leaders.

3.3. Implementation

TSG will organize two meetings for information verification:

- The first meeting:
    - Meeting with one or two land officials.

- Activities: present purposes of the map development, information available on base map and request them to verify, update information (if necessary). After the meeting, depending on the relevant of the information collected, members of TSG start to correct them on the map before the second meeting with hamlet leaders.

- The second meeting:
  - Meeting with hamlet leaders (who know well the hamlet).
  - Activities: present purposes of the map development, information available on base map and request them to verify, update information (if necessary).

STEP 4. UPDATE AND PRINT OUT THE BASE MAP

4.1. Expected results

Base map is updated (if necessary) and printed on large-scale paper.

4.2. Participants

Members of ward's TSG, land officials and hamlet leaders.

4.3. Implementation

After the second meeting, the TSG will adjust information on base maps of each hamlet (please see guidelines in **Module 2– Part 2**) based on relevant comments of hamlet leaders, which will be helpful to collect information from residents in **Phase 2**.

Note:

Verification and updating the base map can also be done in **Phase 2** - Collecting information from local people during disaster risk assessment. This has been successfully tested in the project area by Philippine Red Cross.

SUMMARY

In **Phase 1**, you have gone through four steps:

- Step 1: Develop base map
- Step 2: Print the base map on paper
- Step 3: Verify the base map and update information (if needed)
- Step 4: Update and print out the base map

After these steps, now you are supposed to have the following products:

1. The soft files of the base map in QGIS, which are developed for each hamlet and the entire ward, including different basic layers such as roads, rivers, boundaries;
2. Printed base maps for all hamlet and the entire wards, which will be used in **Phase 2** to collect information through meetings.

PHASE 2. PARTICIPATORY DATA COLLECTION AND CONSOLIDATION

This phase, consisting in collecting information of the entire ward, is the most time and budget consuming phase of the multi-hazard risk mapping methodology. It is because with participatory approach, there will be various meetings at hamlet and ward levels to fully and accurately collect and verify information from different populations in the ward, especially from vulnerable groups such as PWDs, children.

This chapter describes the two main steps of **Phase 2** necessary (i) to collect and verify information and data for each hamlet and (ii) to consolidate them for the entire ward.

Figure 2. Collect information on the base map, Cambodia

INFORMATION FOR MULTI-HAZARD RISK MAP

Basically, with for main objective to support the DRR planning process, the following information need to be collected for the multi-hazard risk maps:

- Capacity on DRR of the community
- The vulnerability of the community
- The risk that the community can encounter when disaster occurs

This information can be categorized in different ways in each country based on their policies, context and assessment tools. In Vietnam, as mentioned in CBDRA guideline, there are three main areas to consider: (i) community safety, (ii) business, and (iii) health, sanitation and environment and three aspects: (i) materials, (ii) social organisation and (iii) awareness, experience, attitude, motivation. Details are mentioned below:

- Community safety:
    - The types of natural hazards frequently occurring in the community.
    - The early warning systems in place for natural hazards to alert the community, and especially for those who need special support for early warning.
    - Risks for the local people upon evacuation, especially vulnerable groups.
    - Support for the local people and related stakeholders to early evacuation, especially those who need special assistance in an evacuation.
    - Support equipment for the local community to respond to disasters.
- Production and business:
    - Main production and business activities for income.
    - Impacts of disasters on the production and business activities
    - Mitigation activities done by the local people and enterprises to reduce the impacts of natural and man-made disasters to their livelihoods
    - The support for the local people and enterprises to mitigate the damages to production and business activities in case of disaster (support already available and the needs for additional support for future disaster)
- Health, hygiene, environment:
    - The use of clean water
        - The daily use of clean water
        - The daily use of clean water during the rainy season/disaster

        - The support needed for the local people regarding clean water (support already available and the needs for additional support for future disaster)
    - The use of the toilets during disaster
        - The number of households with toilets
        - The use of toilets upon the occurrence of a disaster
        - The support for the local people regarding hygienic urination (support already available and the needs for additional support for future disaster)
    - Waste treatment during and after disaster
        - The method of waste treatment during and after disaster
        - The support for garbage collection (support already available and the needs for additional support for future disaster)

Note:

- Collected information should be disaggregated by sex, types of vulnerabilities and disaster risks.
- Detailed questions for data collection are in the **Annex 1**.
- The source of information for multi-hazard risk mapping can come not only from local people and local authority but also from existing maps of different related programmes and projects (if applicable).

STEP 1. COLLECT DETAILED INFORMATION OF EACH HAMLET

1.1. Expected results

The TSGs have:

- Paper map of each hamlet to put in digital map using QGIS.
- Summary tables with information on capacity, vulnerability and disaster risks (from mapping tasks) of each hamlet, which include information from:
    - PWDs
    - Children
    - Other local people in the hamlet
    - Schools
    - Enterprises
    - Religious organisations
    - Authorities of the hamlets
- List of households to prioritize for early warnings and evacuation assistance for each hamlet, including information of PWDs.

- List of households living at the hamlet, who need to evacuate but without special need of assistance (can be affected by disasters, not safe if staying at home).

1.2. Participants

Figure 3. PWDs group meeting in Vietnam

There are three following groups of participant per hamlet:

1.2.1. Group 1: PWDs and their relatives

- 15 PWDs and relatives of PWDs per meeting:
- PWDs (both men and women) with different types of disabilities in the hamlet, who are living in areas that are often affected by disasters, able to participate in the meeting.
- Relatives of PWDs who are not able to participate (e.g., people with mental impairment, people with severe mobility impairment, children with disabilities under 10 years of age).

1.2.2. Group 2: Children

- 10 to 16 children
- They are representing the children of the hamlet, who are at age from 10 to 16, able to participate and living in disaster-prone areas, including children with disabilities.

Figure 4. Children group meeting in Vietnam

1.2.3. Group 3: Representatives of the hamlet

- Representatives of businesses in the hamlet or organisations representing enterprises, for example Enterprise Association.
- Representatives of the local people, especially people living in the hamlet for long time and familiar with the hamlet, representatives of group 1 and group 2. The proportion of men and women in each meeting should be balanced.
- Representatives of the schools
- Representatives of religious organisations
- Representatives of the hamlet authorities.

1.3. Implementation

In this step, the TSG will hold three meetings with these three groups in each hamlet to gather detailed information on capacities, vulnerabilities and disaster risks. Collected information at hamlet level will be put on printed base map (prepared in **Phase 1**) before developing the digital map using QGIS. To collect adequate information, especially from vulnerable groups, TSG need to implement the following activities:

1.3.1. Mapping on printed base map and listing prioritized households for early warning and early evacuation

In order to mobilize effective participation of PWDs and children groups (Group 1 and Group 2) in the hamlet and ward mapping process, the TSG firstly needs to work separately with these groups and to help them drawing their risk maps. After that, some of them are invited as representatives for their groups to participate in Group 3 to draw the entire hamlet map. This additional step is necessary as it enables the PWDs and children to:

> *"Professionally, I'm an information technology graduate, that´s why it was easier for me to use the QGIS and mapping technology. I was one of the participants on the QGIS workshop and I was fully involved in the process. I find it useful because we can map out the hazards and resources available and at the same time we can keep on updating our maps via online and it's easy to be understood once your output is released unlike our traditional spot map (hand-drawn) before."*
>
> **Joshua Gerald Augustine Dela Cruz** (beneficiary), Barangay Tatalon, Philippines

- Be used to the tool - drawing multi-hazard risk map on paper. This helps them feel more confident to participate and to provide their information together with other local people in the other meeting (with group 3).
- Identify their own capacities, vulnerabilities and risks in order to be confident in providing, and integrating their information into the entire hamlet map. This includes sharing the suitable solutions that they have identified for their specific needs for DRR planning.
- Select their representatives to present and share their information to the entire hamlet map.

For those reasons, the process of information collection of each hamlet using printed base map will be implemented as follows:

i. Collect information from PWDs and their relatives through drawing their multi-hazard risk map and collect the lists of prioritized people for early warning and evacuation.
ii. Collect information from children through the drawing of their multi-hazard risk map.
iii. Collect information of the entire hamlet through drawing hamlet's multi-hazard risk map and develop hamlet lists of prioritized households/people for early warning and evacuation, which are also based on the maps and the prioritized lists that the PWDs and children have developed in the previous steps.

Detailed tips for facilitating the three groups will be shown in **Annex 2**.

1.3.2. Collect information using smart-phones and Global Positioning System (GPS) devices

Please see the detailed guidance in **Module 2– Part 4**.

- The TSG will use the smartphone or a GPS device to collect information such as photos, geographical coordinates, status description of a specific object.
- Collected information from the field will help to supplement and verify information provided by local people and other stakeholders in the hamlet.

> *"I participated in the project as an information collector. I collected information such as community resources, geographical boundaries and paths. I used the GPS to check points to be uploaded to the map. I feel very happy to have participated in this initiative because I got new experience; I got to know people from other projects."*
>
> **Poeung Sothea**, Prey Rusey Village, Red Cross

1.3.3. Synthesize information for the entire ward

In this step, based on all collected information, the TSG will first verify information for each hamlet. At ward level, information of all hamlets will be synthesized into a common table. In additions, the TSG will also develop the ward's lists of the prioritized households/people for early warning and evacuation assistance from those at hamlet level.

STEP 2. VERIFY AND CONSOLIDATE INFORMATION OF EACH HAMLET

2.1. Expected results

Through this step, TSGs will have:

- Detailed information of each hamlet verified for developing digital map.
- Lists of prioritized households for early warning and evacuation assistance at ward level.
- The summary table of the capacity, vulnerability and disaster risks of the whole ward.

2.2. Participants

TSGs, representatives of different hamlets and local authorities in charge of DRR.

2.3. Implementation

This step will go through several activities, which are mentioned in details below:

a) Verify information of hamlets (based on paper maps with collected information)

- Explain the purposes of the meeting;
- Agree on working method;
- Invite representatives of the hamlets to represent their maps and the related information;
- Invite the local authorities to verify and comment on the multi-hazard risk map and the related information;
- Invite hamlets' representative to provide feedbacks;

- Take notes of reasonable comments to adjust the map and related information.

b) Develop the ward's prioritized lists of households for early warning and evacuation

- Explain the purposes of developing the prioritized lists of the ward;
- Explain how to prepare the lists;
- Invite the head of hamlets to present their lists;
- Get agreement on the people that need support from ward level and to be put in the lists;
- Consolidate the list and arrange in priority order.

c) Consolidate information of the whole ward:

TSGs can use the **Table 1** of each hamlet (see **Annex 2, Table 1**) to consolidate the information from different hamlets into a ward level table. Information should be categorized into three areas and three aspects, focusing on gender and vulnerable groups.

Tips:

- To reduce the time for implementing this step, each member of TSGs and hamlet leaders should have clearly assigned tasks in order to collectively consolidate information in a common table.
- TSGs can use the checklist in **Annex 3** to keep track on the process.

SUMMARY

In **Phase 2**, the information and data for multi-hazard risk mapping are collected through the following steps:

- Step 1. Collect detailed information of each hamlet
- Step 2. Verify and consolidate the information of each hamlet

Through conducting these steps, you will have:

1. The paper-based maps of each hamlet and the entire ward.
2. Lists of prioritized households for early warning and evacuation assistance at hamlet and ward levels.
3. List of self-evacuating people of each hamlet.
4. Photos and coordinates of specific objects.
5. Detailed notes of all meetings.

PHASE 3. DEVELOP AND VERIFY THE MULTI-HAZARD RISK MAP WITH STAKEHOLDER PARTICIPATION

In this phase, TSGs will use the information and data collected in **Phase 2** to develop the digital multi-hazard risk maps for each hamlet and for the entire ward. These maps will then be verified with local authorities and hamlet leaders. This session will present 4 key steps to achieve these aims.

STEP 1. BUILD MULTI-HAZARD RISK MAP FOR EACH HAMLET

1.1. Expected results

TSGs and local authorities will have digital multi-hazard risk maps of all hamlets.

1.2. Participants

TSGs

1.3. Implementation

There are two methods to transfer collected information and data into the digital map:

- Directly (or manually) transfer the information from paper-based maps into the digital map;
- Transfer the information using scanned files/photos of the paper-based maps.

a. Directly transferring the information from paper-based maps into the digital map:

In this method, the TSGs will use three tools from the QGIS software (i) creating points, (ii) creating lines and (iii) creating polygons to directly transfer information from paper-based maps to digital map. The guidance on how to use these tools is mentioned in **Part 3** of **Module 2**.

The accuracy of this method of data transfer highly depends on TSGs' capacity to compare the positions of objects shown in paper-based map with those shown in digital map (Figure 5).

Example:

In order to transfer the information of evacuation houses/centers shown in paper-based map, TSGs will first identify manually their positions in paper-based maps, then use the tool of QGIS to create the relevant points in the digital map shown in their computer.

Figure 5. Paper-base map with collected information of one hamlet in Vietnam

b. Transferring the information using scanned files or photos of the data collection maps

Transferring information through scanning or taking photos of paper-based maps shall be done in 3 activities as follows:

Activity 1: Scan or take photography of the paper-based maps with the information drawn by local people.

Note:

- If paper-based maps are too large for scanning/taking photos as the whole, TSGs can divide the maps into smaller pieces.
- The scans or photos should be saved as jpeg file (.jpg) with the resolution of 200 - 300dpi.

Activity 2: Geo-referencing of the scanned files or photos

Geo-referencing is the process to add real coordinates to the points in JPEG or other raster files. This is the most important step in preparation for transferring information into digital map.

In order to do geo-referencing, it is necessary to install the “Georeferencer GDAL” plugin in QGIS software. To check if this plugin is installed or not, please see the guidance in **Part 3** of **Module 2**.

Activity 3: Transfer information and data in digital map

After manipulation of the coordinates system, transferring information and objects can be implemented using the tools of creating new layers or editing existing layers in QGIS (Please see **Part 2 – Module 2** for detailed instructions).

The type of layers depends on information in the map, which is classified into 4 basic types:

- Point: is an object of a small area such as: office building, schools, factories, cultural houses, etc.
- Line: shows an unclosed geometrical object, including straight lines, polylines and curved such as: roads, rivers, streams, etc.
- Polygon: shows a closed geometrical object covering a certain area. This can be in a shape of a polygon oval, ellipse and rectangle. For example: administrative boundary of one commune, lakes, forests, etc.
- Text: shows non-geographical features of the map such as labels, titles, notes, etc.

STEP 2. BUILD MULTI-HAZARD RISK MAP FOR WARD

2.1. Expected results

TSG and local authorities have multi-hazard risk map of the whole ward.

2.2. Participants

TSGs

2.3. Implementation

After digitalizing the multi-hazard risk map for each hamlet, in this step the TSGs will consolidate these maps to create a multi-hazard risk map for the entire ward.

For this purpose, the TSGs will have to open all layers of all hamlets in the ward base map. New layers will also be created if necessary. For instance, some households/people on the hamlets priority lists for early warning and evacuation may have to evacuate in another hamlet than where they live. Thus a new layer for mapping those people will have to be created.

For further details please refer to **Part 3 – Module 2**.

STEP 3. VERIFY MAPS WITH LOCAL AUTHORITIES

3.1. Expected results

The multi-hazard risk maps of the hamlets and the entire ward, the lists of prioritized households for early warning and early evacuation, and a summary table of capacities, vulnerabilities and disaster risks are verified.

3.2. Participants

TSG, hamlet leaders and local authorities.

3.3. Implementation

At this stage, the TSG will hold a meeting with the hamlet leaders and local authorities to:

- Present the following information:
  - Information on the multi-hazard risk map of the ward (including hamlets information);
  - Ward lists of prioritized households for early warning and evacuation (including hamlet information);
  - Summary table of capacities, vulnerabilities and overall disaster risks.
- Collect comments from stakeholders to adjust (if appropriate).

STEP 4. FINALIZE AND HAND OVER THE MAPS TO LOCAL AUTHORITIES

4.1. Expected results

- The multi-hazard risk maps for all hamlets and the entire ward are finalized based on results of verification meeting with the stakeholders in **Step 3**.
- The local authorities have digital multi-hazard risk maps of all hamlets and the whole ward as well as the relevant information. These products can be shared with stakeholders at different levels for many purposes.

4.2. Participants

TSG and local authorities.

4.3. Implementation

- Finalization of the map: Based on the results of the verification meeting, the TSG will adjust the information to finalize the map before handing it over to the authorities. The method for adjustment is shown in **Part 2** (**section 4) of Module 2**.
- Handover of digital maps: The TSG will hold a meeting with representatives of the local authorities to:
  - Review the revised points based on the verification results in **Step 3**;

- Officially hand over the digital and paper-based maps of hamlets and ward and related information (hard and soft files) to the authorities, who can use and share with stakeholders at different levels for many purposes.
- Demonstrate how relevant detailed information collected in **Phase 2** can support DRR activities and planning, and the socio-economic development planning.

Note:

In order to ensure ownership of the local authorities for the maps and QGIS mapping approach, the TSG should clearly demonstrate the benefits of using these digital maps (compared to conventional hand-drawn disaster risk maps). For instance the TSG can explain that those maps are easy to store, update and adjust if needed, easy to share with other stakeholders, and they can be used in many purposes. They are also better for visualizing different data and information. This introduction will help the local authorities using these products effectively. Some suggestions about the possible use of those maps for the different stakeholders is presented in details in **Phase 5**.

SUMMARY

In this session, you have gone through four steps of **Phase 3**:

- Build multi-hazard risk map for each hamlet
- Build multi-hazard risk map for the entire ward
- Verify maps with local authorities
- Finalize and hand over the multi-hazard risk maps to local authorities

And you will have the below products:

1. Soft-files in QGIS of the multi-hazard risk map for each hamlet
2. Soft-files in QGIS of the multi-hazard risk map for the entire wards
3. Lists of prioritized households for early warning and evacuation assistance at hamlet and ward levels.
4. List of self-evacuating people of each hamlet.

PHASE 4. SHARE AND UPDATE MAPS ANNUALLY

Phase 4 focuses on sharing the Multi-hazard risk maps to a wider audience and updating them annually. The sharing of these maps can be implemented through different methods, which are presented in the two following two steps.

STEP 1. EXPORT AND SHARE THE MAPS WITH DIFFERENT STAKEHOLDERS

1.1. Expected results

The final multi-hazard risk maps are printed out and shared to local people and stakeholders.

1.2. Participants

TSGs and local authorities.

1.3. Implementation

To share the map and related information with local people, stakeholders at all levels, the TSGs should take the following activities:

a. Export the multi-hazard risk maps into printing format:

Depending on the purposes multi-hazard risk map, its resolution and scale should be adjusted accordingly. Please see the detailed instructions **Section 2**, **Part 2** of the **Module 2**.

b. Share printed maps and related information with local people and other stakeholders

Before sharing the maps and related information to local people and stakeholders at all levels, TSGs should identify clearly:

(i) the target groups with whom to share information,

(ii) the information to be shared with each target group,

(iii) the reasons for sharing those information,

(iv) the most relevant methods for sharing the information.

In order to facilitate this identification, as a starting point to discuss among themselves, the TSGs can use the table of suggestions for sharing the mapping products provided in **Annex 3**. To decide which information and how it should be shared, the TSGs should also take into account the cultural characteristics of the ward, customs, the privacy issue for the persons mapped on the multi-hazard risk map (PWD, persons in need of support for early warning and evacuation…), and the available resources (financial and logistics).

> *"The risk mapping process was really useful. Community members, as well as villages and sangkats (communes) are now more aware of their vulnerabilities, and also about their own resources. We can use these maps to do preparedness planning at the community level. I will use this methodology...for other projects..."*
>
> **Leam La**, Bantey Meanchey Province, in Cambodia

STEP 2. UPDATE INFORMATION ON THE MAP ANNUALLY

2.1. Expected results

The multi-hazard risk maps are updated annually with the participation of local people and other stakeholders.

2.2. Participants

TSGs, local authorities and representatives of hamlet (hamlet leaders).

2.3. Implementation

In order to update the multi-hazard risk maps annually, the TSG should hold the following meetings:

- Meeting at hamlet level: TSGs should organize 1 meeting in each hamlet with hamlet leaders, representatives of businesses, schools, religious organisations and local people (including PWDs and children), who live in the hamlet. In this meeting, TSGs can use the paper-based maps of previous year to draw directly the changes or take notes of this information. All the suggested changed will be shared and reviewed in ward level meeting.

- Meeting at ward level: one meeting will be held with all hamlet leaders and local authorities to collect changing information of the whole ward compared to the previous year. Each hamlet will share their changes by showing and explaining new adjustments added on their paper maps and/or mentioning information that cannot be reflected on the maps. All participants will discuss and get consensus on which information should be adjusted.

With the agreements after these two meetings, the TSG members will update the changes on the ward's digital map. Please see the details of how to update information in **Part 3**, **Module 2** and the checklist of activities for this step in **Annex 4**.

"The map developed using QGIS has helped me to better coordinate all departments for the implementation of our disaster reduction plan. Especially, I can assign more accurately specific tasks to the right person… for example, to assign the Emergency Response Team to evacuate vulnerable people to the risk location and through the appropriate route… The database save me much time as the technical staff and I can now easily extract the right information from this comprehensive database. In case of drill or emergency, we can just look at the map layers that we need and take immediately action ….In order for the map and our work to function most effectively, I think the most important thing is having the database updated on a frequently basis. This will not only help us to better plan for natural disaster prevention, but also for the development of our socio-economic development plan."

Phan Dang Khoa *(Chairman of Thi Nai Ward)*, Vietnam

Note:

- The updating multi-hazard risk maps and related information, especially the prioritized lists of households for early warning and evacuation is very important for the DDR plans.
- In order to ensure the sustainability of this mapping method, it is necessary to take into account the following issues:
    - Regular capacity building for TSG members, especially to new members should be held through training to have enough human resources available for multi-hazard risk mapping. During this training, the benefits of annual updating should be clearly emphasized to create motivation for this regular activity.
    - TSGs should consider and get consensus on an updating method that is feasible to apply with their existing resources.

SUMMARY

There are two steps in **Phase 4**:

- Export and share multi-hazard risk maps with different stakeholders
- Update information on the map annually

The first year of implementation of the methodology, you will have the following products:

1. Soft files in printing format (jpeg or pdf files) of the multi-hazard risk maps for all hamlets and ward.
2. Printed maps in large scale and good quality or in simple, portable and waterproofing format, depending on the sharing purposes.

From the second year onward, after you will have conducted this phase, you will have:

1. The updated multi-hazard risk maps for each hamlet and the entire ward.
2. The updated lists of prioritized households for early warning and evacuation assistance at hamlet and ward levels.
3. The updated list of self-evacuating people of each hamlet.

PHASE 5. USE MULTI-HAZARD RISK MAPS FOR DISASTER RISK REDUCTION

This part describes the three key applications of multi-hazard risk maps, namely (i) to make disaster risk reduction plan, (ii) to organize evacuation drills and (iii) to use in damage and needs assessment. These applications should be highlighted and promoted from the beginning of the implementation of the methodology to encourage and persuade local authorities to use the multi-hazard risk mapping method.

STEP 1. USE THE MAP TO MAKE DISASTER RISK REDUCATION PLANS AT HAMLET AND WARD LEVELS

1.1. Expected Results

The multi-hazard risk maps are effectively used by local authorities to develop disaster risk reduction (DRR) plans of the ward and all hamlets.

> *"The new methodology makes planning for DRR more efficient than in the past… it allows us to collect geo-referenced and accurate information on multiple hazards, risk exposure, and vulnerabilities. Before, the DRR plans at ward level were very general and difficult to put into action. With the new methodology, the most vulnerable people are listed in data basis and georeferenced on the ward maps, so this provides an excellent foundation for developing realistic and actionable DPR plan."*
>
> **Nguyễn Ngọc Trinh** (TSG member), Hai Cang ward, Vietnam

1.2. Participants

- The development of DRR plan for each hamlet will need the involvement of TSG members, representatives of schools, religious organisations, enterprises, residents and other related stakeholders of this hamlet and representatives of the ward authorities.
- The ward's DRR plan will be done by the ward authorities, especially the ones in charge of DRR, all hamlet leaders, and representatives of the city authorities.

1.3. Implementation

The DRR plan of each hamlet and the whole ward can be integrated with the following information and products from the multi-hazard risk mapping:

- Firstly, all the relevant information and products from the multi-hazard risk mapping can be integrated into the DRR plan of each hamlet and for the whole ward:

- The information of risks, vulnerabilities and solutions collected during the mapping will be categorized based on the types of natural and man-made hazards and shall inform each phase of the DRR plan: preparedness, response and recovery phases. Based on this information, the authorities can estimate the budget and resources to implement the relevant measures accordingly.
- The two lists of prioritized people for early warning and evacuation will be the base for developing Standard Operating Procedures for the different stakeholders involved in DRM:
  - The authorities should assign specific members / stakeholders to support early warning and early evacuation to those people mentioned in the lists and to monitor the self-evacuating people.
  - The authorities should set up relevant mechanisms to meet local people's needs for early warning and evacuation. Those mechanisms should clearly state the role and responsibilities of each member/stakeholder, the chain of command, and should be specific for each type of hazard and risk level

- Secondly, the multi-hazard risk maps can be used to support the sharing of the DRR plan with the different stakeholders (from population to upper authorities). Thus, the multi-hazard risk maps should be an integral part of the DRR plan as they are better for visualizing information. For instance, when the ward authorities want to present to the city authority the actions described in their DRR plan for a specific type of hazard (such as flood), they can select on the QGIS map only the layers related to this type of hazard to present the areas potentially flooded, and to illustrate the specific vulnerabilities and capacities associated with this hazard.

STEP 2. USE THE MAP FOR EVACUATION DRILLS

2.1. Expected results

The multi-hazard risk maps and lists of prioritized people for early warning and evacuation are used effectively to organize evacuation drills at the hamlet and ward levels.

2.2. Participants

- For the hamlet evacuation drill: TSG, hamlet leaders, representatives of schools, religious organisations, enterprises, local people and other stakeholders living in this hamlet.
- For the ward evacuation drill: TSG, ward authorities, hamlet leaders, local people and related stakeholders.

2.3. Implementation

The evacuation drills at hamlet and ward levels can use the multi-hazard risk maps and the lists of prioritized people for early warning and evacuation as follows:

- To develop scenarios for the drills which will test the evacuation roads, the evacuation points, and the mechanisms to support the people in need for early warning and early evacuation, etc.
- To raise awareness of the local people about the evacuation points, roads and mechanism.
- To monitor and support the implementation during the drills.

"The new new mapping methodology was a big help for our barangay since we were able to update and produce new maps which are more in detail and update although it was difficult at the beginning we've managed it along the way. We can also utilize the map for DRR planning such as identifying evacuation routes, hazards, vulnerabilities and risks. It became a useful tool in prioritizing the programs of the barangay."

Alexis Reynaldo G Santos (Community leader), Quezon City, Philippines

Figure 6. Evacuation drill in Thi Nai Ward, Vietnam

STEP 3. USE MAPS TO ASSIST DAMAGE AND NEEDS ASSESSMENT

3.1. Expected results

The maps are used by the local authorities and other stakeholders in the damage and needs assessment after the disasters occurred.

3.2. Participants

Ward authorities, related hamlet leaders and other external organisations.

3.3. Implementation

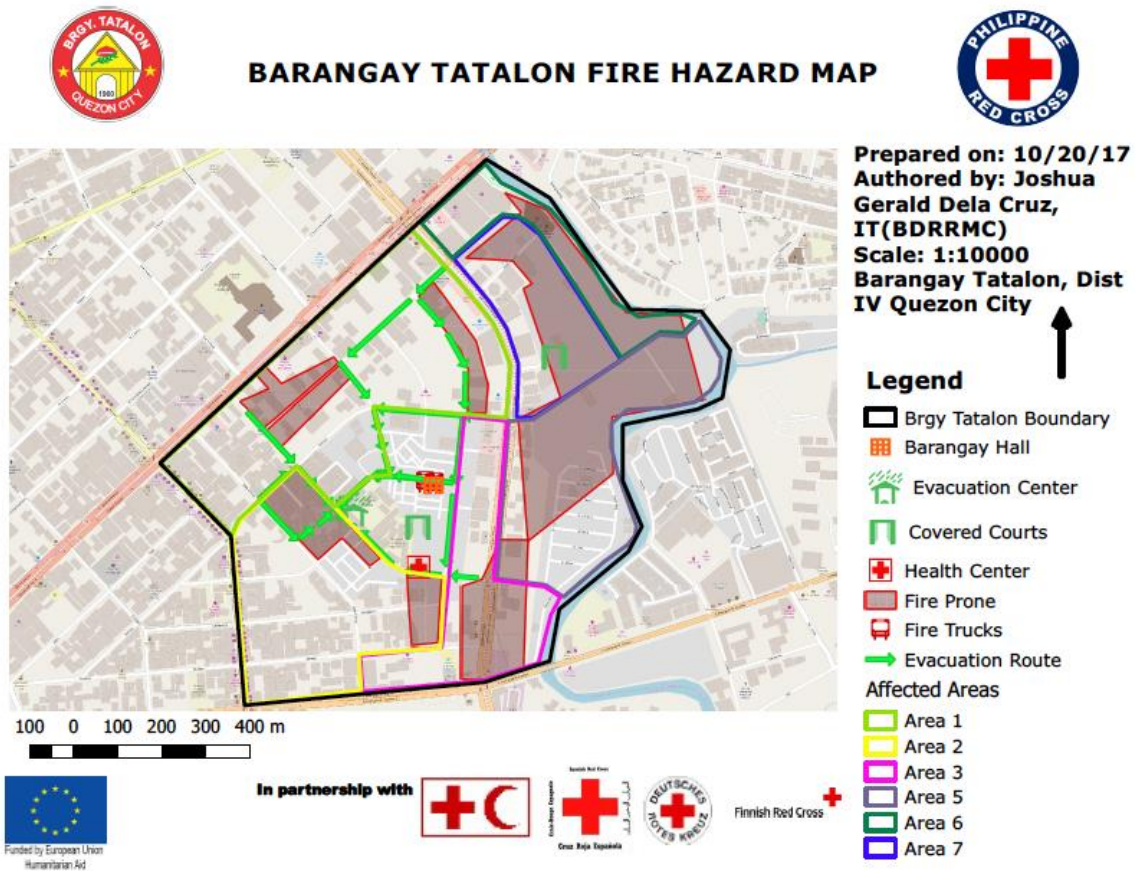

Figure 7. Multi-hazard risk map of Barangay Tatalon

The multi-hazard risk maps can be used in meetings at the hamlet and ward levels after a disaster occurs:

- In preparation of the field assessment. The maps are used to visualize :
    - the areas which are the most disaster prone,
    - the location of the most vulnerable

Thus, the maps allow the authorities to concentrate their Damage and Needs Assessment effort to the most relevant locations and persons.

- During the assessment, the maps can be used to display information on the assessment plan such as the location of the people/team assigned to collect data in specific areas. Those maps and related information can be shared with other stakeholders/organisations to support and better coordinate the assessment.
- After the need assessment, the maps can be used to identify the areas and households actually affected by the disaster and to compare with the situation before disaster. The local authorities can note down the differences or put this information directly on the map using stickers or geo-referenced pictures. Those maps can be shared with other stakeholders and with upper authorities as reporting mean, and also potentially for fundraising purposes.

SUMMARY

This part presents the three main uses of the multi-hazard risk maps in DRR works:

- To make DRR plans at hamlet and ward levels
- To apply for evacuation drills
- To assist the damage and needs assessment

ANNEX 1. QUESTIONS FOR COLLECTING INFORMATION

1. Questions for the PWDs

No.	Types of information	Questions	Types of display	
			Map	Report/plan
General information				
1	Basic information in the base map	• Are available information drawn in the map accurate or not? If not, how to adjust?	X	
2	Housing	• How many PWDs are there in your hamlets? • What are their names? • Where are your houses? • Is there any house of PWDs that is not in the map?	X	X
		• In our hamlet, how many strong houses that local people can come for evacuation are there? • Where are those houses?	X	X
		• Where are hamlet leaders' houses?	X	
3	Types of disasters	• Which types of disasters often occur in hamlet? (e.g. storm, flood, draught)	X	X
		• Which areas in the hamlet are often affected? • Why?	X	X
		• Which houses of the PWDs are the most severely affected?	X	X
Safety for community				
1	Early warning	• Which areas in the hamlet are not received the early warning? • Why?	X	X
		• Besides the households in such areas, is there anyone else not received the early warning? • Why?	X	X
		• Is there any different between warning given to PWDs and non-disabled people? • Why?		X

		• Among the households not received the warning, which households need support on early warning in priority?	X	X
		• What is appropriate supporting method?	X	X
		• Reasons for proposed method of support?		X
		• The other households desire to receive warning by which methods?	X	X
2	Early evacuation	• How many PWDs need to be evacuated? • Among them, which households need support on early evacuation? • Why?	X	X
		• What is appropriate supporting method?	X	X
		• Where do they want to go?	X	X
		• Why?		X
		• What are the conditions of evacuation points to facilitate the accessibility and living of PWD?	X	X
		• Which roads to go in case of evacuation? • Why?	X	X
		• Which are risks that PWDs may face during the evacuation?	X	X
3	Equipment supporting for the PWDs' evacuation in disaster	• Which equipment is available to support the PWDs' evacuation? • How is the quality of such equipment?	X	X
		• Where is this equipment located?	X	
		• Is there any difficulty to use this equipment to support the PWDs?		X
Production and business activities				
1	Livelihoods of the PWDs	• What are the livelihoods of the PWDs?		X
2		• Which work do male and female PWDs regularly undertake?		X
		• Where do they work?	X	X
		• Why do they choose this work?		X

	Risks to PWDs' livelihoods	• How do natural and man-made hazards affect livelihoods compared to people without disabilities? • Which area is likely affected?	X	X
		• Which livelihood of PWDs women or men is more likely to be affected? • Why?		X
3	Measures to reduce these risks	• What do they often do to reduce the risks?		X
		• What differences are there between men and women?		X
4	Support from the authorities	• How do the authorities assist the PWDs in their business as the hazards occur?		X
		• Do these support meet the PWDs' demands?		X
		• How should the authorities and communities support the PWDs to protect their business and to recover it during and after disasters?		X
Health, hygiene and environment				
1	Water	• How many households with PWDs do not have enough clean water for consumption, especially during the disaster?	X	X
		• Which water resources do they often use? • Why?	X	X
		• How are they supported with enough clean water?		X
2	Toilet	• How many households with PWDs can use toilets during the disasters? Which type are they?	X	X
		• How many households with PWDs cannot use toilets during the disasters? • Why?	X	X
		• How do they often handle in that situation?		X
		• Which suitable supports do they need?		X

3	Garbage	• How is garbage disposed during and after disasters? • Where is it dumped? • Why is sewage treated like that? • Who disposed garbagein their family?	X	X
		• How does the disposal of garbage affect the PWDs?		X
		• What supports do PWDs need to deal with this issue? • Why?		X

2. Questions for children

No.	Types of information	Questions	Types of display	
			Map	Plan/Report
1	Basic information in the base map	• Are available information drawn in the map accurate or not? If not, how to adjust?	X	
2	Children's houses and schools	• Where is your house located? (Write their names on the map)	X	
		• Where is your school located? • Are there any children that do not attend school? Why?	X	X
		• Which road do you often go to school? By which means? And with whom do you go?	X	X
3	Type of hazards	• Is there any hazard such as storms, floods and landslides hitting your hamlet?	X	X
4	Disaster risks	• What do you worry in case of flood/storm/landslide? Why? • Are there any dangerous places on your way to the school during rain or storm? Where are they and how dangerous are they?	X	X
		• Are you impacted by disasters? If yes, how and why are you impacted? • Are PWD girls affected more than PWD boys? Why?		X

		• What difficulties do you have during disasters? • What difficulties do children with disabilities have different from non-disabled children?		X
5	Prevention	• What do you (boys/girls, even the children with disabilities) often do to avoid the undesirable incidences?		X
		• Does anyone assist you? How? • Are their supports appropriate to you?		X
6	Safe and dangerous areas	• Which areas in the hamlet are safe to you when disasters occur? Which areas are not? • Why?	X	X
		• Do you want to evacuate? If yes, where do you want to go? By which road? And why? • What do you need to support this evacuation? • For girls and girls with disabilities, what support do you desire for evacuation?	X	X
7	Water resources	• What kind of water do you use? Where does it come from?	X	X
		• Is this water contaminated during the disasters? If yes, what kind of water do you use? Where to get? Is the water enough for your daily needs?	X	X
		• Do you know how to treat contaminated water before using? • If you know, how to do? If not, who handle it? • Does anyone support you with water treatment for your families?		x
8	Toilet	• Do your family have a toilet? Are the toilets temporary or septic? • When disasters occur, can you use your own toilets? If not, how do you bath? Why do you choose that?	x	x
9	Garbage	• Where do your family often dispose daily garbage? • During the disasters, where do your family often dispose garbage? Why	X	x
10	Diseases due to hazards	• Is there anyone having diseases after disasters? Why? • Do you know how to avoid?		x

11	Assistance	• Which supports from adults do you want to reduce disaster risks? Why? How is appropriate support? • Which is the most priority thing to support to boys/girls?		x
		• What do you want to do with the adult for disaster prevention and control? Why?		x

3. Questions for the hamlet representatives

No.	Types of information	Questions	Types of display	
			Map	Plan/Report
1	Basic information of the base map	• What is the boundary of the hamlet? • How many sub-hamlets are there?	X	
		• Where are the main roads and alleys in the hamlets?	X	
		• Are there any rivers, streams or lakes? Where are they and where do they flow?	X	
		• Where are the common areas of the hamlet such as pagodas, cultural houses? • Which one can be used as evacuation points?	X	
2	Housing	• How are the houses in the hamlet usually distributed, especially in disaster-prone areas? Note down names of people living in those areas? • Where are the houses of the vulnerable people that need support of early warning and early evacuation? Note: • Transfer information from two maps of Group 1-PWDs and Group 2-Children. • Gather information from other vulnerable groups (elderly, pregnant women…)	x	
		• How many evacuation points, including permanent buildings/houses, are there in the hamlet? • How many people can stay in each location? • Is it easy for PWDs and the elderly to access to these evacuation points? Why?	X	X

		• How are the living conditions in these evacuation locations? (such as food, drinking water, sanitary conditions)	X	X
		• Where are the houses of hamlet authorities located?	X	
		• How does this distribution of hamlet authorities' houses affect the support of the local people as a disaster occurs?		X
		• Are they trained about DRR skills?		X
		• Which experience and skills do they have in helping local people and stakeholders in DRR?		X
3	Natural and man-made hazards	• Which types of hazards often occur in the hamlet?	X	X
		• Which areas are most vulnerable? Why?	X	X
		• In those areas, which households are most severely affected? Why?	X	X
Community safety				
1	Early warning	• Which areas in the hamlet cannot receive early warning information? Why?	X	X
		• In addition to the PWDs (mentioned in the map of the PWDs), who should also be prioritized to get the early warnings? What is the appropriate support? Why? • Are there any differences between the current warning for vulnerable groups and that for other local people? Why?	X	X
		• How do the rest of the local people want to get the warning information?	X	X
2	Early evacuation	• In addition the PWDs (mentioned in the maps of the PWDs), who should be prioritized to get the early evacuation? Why? What is the appropriate support? Where to evacuate? In what way? • Will the remaining local people in the residential areas evacuate? • How many households and household members should evacuate (for each disaster)? Who are they? • Which area they live in the hamlet? Where to evacuate? Why? • Where is the road of evacuation?	X	X
		• Are there dangerous places on the way to evacuation points?	X	X

		• Are there any enterprises/businesses that support the evacuation? And how?		X
		• Which supporting equipment is there in the hamlet to respond to disasters? • How is their quality?	X	X
		• Where are they stored?	X	
		• Is there any list of the equipment?		X
		• Who is responsible for preserving the equipment?		X
		• If the disaster occurs suddenly, can the equipment be used immediately? For whom are the equipment used? Why?		X
	Production and business activities			
1	Livelihoods	• What are main livelihoods of the local people?	X	X
		• Which jobs do men and women do most? Why?		X
		• Between men or women, who play the major role in the family business and production? Why?		X
2	Disaster risk	• How can natural and man-made hazards affect their livelihoods?	X	X
		• Which area is affected? Why is that affected?	X	X
		• Are men or women affected the most? Why?		X
3	Experience in DRR	• What do they often do to reduce the disaster risks to their livelihoods? • What are the differences in DRR work between men and women? • Is this work division appropriate?		X
4	Government support	• Do the local people and enterprises get any supports to reduce the losses in production and business when a disaster happens? If yes, who supports?		X
		• Are such supports suitable with needs (especially the needs of men, women)?		X
		• Do the local people and enterprises get any further supports in preparedness and recovery phases? Why should such supports be made?		X
	Health, sanitation, environment			

1	Water resources	• What types of water do people use for daily activities? • How far is it from home to the place of taking water? Who in the family usually does this task? • How many households must buy water to use, why do they have to buy? If the use of water is charged, how much per month?	X	X
		• How long do the local people have enough clean water to use during flooding time? • How many households do not have enough clean water to use? Where? Why?	X (Draw the households in shortage of clean water)	X
		• What types of water do they usually use in case of water shortage? Why?	X	X
		• Which difficulties do vulnerable people have to face in securing clean water for use? Why?		X
		• What support do they need referring to clean water? If yes, who will support? • Do such supports meet their needs especially between men and women with disabilities? Why?		X
		• Which further supports should be given to the local people to get enough water during the rainy season /disaster?		X
2	Toilet	• How many households have toilets? Which types of toilet are they? Why don't they have septic toilet? • Where are the households without toilets located?	X	X
		• When a disaster occurs, how many toilets cannot be used? Why?	X	X
		• How can people deal with this situation? Why do they choose that way?		X
		• Do those households get any supports in this situation? If yes, who supports? In what way? What is the difference in the supports for households with PWDs and the poor? Why? • Do these supports meet the needs of both men and women; especially men and women with disabilities? Why?		X
		• Are there any further supports in hygiene to the local people?		X

3	Garbage	• Are there any garbage collection places in the hamlet? If not, why? If yes, where are they?	X	X
		• How is garbage collection during and after the disaster? If there is dead animal carcass, how is it treated? Why? Is that hygienic? Can it cause illness? What disease? Why?		X
		• Are there any supports for garbage collection during and after the disaster? If yes, who supports? • How the support is done? • What additional supports are needed to reduce the difficulty of garbage collection during and after a disaster?		X

ANNEX 2. FACILITATION TIPS FOR GROUP DISCUSSION

Group 1. PWDs

During the meeting with PWDs and their relatives, there are three main activities consisting in (i) drawing information on the base map, (ii) collecting the lists of households to prioritize for early warning and evacuation and (iii) selecting PWD representatives to participate in Group 3 (Representatives of hamlet).

a) Draw multi-hazard risk map

The following steps are suggested to facilitate the information collection from Group 1:

- Explain the purposes of the meeting;
- Explain the information that needs to be collected (using the sample map);
- Get agreement on the working method, symbols and legends of the map;
- Introduce information on the printed base map;
- Request the PWDs and their relatives to check the information available on the base map (roads, rivers, community houses, pagodas, schools, markets, and others areas of business production, etc.);
- Ask questions to collect information based on the questionnaires (See the detailed questionnaire at **Annex 1**).
- Invite the PWDs and their relatives to answer and draw information on the base map.
- Record all the information that they answered (both the information that can be and cannot be mapped) in the summary table below.

Table 1. Summary table

No	Disaster	Disaster risk	Vulnerability	Capacity	Assistance need/ Proposed solutions
		Risk 1 related to Community safety	*Materials*	*Materials*	
			Social organisation	*Social organisation*	
			Awareness, experience, attitude, motivation	*Awareness, experience, attitude, motivation*	
			Materials	*Materials*	
			Social organisation	*Social organisation*	

Risk 2 related to Community safety	*Awareness, experience, attitude, motivation*	*Awareness, experience, attitude, motivation*	
Risk related to Business/ Production	*Materials*	*Materials*	
	Social organisation	*Social organisation*	
	Awareness, experience, attitude, motivation	*Awareness, experience, attitude, motivation*	
Risk related Health, hygiene and environment	*Materials*	*Materials*	
	Social organisation	*Social organisation*	
	Awareness, experience, attitude, motivation	*Awareness, experience, attitude, motivation*	

b) Collect lists of the PWDs to prioritize for early warning and evacuation

From the drawing activity the TSGs are aware of the people that need special assistance for early warning and evacuation. Now, TSGs should combine and collect more detailed information to complete the two relevant lists (**Table 2** and **Table 3**) through the following steps:

- Introduce the purpose and templates of the lists:
    - List of prioritized people for early warning includes the persons that
        - live in disaster-prone areas and need special warning assistance because they cannot access the information. For example, the people with hearing impairment, the elderly, the people with mental and intellectual impairment who live alone or in areas far from loudspeaker
        - and do not have support from their relatives.
    - The list of prioritized people for early evacuation includes the persons that
        - live in disaster-prone areas
        - (need special assistance from outsiders to be able to evacuate because they cannot go by themselves
        - (ad their relatives cannot support them. For example, the people with severe physical impairment, the family with two children with disabilities which cannot support them to evacuate, etc…
- Ask relevant questions to fill in the lists as mentioned below:

Table 2. List of prioritized people for early warning

Prioritized order	Full name	Sub-hamlet	Reason for assistance	Way of assistance

Table 3. List of prioritized people for early evacuation

Prioritized order	Full name	Sub-hamlet	Reason for assistance	Way of assistance	Evacuation points

c. Select representatives of PWDs to participate in hamlet meeting

In order to ensure that the information of Group 1 will be fully integrated into the hamlet map, the TSG should help them to select and support their representatives to prepare their information. Specific works need to be done as mentioned below:

- Explain the purposes of selecting representatives for PWD group to participate in hamlet meeting, i.e. to integrate their information into the hamlet map and into the prioritized lists.
- Get consensus on criteria for selecting representatives. For example: being a PWD or their relatives; having the ability to travel to meeting venue and to present their information clearly; having available time to participate in hamlet meetings for the mapping activity or other meetings in the course of disaster risk assessment.
- Ask PWDs and their relatives to choose their representatives based on agreed criteria.
- Get agreement with the representatives about the way and contents to present in the hamlet's map.

Tips for facilitation:

Multi-hazard risk mapping can have full participation of PWDs, if the facilitators are aware of the differences among different types of disabilities and provide relevant assistances for them to participate. The following sessions show some tips to mobilize the participation of the five types of disabilities: people with physical impairment; people with visual impairment, people with hearing impairment, people with intellectual and mental impairment and children with disabilities.

- People with physical impairment:
    - Selecting accessible place for meeting, i.e. not far away from their houses, and ensure that people with wheelchair can go inside the meeting room.
    - Asking assistants to assist people with wheel chair to get inside meeting room if the room is not accessible.
    - Arranging suitable seating arrangement for PWDs with wheel chair.
- For people with visual impairment:
    - Explaining the importance of the disaster risk mapping for their own preparedness.
    - Explaining the tentative participatory method and confirming with them the way they want to be involved.
    - Describing the process of drawing so that they can follow and participate.
    - Encouraging them to share information, opinions.
    - Using tactile materials suitable with people with visual impairment.
- For people with hearing impairment:
    - Spending some time with them to get agreement on signs/gestures and checking their capability in reading and writing.
    - Using big size/simple pictures and visualized materials as much as possible.
    - Using short and simple questions to read (for those who can read).
    - Should not invite more than 7 people with this impairment in the meeting (as they need more individual attention).
    - Preparing sign interpreter (if PWDs knows the sign language).
- People with intellectual and mental impairment:
    - Using assisting visualized materials and pictures as many as possible.
    - Trying to collect information from PWD first. If it is not possible, ask their relatives.
- Children with disabilities:
    - Should invite children with disabilities above 10 years old, their parents and/or their teachers. However, do not let parents and teachers decide for the children.
    - Using simple questions to ask and helping them to draw.
    - Inviting no more than 10 children at a time.

Group 2. Children

In multi-hazard risk mapping with children group, TSGs can follow the following steps to facilitate information collection:

- Introduction of the meeting purposes;
- Organize games for warming up;
- Get agreement on working method symbols and legends of the map;
- Use the base map to introduce and verify information available on the base map;
- Ask questions in turn to collect information following the guided questionnaire in **Annex 1**;
- Invite the children to answer questions and draw their information on the base map;
- Take notes of all the information that children answered (including the information, which can and can not be drawn on the map);
- Ask them to nominate one representative, who is confident enough to present their map;
- Give instructions on how to present their map and their needs in case disasters occur to adult audiences in the hamlet meetings.
- Put all information in **Table 1** above.

Tips for facilitation:

- Prepare games/entertainment activities to create close relationships with children before asking them questions.
- Select a place familiar to children to organize the meeting (for example: schools and recreation centers, etc.)
- Prepare drawings, questions that are simple and close to their ages.
- Consider appropriate time for pupils to participate (meeting during weekends).
- Also invite children that do not go to school to gather information.

Group 3. Representatives of the entire hamlet

In the meeting with hamlet representatives, TSG will facilitate to (i) develop multi-hazard risk map on the printed base map and (ii) collect the lists of households in need of early warning and evacuation for this hamlet.

a. Develop multi-hazard risk map

To do this task, TSGs can consider taking the following steps:

- Explain the purposes of the meeting;
- Explain the information that needs to be collected (using the sample map);
- Get agreement on working method, symbols and legends of the map;
- Invite representatives of the PWDs and children to in turn to present briefly their maps;
- Get agreement on the information of each group to put in the entire hamlet map;
- Introduce information on the printed base map;
- Invite local people and related stakeholders to verify information on the base map;
- Ask questions and help the participants to draw information on the map (See the detailed questionnaire in **Annex 1**);
- Put all information in the Summary table (**Table 1**).

b. Collect lists of prioritized people in needs of early warning and evacuation

The two lists will be fulfilled following these steps:

- Explain the purposes of developing hamlet's prioritized early warning and evacuation assistance list;
- Explain how to prepare the lists;
- Invite representatives of PWDs to present their lists;
- Get agreement on the names of PWDs to be integrated in the hamlet's list;
- Add names of other non-disabled people in the lists based on the hamlet's map using **Tables 2 and 3**.

Tips for facilitation:

In order to facilitate the group of hamlet representatives, TSGs can consider the below tips:

- Encourage silent people to raise their opinions by calling their name or asking them questions directly;
- Control dominant people, who talk too much or have disrespectful comments;
- Should have a female facilitator to encourage women, especially the women with disabilities to talk;
- Use understandable and short questions;
- Use open questions to get in-depth information;

Collect differences in capacity, vulnerability and disaster risks of women and men, of PWDs and people without disability (if any) in each field and aspect.

Note: It is also necessary to collect information about the self-evacuating households in disaster-prone areas. That will help local authorities monitoring and ensuring their safe evacuation when a disaster occurs. The information can be put in the **Table 4** below.

Table 4. List of self-evacuating households

Type of disaster	Name of hamlet	Number of self-evacuating households	Name of self-evacuating households	Evacuation point
Ex: Flood	*Sub-Hamlet number 1*	*3 households (12 people)*	*Household of Mr Nguyen Van Minh (3 people), Ms. Nguyen Thi Thu (5 people) and Mr Bui Van Tien (4 people)*	*Hamlet's cultural house*

ANNEX 3. SUGGESTIONS OF SHARING MAPPING PRODUCTS

Targeted audience	Purpose of sharing	Information to be shared	Method of sharing
• TSG; • Hamlet leaders • Local authorities	• Supporting the DRR planning • Sharing information to different stakeholders	• Multi-hazard risk maps; • Lists of prioritized people for early warning and evacuation; • List of self-evacuating people	• Printed products and soft files can be handed over to local authorities; • All products are introduced in meetings.
• Authorities at higher levels	• Support DRR planning • Sharing information to different stakeholders	• Multi-hazard risk maps; • Lists of prioritized people for early warning and evacuation; • List of self-evacuating people	• All products are introduced in meetings. • Soft files of all products can be sent via emails • The multi-hazard risk maps can be uploaded in websites of relevant authorities.
• Authorities at national level	• Support DRR planning • Sharing information to different stakeholders	• Multi-hazard risk maps; • Lists of prioritized people for early warning and evacuation; • List of self-evacuating people	• Soft files of all products can be sent via emails • The multi-hazard risk maps can be uploaded in websites of national authorities (if available).
• Local people in the hamlets and ward	• Raising general awareness about DRR	• Disaster risks • Weaknesses to be improved in the hamlets/ward DRR plan. • The measures taken by local authorities	• Printed multi-hazard risk maps in large scale and good quality can be put in public places, where many people can see.
	• Knowing the safe way and where to go during the evacuation and the drills.	• Evacuation points and roads to the evacuation points •	• Printed multi-hazard risk maps in large scale and good quality can be put in public places, where many people can see.
• Authorities of hamlets, ward and city in charge of DRR	• Assisting people in warning and evacuation	• Households and people in need of early warning and evacuation • Evacuation routes • Evacuation points	• At hamlet level, information and can be shared in printed formats or can be shown via projector in meetings.

		• The places to store related supporting equipment	• At ward and city levels: soft files of all products can be shared directly • For field officials, printed products should be small, portable and waterproofing.
• Hamlet, ward leaders and emergency teams in charge of evacuation	• Coordinating and supporting the organisation of early warning and evacuation	• Households and people in need of early warning and evacuation • Evacuation routes • Evacuation points • The places to store related supporting equipment	• Small, portable and waterproofing products can be printed for emergency teams • Multi-hazard risk maps in large scale and good quality can be hanged in hamlet office. • Soft files are shared.
• Authorities of ward and city in charge of socio-economic planning	• Supporting the socio-economic development planning	• Disaster risks • Vulnerability (related to socio-economic development) • Capacities (related to socio-economic development)	• Soft files of all products can be shared. • Related information can be introduced in planning meetings.

ANNEX 4. CHECKLIST FOR MULTI-HAZARD RISK MAPPING

Phase 1: Preparation of base map

- ☐ Base map is developed in accordance with the technical guidance.
- ☐ Local people and related stakeholders can easily understand the base map and provide detailed information on the map.

Phase 2: Participatory data collection and consolidation

Before collecting information:

- ☐ Read instructions and tips for each step of data collection.
- ☐ Assign clearly and equally tasks of data collection for TSG members.
- ☐ Develop the plan of information collection
- ☐ Choose the participants in line with criteria for information collection.
- ☐ Choose suitable time.
- ☐ Check the assistance needs for vulnerable groups to facilitate their participation.
- ☐ Check the location of meetings.
- ☐ Prepare enough instruments, stationery and forms etc. if needed.
- ☐ Read reference questions to master the meanings.

During information collection:

- ☐ Arrange seats appropriate to participants, especially the PWDs.
- ☐ Assist PWDs and vulnerable groups to participate.
- ☐ Control talkative people and encourage everyone to show their ideas, especially the women with disabilities.
- ☐ Keep neutral attitude.
- ☐ Clarify different opinions (if any).
- ☐ Take notes with full and accurate information.
- ☐ Summarize contents agreed in the meeting

After collection:

- [ ] Classify and analyze information collected, including information of gender and vulnerable groups.
- [ ] Check and verify available information in the following meetings.
- [ ] Organize an evaluation meeting to share lessons-learnt on facilitation skills among TSG.

Phase 3: Develop and verify the maps with stakeholder participation

- [ ] Transfer appropriate information collected from local people, especially at vulnerable groups to hamlet maps in accordance with technical instructions.
- [ ] Transfer information in hamlet maps into the ward map in accordance with instructions.
- [ ] Follow technical guidance in **Module 2** to transfer information from paper-based maps to digital maps using QGIS.

Phase 4: Share and update maps annually

- [ ] Map information is updated in accordance with technical instructions
- [ ] Updating takes into account information from the vulnerable groups.
- [ ] The multi-hazard risk maps of hamlets are updated with the effective participation of different stakeholders.
- [ ] The multi-hazard risk map of the ward is updated with the effective participation of different stakeholders.
- [ ] Information of the multi-hazard risk mapping is put in DRR Plan.
- [ ] The updated maps are shared to local people and related stakeholders.