

Information and Knowledge Management



Humanitarian Aid
and Civil Protection



Information and Knowledge Management: Key Practices for DRR Implementers

First edition, 2014. All rights reserved. Data and rights of publication belong to COOPI.

Cooperazione Internazionale, Milano – Via De Lemene, 50 20151 – Italia – coopi@coopi.org, Tel. +39.02.3085057 – Fax. +39.02.33403570

This document was prepared by Cooperazione Internazionale (COOPI).

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations (FAO) concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that these have been endorsed or recommended by FAO in preference to others of a similar nature that are not mentioned.

The views expressed in this information product are those of the author(s) and do not necessarily reflect the views or policies of FAO.

ISBN 978-92-5-108340-6 (print)

E-ISBN 978-92-5-108341-3 (PDF)

© COOPI, 2014

Authors	Hanitra Raveloson and Laurent Rajoelison, COOPI Madagascar
Project supervisor and editor	Paola Fava
Photographs	Ilmaestroemargherita.it
Series coordinators	Javier Sanz Alvarez and Erin O'Brien
Design and layout	Handmade Communications, design@handmadecom.co.za

Information and Knowledge Management



This brief is part of the series, *A Field Guide for Disaster Risk Reduction in Southern Africa: Key Practices for DRR Implementers*, coordinated by the FAO Subregional Office for Disaster Risk Reduction/Management for Southern Africa. This series has been produced with contributions from COOPI, FAO, OCHA and UN-Habitat, and comprises the following technical briefs:

- Information and Knowledge Management (COOPI)
- Mobile Health Technology (COOPI)
- Safe Hospitals (COOPI)
- Disaster Risk Reduction for Food and Nutrition Security (FAO)
- Appropriate Seed Varieties for Small-scale Farmers (FAO)
- Appropriate Seed and Grain Storage Systems for Small-scale Farmers (FAO)
- Farmer Field Schools (FAO)
- Irrigation Techniques for Small-scale Farmers (FAO)
- Management of Crop Diversity (FAO)
- Community-based Early Warning Systems (OCHA and FAO)
- Disaster Risk Reduction Architecture (UN-Habitat)

This document covers humanitarian aid activities implemented with the financial assistance of the European Union. The views expressed herein should not be taken, in any way, to reflect the official opinion of the European Union, and the European Commission is not responsible for any use that may be made of the information it contains.



Humanitarian Aid
and Civil Protection

The European Commission's Humanitarian Aid department funds relief operations for victims of natural disasters and conflicts outside the European Union. Aid is channelled impartially, straight to people in need, regardless of their race, ethnic group, religion, gender, age, nationality or political affiliation.

Foreword

by ECHO

The southern Africa and Indian Ocean region is extremely vulnerable to cyclones, floods, droughts and tropical storms. These recurrent climate-related shocks negatively affect the highly sensitive livelihoods and economies in the region, and erode communities' ability to fully recover, leading to increased fragility and vulnerability to subsequent disasters. The nature and pattern of weather-related disasters is shifting, becoming unpredictable, and increasing in frequency, intensity and magnitude as a result of climate change. Vulnerability in the region is further compounded by prevailing negative socio-economic factors, such as high HIV rates, extreme poverty, growing insecurity and demographic growth and trends (including intra-regional migration and increasing urbanization).

The European Commission's Office for Humanitarian Affairs (ECHO) has actively engaged in the region through the Disaster Preparedness ECHO (DIPECHO) programme since 2009, supporting multi-sectoral disaster risk reduction interventions in food security and agriculture, infrastructure and adapted architecture, information and knowledge management, water, sanitation and hygiene, and health. This programme operates with two objectives, notably:

- Emergency preparedness by building local capacities for sustainable weather-hazard preparedness and management, including seasonal preparedness plans, training, emergency stocks and rescue equipment, as well as Early Warning Systems.

- Empowering communities through multi-sectoral and multi-level approaches with DRR mainstreamed as a central component and improved food and nutrition security as an outcome.

This is done in alignment with national and regional strategies and frameworks.

For DIPECHO, one of the main measures of success is replicability. To this end, technical support through guidelines established for DRR implementers is a welcome output of the DIPECHO interventions in the region. ECHO has supported regional partners, namely COOPI, FAO, UN-Habitat and UN-OCHA, to enhance the resilience of vulnerable populations in southern Africa by providing the funding to field-test and establish good practices, and to develop a toolkit for their replication in southern Africa. It is the aim of the European Commission Office for Humanitarian Affairs and its partners to fulfil the two objectives sustainably and efficiently through the practices contained in this toolkit to ensure the increased resilience of the most vulnerable populations in the region.

Cees Wittebrood

Head of Unit, East, West and Southern Africa
Directorate-General for ECHO
European Commission

Foreword

by COOPI

02

In 2013, Cooperazione Internazionale (COOPI) adopted a specific environment and disaster risk reduction policy.¹The main goal of the organization is to increase communities' and institutions' resilience by promoting environmental sustainability, fostering participation, and integrating prevention, mitigation and preparedness actions. COOPI aligns itself with international legal frameworks, such as the Kyoto Protocol (1997), the United Nations Millennium Declaration (2000) and the Hyogo Framework for Action (2005–2015). COOPI enacts these frameworks using experience and knowledge in three key concepts: environmental sustainability, participation, and the integration of prevention, mitigation and preparedness. COOPI uses six well-established approaches to implementation.

- **Land analysis and information systems:** an essential tool for crisis and risk management, which allows the optimization of resources. COOPI has developed a series of good practices in

these areas of intervention, promoting the use and development of research.

- **Natural resources conservation and DRR-oriented land management:** orienting land management interventions' focus towards protection and appropriate resource management through interventions on protection, value, efficient use and optimization of land.
- **Capacity building and knowledge transfer:** enhancing communities' and institutions' capacities is essential. COOPI stresses the importance of empowering emergency management structures, at both the institutional and at community level, through decentralization strategies.
- **Education, communication and information:** combining education, communication and information to create a culture of risk management.
- **Risk mitigation and supporting infrastructures:** strengthening responses, mitigation and early recovery by identifying vulnerable and useful resources.
- **Scientific research and know-how transfer:** establishing relationships with DRR academics, scientific institutions and bodies

¹ Policy available at http://www.cooi.org/repository/pagine/coopi_ambiente_2013.pdf

for alternative energies innovations, monitoring methodologies and vulnerability analysis, natural hazard assessment, sharing good practices, and so on.

The Information and Knowledge Management: Key Practices for DRR Implementers resource toolkit presented here provides support to DRR practitioners in the management of information in the context of DRR, referring to the fourth COOPI approach, described above. Specifically, the tool is based on the experience and lessons learnt during the information system set-up within the DIPECHO

frameworks. Specific sections are dedicated to geographic information systems (GIS), providing some key elements and guidelines in how to use geographical resources in the context of DRR.

The toolkit is also available at www.seadrr.org.

Tiziana Vicario

DRR & Environment Focal Point

International Programs Planning & Innovation Office



Contents

04

Acronyms and Abbreviations	05
Preface	06
1. Introduction.....	07
2. Steps for Implementing an Information Management System for DRR.....	12
3. Practical Examples to Guide Implementation	23
4. Conclusion	33
5. Bibliography and References for Further Reading	34

Acronyms and Abbreviations

CI	content information
CMS	content management system
DRR	disaster risk reduction
ESRI	Environmental Systems Research Institute
GI	geographic information
GIS	geographic information system
GPS	global positioning system
IKMS	information and knowledge management system
NGO	non-governmental organization
PGIS	participatory geographic information system
SADC	Southern African Development Community
UTM 36S	Universal Transverse Mercator – latitude -36° – southern hemisphere
WGS84	World Geodetic System [established in year] 1984

Preface

In the context of disaster risk reduction (DRR) activities, information and communication are critical to inform decisions and to ensure efficient reactions in emergency contexts. Humanitarian workers and decision-makers need to be connected to one another to share information about ongoing activities, changing hazard contexts and to communicate with the general public and at-risk populations. Information technology and communications tools, as well as a system to manage the incoming information and disseminate the knowledge resulting from these tools, are

becoming increasingly prevalent and important in DRR, along with more traditional information-sharing media (web portals, reports, news, etc.).

Geographic information (GI) is also a critical aspect of an information and knowledge management system (IKMS) for DRR, because the hazards affecting a population, the level of exposure and the response all require that DRR practitioners know precisely where an event is taking place, what is going on around it and how best to respond. Including the spatial dimension in the information is invaluable for efficiency in information sharing, mitigating negative impacts, early warning systems and emergency responses and to increase the accuracy of planning for and responding to hazardous situations.

As a result, DRR stakeholders no longer communicate only with text, graphics and pictures; they can now call upon new technologies for managing geographic and real-time information to produce maps and simple tabular databases to pinpoint vulnerable people and places to facilitate an efficient and higher-impact intervention.



Figure 1: Information collected by mobile phones at Mbulu village clinics

1. Introduction

Managing ‘information’ is a delicate issue; indeed, we all know that those with information also have power. In this regard, information is precious and necessary in order to:

- make decisions, and
- prioritize interventions and activities in complex development contexts.

Decision-making and prioritizing actions are both particularly important in a disaster risk reduction (DRR) context, as the various actors in this field need to have access to very specific and accurate information before intervening by mitigating, preventing or responding to natural hazards. Accurate information provides DRR implementers with a clear vision of what can and cannot be done and helps them to identify and reduce the various risks associated with actions. Information in its different forms is, therefore, a powerful strategic tool. As a result, it should be handled carefully and the possible impacts of sharing it should always be carefully considered and monitored.

Special consideration should be given to geographic information (GI). Location is an important piece of information as it is an essential element for developing a strategy. Information is called

‘geographic’ when it can be located on the earth, and the tools for managing this information are called geographic information systems (GIS). GIS allows stakeholders to know exactly where a phenomenon has taken or will take place, to analyse which populations are most affected or exposed and which infrastructures would be affected, and – more importantly – where to send and use specific resources.

Furthermore, GIS can facilitate the discussion between DRR stakeholders and the public. This is critical for DRR practitioners,



Figure2: River levels recorded manually

as the public possesses a wealth of information about past and recurrent disasters that affect their areas and the infrastructure and populations most at risk. By using GIS and participatory methodologies for community engagement, this information can be shared easily with non-governmental organizations (NGOs), government and other stakeholders to plan and execute well-informed interventions to reduce the negative impact.

While several questions can be answered and different kinds of challenges resolved using GIS, it does not require major financial investment or major capacity building, because sophisticated GIS software can be obtained and used through open access (i.e. free of charge) and basic GIS knowledge can be acquired during a week of training.

Objectives of information management and GIS in a DRR context

An information and knowledge management system (IKMS) refers to the collection and management of **information** from one or more sources and the **distribution** of that information to various audiences. For both the input to and dissemination of the information, different stakeholders are involved at multiple levels of interaction and consultation. Generally, the objectives of information management systems are to:

- make information readily available and easily accessible;
- share data and knowledge by facilitating the exchange data (including geographical data) and documents in an interactive way;



Figure 3 (left): Stakeholders sharing information during the safe hospital workshop in Antananarivo

Figure 4 (right): Health-related information shared at Salima District Hospital

- educate and create awareness among the public or the target audience; and
- keep donors informed and support the decision-making process for future actions.

These four main objectives are both complementary and interdependent: making information available will facilitate the sharing of knowledge and expertise, thereby raising awareness and possibly leading to common and more coordinated, efficient and effective actions.

As a core part of information management in a DRR context, GIS plays an important role within the system as information is communicated by means of maps and tabular databases. Maps are particularly useful to communicate specific information quickly, as they can depict several aspects of a disaster's impact without requiring the audience to read lengthy texts; like a picture, a map is worth a thousand word. The combination of spatial information and databases allows the production of maps that depict the location of disasters and their interaction with infrastructure, people, biodiversity, etc.

GIS can be applied to many disciplines, but this toolkit explains briefly, concisely and clearly how GIS is used in the framework of DRR, in particular how to use GIS to create hazard maps.

The specific objectives of using GIS are to:

- help people become well prepared face to disasters;
- optimize the management of information for decision-making;
- expedite the flow of information between public and experts in both directions; and
- share geographic data among various audiences.

Application of information management for DRR

How an information management system is applied and used depends on the objectives and the target audience. While the general objectives are outlined above, this section breaks down the various applications of information management and the audiences for whom these applications would be of interest. It is important to bear in mind that the innovation of an information management system lies in its ability to serve different stakeholders in different ways that meet their array of needs (Deschamps, 2009).

A good information management system that also includes geographical data contributes to:

1. **Making documents/data/maps readily available and easily accessible:** most DRR projects use a multisectoral approach with a wide range of themes (agriculture infrastructure, mapping, irrigation, microcredit, etc.). While a project manager cannot be an expert in all of these sectors, having access to documents, reports and maps about current and previous



experiences in each of these sectors can help to design a technically sound and successful project. Access to information helps a project manager to:

- plan future interventions, based on a multisectoral approach;
- acquire knowledge about good and bad practices based on the experiences of others;
- access specific documentation and expertise;
- access and share information among stakeholders to organize events with partners and other stakeholders;

Figure 5: Students viewing online information

- use maps to locate specific indicators and characteristics that are relevant for the DRR context;
- expedite the flow of information between the public and experts;
- make GI comprehensible and accessible to non-technicians; and
- easily perform spatial analysis of different kinds of information.

Result: Being able to access accurate and timely information helps project managers and DRR stakeholders to design a relevant and technically sound project.

2. Sharing knowledge (including geographical knowledge) among DRR partners (NGOs, universities, international agencies, governments, donors, etc.). A good information management system should facilitate the sharing of information so that it is possible to:
 - know partners' activities: Who does what? and Where?;
 - exchange information, comments, know-how and expertise with other organizations, possibly using interactive tools that are part of, or result from, the information management system (forum, chats, social networks, etc.);
 - learn from others' experiences and lessons learned;

Figure 6: Creating awareness among community members

- collate GIS information (for specialists) from several ministries, departments and institutions to produce operative maps; and
- distribute processed geographic data to experts from several disciplines for their studies, research or projects.

Result: Each partner can progress in their respective sector(s) and area(s) of intervention in the DRR context thanks to shared data and documents (using the open data approach).

3. Educating and creating awareness among the public. An information management system helps to sensitize the audience about DRR interventions and activities in a specific region by:

- increasing the visibility of the activities and the actors involved in DRR;
- sensitizing the public about the importance of DRR, through videos and educational material;
- promoting a culture of environmental preservation; and
- providing people with materials that would help to increase preparedness for specific disasters.

Result: More people become more aware about, and engaged in, DRR actions and contribute towards their successful implementation.



4. Keeping donors informed and supporting the decision-making process. An information management system helps projects funders to:

- view what funded organizations are doing;
- monitor the effective use of funds and their impacts; and
- identify good practices that can address funding decisions for future actions.

Result: Donors are more informed about implemented activities and they can use successes in planning their future actions.

2. Steps for Implementing an Information Management System for DRR

There are many ways to manage and disseminate information, whether presented in a standard format or as geographical data, for example, by: creating an online information-sharing tool (web portal), creating maps related to a specific theme or objective, organizing workshops or producing monthly reports. However, in order to ensure the production and sharing of good-quality information, some key principles and steps should be respected.

Key principles for an information management system in DRR

The following are the different key principles to ensure that a good information management system is in place (Lesca, 2010).

1. Information should be available at the right time

Make sure that the information that you would like to have is available at the moment the target audience needs it. For example, if the message you are communicating is time bound or has a deadline, make sure you are able to respect the announced time frame.

2. Information should be trustworthy

Once obtained, the information that you have searched for should be verified to see whether it is trustworthy. To do this, the information can be compared with other information or documents on the same topic but from different sources.

3. Information should be clear and 'to the point'

The following questions should be considered:

- Does the information really answer my question?
- Do I understand this information properly?
- Does the information meet my expectations?

4. Information should be 'catchy' and attractive

The following question should be answered:

- Why did I consult this particular information instead of another source?

Users should be motivated to go back to the source of information either to provide feedback or to look for more details. Feedback is extremely important: opinions and suggestions from users help information managers to shape the way they manage documents, publish resources, communicate key messages, etc.

5. It should be possible to enter information into the public domain
Before sharing and publishing information, always ask yourself the following questions:

- Is it confidential or sensitive information? If it is sensitive, are privacy and restricted users rights established?
- What part of this information can I share?
- How can this shared information be useful to those on the receiving end?

Key principles for the use of geographic information

When dealing with GI, additional considerations need to be made.

1. A basic knowledge of GIS components

To manage information for a specific topic, such as DRR, it is very important for the person designing the system to be aware of the five elements of GIS and their functions. These elements, which are strictly related to each other in order to produce maps and databases, are:

- software;
- computer;
- people;
- data;
- procedures.

Software is a product that is installed on a *computer* and contains logic programs, which allow the automatic processing of *data* and the performance of specific tasks. *People* collect and manipulate the software by following *procedures*.

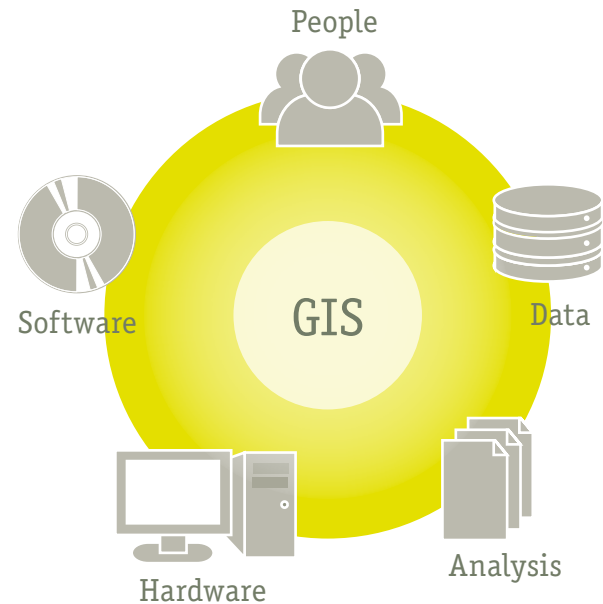


Figure 7: GIS components

2. Awareness of stakeholders' knowledge of GI management

Experts from different technical sectors may use the GI for specific tasks within DRR; therefore, it is essential to understand stakeholders' knowledge about basic geographic principles and motivate them by providing them with a clear, concise vision of why the data are being shared and how they should be used. Undertaking a brief awareness-raising exercise is necessary prior to the organization of any workshop or training.

3. Data accuracy

In GIS, it is extremely important to have accurate data. Both the data and their location must be verified before anything is shared among stakeholders or is made public. People manipulating GIS should always use one of the following practices to make sure that data is correct:

- i. *comparison*: technicians can compare the collected data with archives, and their experience(s) in the region(s), in consultation with other professionals, organizations, etc.
- ii. *cross-checking*: if data are collected during a workshop where many people participate, a GIS technician should verify data from at least one other participant.

Regarding data location accuracy, the technician should use exogenous data to make sure that the newly collected data is good enough for the intended use. For example, the accuracy of newly collected or acquired data and their location can be verified by overlaying them with official (and therefore presumably correct) administrative boundaries data.



Figure 8: District map presented at Salima District Hospital in Malawi

Activities and key steps for the development of an information management system for DRR

Key steps and activities required to manage information are indicated below.

Step 1. Know the target audience and purpose

The first issue to take into consideration when designing an information system is the identification of the target audience (i.e. Who are the intended users of this information?) and purpose (How will it be used?). Once this is established, it is easier to identify and develop the appropriate tools for collecting and communicating information, and establishing criteria and standards to determine the inclusion of data in the information management system.

Step 2. Identify the appropriate information system

There are many options available to manage information. Different solutions suit different audiences and users. For example, web portals, magazine articles, scientific papers, videos, photo galleries and workshops are all media and means for the management of information. Deciding how to collect, process and communicate information depends on the user's needs and expectations, which should be clearly identified in Step 1.

Step 3. Search for and collect information

At this stage, the information manager searches for and collects information from various reliable sources. These sources can be publicly available information (newspapers, journals, newsletters or online articles) that has been organized in a way, (e.g. thematically,



Figure 9: River gauge data collection



by organization, by sector or by geographical reference) that will facilitate its use after all the processes (Steps 1 to 8) have been carried out. Collecting information can be a two-way system, wherein stakeholders are invited to contribute through various fora (online, workshops, articles, etc.). At this stage, information managers put together all the information that they have collected.

Step 4. Assess, select and sort information

Once the information has been collected, the information managers begin to: assess the data according to their quality (accuracy, source, relevance); select the information that will be used in the current system and which will be omitted (based on the criteria in the assessment stage); and sort the information and data according to topics, themes, intended audience, communication media and other parameters established in Steps 1 and 2.

Step 5. Review the selected information at least three times

To ensure the quality of the information to be published, information managers must read all of the information that they have selected at least three times to check for coherency and consistency. Having multiple reviewers and fact checkers for this step is a good practice, where possible.

Figure 10: Civil Protection Committee (CPC) member verifying collected information

Step 6. Analyse the information from a different point of view, identify possible criticisms

After thoroughly reviewing the information, the information manager should anticipate how readers from different segments of the public (participant communities in DRR projects, general public, NGOs, government, academics, etc.) might react while reading the information being shared. The information manager should list the potential criticisms that the various audiences could raise and prepare a response to each – whether it is to correct or amend the messaging (see Step 7) or to have a prepared statement in case these criticisms are raised in public.

Step 7. Correct and re-adjust the information

After analyzing the information, managers correct and re-adjust it by taking into account the possible criticisms, as per the responses prepared in the preceding step.

Step 8. Publish and integrate the information on the system

After all the above key steps, information can be published. At this stage, the information content is finalized and ready to be disseminated to the public in the medium that has been identified as most suitable to convey the messages generated by the information system.



Figure 11: Field visits to help verify collected data

Key steps for the use of geographic information to create hazard maps

To manage GI and create maps, the following steps should be followed as general guidelines.

Step 1. Define your project's needs

For DRR projects, you are likely to need to create hazard location maps, "most hazard prone areas" maps, baseline maps, etc.

Step 2. Prepare data needed for the map

Two kinds of geographic data are required:

- the fundamental dataset, which contains roads, rivers, administrative boundaries, protected areas, lakes, railways and buildings in the study area;
- the thematic dataset: data directly related to the objective of the map. If the objective is to create hazard maps, then data related to hazards occurring in the study area need to be identified, i.e. type, frequency and intensity of the hazard.

Step 3. Identify where and how to collect data

Fundamental datasets can normally be obtained from government agencies responsible for national geographic data management; in some countries, fundamental datasets are made available online for easier access. If this is not possible, existing maps that cover the area of interest can be digitized and used in place of official data.

There are many ways to obtain thematic datasets: organizing a workshop, digitizing existing maps, performing a survey, looking up available documents and collecting global positioning system (GPS) points. Other organizations operating in your study areas may also have collected geographic data, and agreements on its use, manipulation and publication can be negotiated.

Step 4. Verify, refine and structure acquired data, and assign it a coordinate system

Acquired data should be verified, refined and structured before integrating it onto a map. GPS data may not always be very accurate, and it is a good idea to check with field staff whether the location of schools, houses, infrastructure, etc. is the true geographical position. If available, satellite images or Google Maps/Google Earth can also help with this task, as GPS data can be exported and integrated into these programmes in .kmz file formats.²

GIS data must be assigned a correct coordinate system too, as per the needs of the overall information management system. A coordinate system is a reference system used to represent the locations of geographic features, imagery and observations, such as GPS locations within a common geographic framework. Each coordinate system is defined by the following:

² Google Earth uses the .kmz file format for the exchange of geographic information.

- its measurement framework, which can be either geographic (spherical coordinates are measured from the earth's centre) or planimetric (earth's coordinates are projected onto a two-dimensional planar surface);
- its units of measurement (typically feet or meters for projected coordinate systems or decimal degrees for latitude-longitude). Several hundred geographic coordinate systems and a few thousand projected coordinate systems are available for use, but two types of coordinate systems are most commonly used in a GIS:
 - a geographic coordinate system: latitude-longitude. This is a global or spherical coordinate system.
 - a projected coordinate system, such as Universal Transverse Mercator (UTM), that provides various mechanisms to project maps of the earth's spherical surface onto a two-dimensional Cartesian coordinate plane. Projected coordinate systems are referred to as map projections (ESRI, n.d.).

Step 5. Map geographic data

Create the map by overlaying all of the collected datasets using GIS software.

Step 6. Layout and print the map – make geographic data available for others

The layout should be aligned with the needs of the project and the shape of the entire data. If the entire data shape length is longer

than its width, then you should choose portrait orientation, in the other case, you can choose landscape page orientation. The size/format of the map page (A0, A1, etc.) should also be taken into account.

Because other organizations or people may need your geographic data for their own projects, research or studies, it is recommended to also think of how to make it available for them.

Technical considerations and specifications

The most important considerations and specifications to manage information are summarized in this section, which focuses particularly on information shared on the web. Because GI requires specific attention and technical considerations, it is addressed separately from other general sources of information.

Structure of the information system: Software

Once the target audience is identified, the information system can be designed. Websites are appropriate and affordable tools to gather information and share it easily. Many open source solutions are available for website development: content management systems (CMS), such as WordPress, for user-friendly website development, or MySQL or PostgreSQL for database design and management. If a website requires GI management, then some additional software components need to be installed, such as OpenGeo. Users' rights should be defined during the design phase to establish which

information can be downloaded or shared and which information is for viewing only.

Additional information regarding software managing GI is included below.

Content format

Particular attention should be given to the size of the files included in any web application, such as photos and videos. For example, images for websites should be in a sRGB profile with 72 dpi resolution. These are the generally accepted standards for photos posted on the Internet, as sRGB profile pictures are displayed consistently across all programs and are suitable for normal prints and 72 dpi photos are universally recognized as a good compromise between

quality and download speed. A lower resolution would reduce the quality of the photos and higher resolution would make the file too heavy for download. Photo galleries should also be designed so that image browsing is easy and user-friendly, and the images in the photo gallery should be self-explanatory and attractive to keep users' attention once they enter the galleries section.

Update frequency

Information needs to be updated constantly and its accuracy should be verified. Selected staff should be dedicated to this task, as it is very time consuming and the accuracy of information is key to keeping an audience interested. It is important to set this frequency properly at the start of the project and try to stick to it as much as possible.



Figure 12: River gauge data verification

Technical considerations and specifications for geographic information

Software to be used

There are many efficient professional GIS software products available on the market, but their prices vary considerably, making some options inaccessible for some DRR practitioners. For example, ESRI's ArcGIS 10.1 suite is one of the best GIS software products in terms of processing capacity and speed. It offers user-friendly tools and produces an attractive map layout. A license for a standard desktop version of this software, which can be used for creating maps and editing geographic data, but not for performing sophisticated GI analysis, is generally quite expensive although there are preferential

pricing options for NGOs. If users want more sophisticated tools, extensions or additional options for this software, they can be bought separately. The majority of GIS commercial software has approximately the same price to quality ratio.

On the other hand, open source GIS software is also available. Unlike commercial software, they do not require a licence for either acquisition or use, i.e. they can be downloaded and used free of charge. The user can search for software online and choose one from the many of options according to their needs. In terms of results, the performance of such software differs according to which group or association has developed it. The open source GIS software QGIS is one of many that can provide its users with the best performance and quality. Therefore, this



Figure 13 (left): A community hazard map on the bridge indicates the most at-risk areas

Figure 14 (right): Mapping and digitized information used among DRR stakeholders

software is recommended if the project does not require complex and advanced data processing.

Coordinate system

With good maps, one can assure efficient and precise broadcasting of information to stakeholders of a project. The production of a good map relies on the appropriateness of the coordinate system assigned to data. Even though data can be processed in GIS without necessarily having to assign a coordinate system, experience has proven that it is important that the technician knows and assigns the appropriate coordinate system to data. This reduces the risks of making errors during data processing.

For example, in the southern Africans region, COOPI has used two kinds of coordinate systems for all of their data.

- **World Geodetic System 1984 (WGS84)** is a geographic coordinate system, wherein the location of a point is defined by spherical coordinates (latitude and longitude) that are measured from the earth's centre.
- **UTM-XS** is a planimetric coordinate system, wherein the earth's coordinates are projected onto a two-dimensional planar surface; therefore the location of a point is projected over a flat surface.

In the UTM coordinate system, the variable X changes according to which country or region of intervention the data comes from, for example: in Malawi, UTM 36S and in Madagascar, UTM 38S or UTM 39S.

WGS 84 is good to use when the data are being collected or still in the stage of processing, UTM is preferred when data measurements are needed or to finalize a map within GIS software.

Therefore, it is necessary to switch between both coordinate systems according to the needs of your project. Each GIS software program is already equipped with tools that allow this transformation.

Perform simpler but smarter

People who lead activities related to GIS in DRR should be aware of use of the maps by their audience and by the broader public. To ensure that the information contained in the map is well communicated to and understood by its recipients, activity leaders should also know the level of knowledge of their interlocutors: decision-makers, citizens and experts in a given field, etc. Activity leaders should then balance readability of the map against including the maximum amount of information, based on the recipients' needs.

3. Practical Examples to Guide Implementation

Specific context in southern Africa and the Indian Ocean region

Every year, countries in southern Africa and the Indian Ocean region face different types of disaster: flood, drought, cyclone, food insecurity, etc. For instance, Madagascar, due to its geographical position in the Indian Ocean, faces tropical cyclones each year. These disasters affect the lives of millions of people, both in urban and rural areas. Various factors make Madagascar's capital city, Antananarivo, vulnerable to disasters, in addition to natural disasters

- It is located only 20 kilometres away from a significant dam whose water runs through two large rivers surrounding the city.
- It is the location of a major petroleum depot.
- It houses the national army ammunition storehouse.
- Buildings and other infrastructure are not constructed to resist frequent catastrophes.
- The population of Antananarivo is affected by problems with food security.

Because this is the capital city these hazards are well known, but in smaller villages people are often unaware of potential hazards that

could affect them – sometimes drastically. It is for these reasons that information plays a fundamental role in supporting interventions, because it helps people – both the local population and organizations planning interventions – to know the area better and to be more aware of the hazards that could affect them and the activities being implemented to reduce their exposure as well as familiarizing populations with the stakeholders working in the area, etc.

In the region, the Southern Africa Climate Outlook forum is responsible for forecasting the major climate events foreseen in the peak hazard season annually and the UN Office for the Coordination of Humanitarian Affairs (OCHA) is in charge of managing and coordinating information related to disasters and creating awareness among citizens. In addition, some information management systems based on web platforms already exist (e.g. the Southern African Development Community (SADC) at <www.sadc.int/>). However, at local levels and at levels that require interaction and coordination of information on a smaller scale, DRR implementing organizations, partners and stakeholders play an essential role in the collection, handling and dissemination (i.e. the management) of information. In addition, projects or programmes that include an information management system are vital for these larger-scale efforts coordinated at a broader level by institutions such as SADC and OCHA.

Unfortunately, GIS technology is not yet widely used in the southern African region's DRR and development projects and programmes. NGOs and other partners are usually unable to keep up with the fast pace of GIS technology, from simple computerized mapping procedures to the production of interactive online maps. Nevertheless, interventions would benefit greatly from this technology.

Experiences in southern Africa and the Indian Ocean region

Two experiences are illustrated in this section: the development of the DRR IKMS and participatory GIS exercises conducted in Mozambique and Malawi.

DRR information and knowledge management system

DRR IKMS is a web platform created to facilitate the work of humanitarian aid staff in the southern Africa and Indian Ocean region through the following objectives:

Objective 1: Share, exchange, research information among stakeholders

It is hoped that this platform will become an important platform tool for DRR activities in the region by offering various possibilities for information management (information on partners' activities) and technical knowledge and data (geographical data and scientific knowledge regarding the risks).

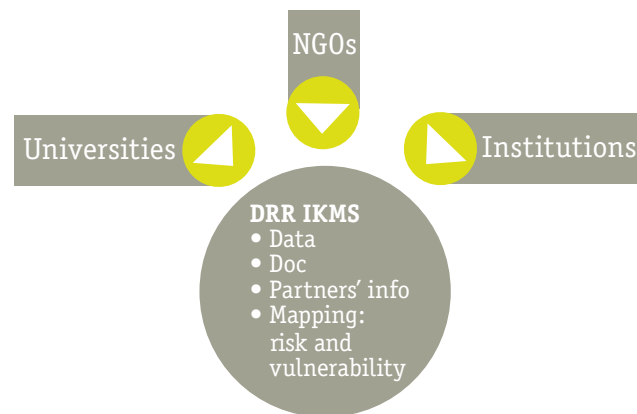


Figure 15: IKMS' stakeholders and content

Objective 2: Serve as an interactive tool between DRR partners
The IKMS helps to: increase visibility of the implemented actions, avoid duplication of activities between different partners, provide a clear idea of Who does what? and Where?, help geographical data management and provide access to technical documents. It also gives different rights to different types of users, such as: viewing data only, downloading information, uploading information or data, etc.

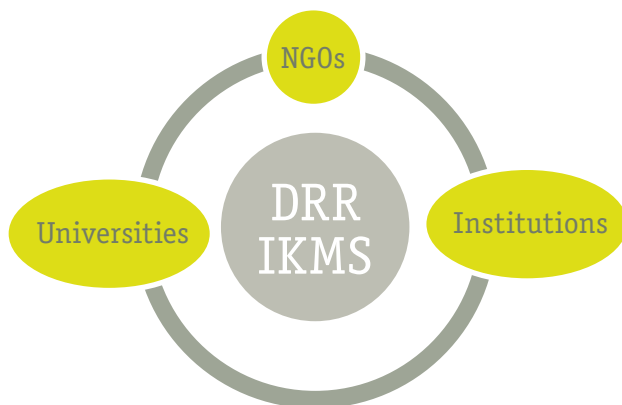


Figure 16: IKMS' DRR partners

These were the main steps followed to develop the DRR IKMS:

1. Design the webportal specifications.

***Step 1:** Web portal general structure and organization (menu, sections)

***Step 2:** Operationalization (e-tools); e-tools are electronic tools that allow authorized users to: enter their own data into the web platform, search for documents, and view and download maps. There are particular two types of e-tool: the e-library (to share papers or articles) and the geo-portal (to share geographic data).

2. Design the webportal's empty shell. This refers to the general structure of the web platform, specifying the relationships between the different sections (documents, events, galleries, etc.).

3. Collect and manage the information. Information is collected from various sources: partners, websites, newspapers, primary data collected through fieldwork, workshops, etc. For example, in the DRR IKMS, the main information was provided by partners of the regional project, such as FAO REOSA and UN-Habitat, but also from national partners, such as the national DRR platforms in Madagascar, Malawi, Mozambique and the Comoros. Managing information consists of summarising the essential points from the

different sources, using simple and clear language, so that it can be communicated to the general public.

4. Organize the content information (CI). Assign an order of priority to each piece of information by selecting the least and most useful and interesting for users. Vital information should then be highlighted and posted on the website.

5. Adjust the organization of the CI, by reviewing selected elements that may require clarification and correction to provide quality information to users.

6. Send the CI to the webmaster.

7. Webmaster inserts the CI into the portal.

8. The CI is published on the website.

9. Update the CI. Then, repeat the cycle from Steps 3 to 9.

The IKMS serves as an information tool that meets the needs of users, gives them a focal information point with regularly updated data, follows technological development, and offers them a modern platform to increase their interactivity. The IKMS has been developed in collaboration with Z_GIS, Dep. Of Geoinformatics, Paris-Lodron Universität Salzburg (Plus).

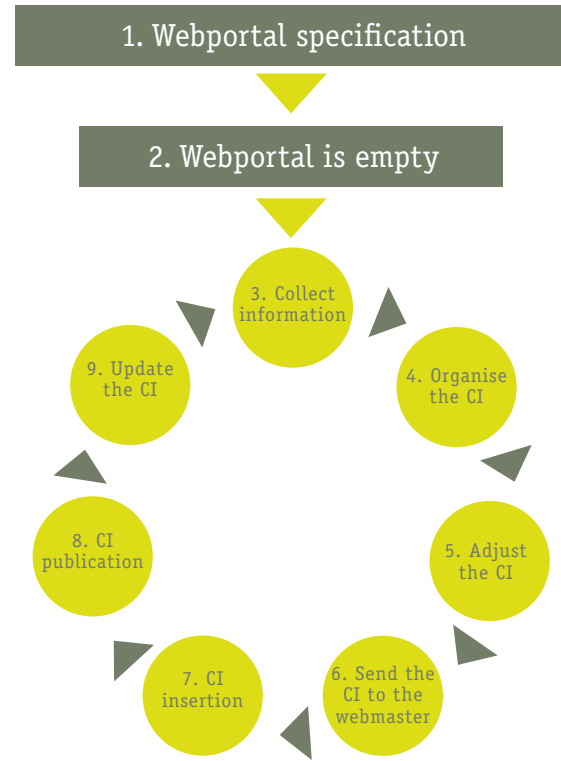


Figure 17: Steps involved in the development of the IKMS

Geographic information: Participatory GIS

Important information on disasters can be obtained from people during participatory geographic information system (PGIS) mapping exercises. PGIS is an activity in which professionals of different categories (experts, associations, NGOs, farmers, government officials, local community members, etc.) participate in discussions about one or more themes. Six steps are required to perform PGIS.

The components of each step are described in detail in Box 1.



Figure 18: Steps involved in practising PGIS



BOX 1: PGIS STEPS FROM TOWN TO VILLAGE LEVEL

STEP 1: Preparation (with the municipality or mayor and local authorities)

1. Introduce the concept of participatory mapping for risk management to local authorities.

- Outline the six steps as above.
- Objectives:
 - Map, through GIS tools, the knowledge of the authorities and information from local population about risks and disasters in their locality.
 - Build capacity of municipal staff in the implementation of participatory mapping for risk management.
- Expected results: Data and location of disasters and hazards in cities and villages are mapped.

2. Organize a participatory mapping session with municipal technicians.

- Select sites.
- Acquire (order or download) satellite images – high (for villages), low or medium resolution (for districts, regions) – freely available from Landsat images.
- Process images: geo-referencing, calibrating, pan sharpening.
- Set up page size. A0 format is recommended as this is usually big enough for users to identify small details and infrastructure.
- Print the first draft of the map (image of the city/region) [A01A].

STEP 2: Participatory mapping exercise

1. Identify the existing risks in the area with participants:
 - their features: name, date, frequency;
 - the amount of damage: human and material.
2. On the printed A01A, at the scale of the city/region and with the support of municipality technicians, delimit, using a marker, the location of areas affected by a specific risk.
3. Processing of the first draft.
 - Scan the first draft of the map that has been worked on collaboratively (map A01A).
 - Calibrate the scanned map.
 - Digitize the boundaries of location risk.
 - Develop a database on the characteristics of each risk represented.
 - Highlight sensitive areas with different colours.
 - Lay out and print to have the second draft A0 map (map A01B).

STEP 3: Map the places where hazards have occurred in the area

1. With the municipal representatives, check/confirm the information obtained about the risks.
 - Take note of their criticisms, corrections, updates and comments on the printed second draft.
 - Scan and geo-reference the second draft.
 - Outline new elements.
 - Update the database.
2. Lay out and print the semi-final map A0 (map A02).
3. Disseminate map A02 to various stakeholders.
4. Lay out the second draft at the scale of the most sensitive areas.
5. Print A0 maps for each sensitive area (A02).

STEP 4: Second preparation (with local authorities)

1. Organize a coordination meeting at the local authority (municipality or district).
2. Introduce participatory mapping project for risk mapping by explaining:
 - the stages of the project;
 - the objectives;
 - the results.
3. Organize a participatory mapping exercise with village leaders.
 - Identify the hazards and disasters that have occurred in the village.
 - Discuss in detail the disaster identified, including where it happened and the epicentre of impacts – both human and material.
 - On each of the A02 maps, delineate the areas most affected by the disaster.

STEP 5: Mapping of high risk sites (with the participation of residents)

1. Using the A02 maps, identify risks in the village (or confirm the identified risks).
 - Identify types of risks: floods, massive explosion, etc.
 - Identify disasters that have already occurred in the quarter.
 - Record data on a paper or computer (text file).
 - Record data on the types of disasters, date, time of occurrence, scale.
 - Record data on extent of damage.
2. PGIS or participatory mapping of identified risks (locally).
 - With the inhabitants (or local civil protection committees, if they exist), locate and delineate on the printed A02 map the at-risk or affected areas and areas with high additional risk.
3. Collect data (on schools, health centres, water points, etc.) by conducting a survey of the population using GPS and questionnaires.

4. Process the information on the map.

- Scan maps.
- Geo-reference them, calibrate them. This process involves specifying the location of two or three known points on the map. Once the correct geographic coordinates are known for these points (called calibration points), the coordinates of every other point on the map can be calculated.
- Outline boundaries and representations previously identified and reviewed with the local population.
- Define the legend icons and labels.

5. Process data collected by survey.

- Verify and refine information with the inhabitants or civil protection committees, if they exist.
- Enter data into the GIS software (ArcGIS or QGIS).
- Map geographical data.

6. Map geographical data from two sources (survey and PGIS), highlighting the most sensitive areas.

7. Lay out and print A0 (for the A03 map).

STEP 6: Participatory mapping locally

1. Present the map A03 to local authorities (village, town commune, neighbourhood) for comment, verification and/or possible correction.
2. Incorporate comments and corrections on the map and GIS.
3. Lay out and print final maps.
4. Distribute maps to stakeholders.



The final version of the hazard map contains important, accurate and clear information on disasters in a given area. It specifies what kind of disasters occur, the frequency of hazards and disasters, which localities are high-, medium- and low-risk, what elements (people, infrastructure) are exposed to recurrent hazards, the scale and extent of past hazards, etc. A database describing all of the elements of the map can be attached to the final map to help users to understand it fully.

This final map is distributed to DRR stakeholders (for managing DRR operations) and to government and public audience (for information and disaster preparedness actions).

PGIS exercises have been performed in municipalities and many villages across the region, such as in the city of Chokwe, Mozambique and Kasache Village, Malawi. Participants have demonstrated great interest in the exercise and were able to properly interpret the satellite image to identify key structures in their villages or regions and hazard zones. Copies of the final map have been provided to local authorities to be used to plan future interventions. Communities appreciate both the maps and the process followed, because the process takes into account their past experiences and their practical knowledge of natural hazards and resulting disasters in their communities. This is an important recognition of their experiences and their reality, and it is invaluable to DRR to help better prepare for and mitigate the impacts of future hazards.



Figure 19: PGIS session with residents in Kasache, Malawi showing steps 4 and 5 in the process outlined above

4. Conclusion

Managing standard information (web pages, documents, etc.) or GI is a critical issue in DRR projects and programmes. The more knowledge NGOs, and implementing organizations and their partners, acquire and share about a village, district, country or region, the more significant an impact their actions will produce, and the more they can advance in their efforts together.

Web platforms, documentation and case studies facilitate the information flows between regional actors, facilitating the sharing of good practices and lessons learned as well as avoiding mistakes that may have been experienced in the past. PGIS helps to integrate local knowledge with technical tools (such as GPS and mapping software) to get the best, most accurate information out of the two communities: the inhabitants or local authorities and the GIS experts. This also helps in the planning of future actions, such as building new infrastructure or identifying where to relocate people in the occurrence of a disaster, to lessen the negative impacts on lives and livelihoods.



Figure 20: Members of the community during an emergency drill

5. Bibliography and References for Further Reading

Deschamps, C. 2009. *Le nouveau management de l'information*. France. FYP Edition.

ESRI. (n.d.). Coordinate systems, map projections, and geographic (datum) transformations. Available at <http://resources.esri.com/help/9.3/arcgisengine/dotnet/89b720a5-7339-44b0-8b58-0f5bf2843393.htm>. Environmental Systems Research Institute.

ESRI ArcGIS 10 Desktop license: <http://esri.osu.edu/node/31>.

Geoportal: https://reach1.cern.ch/reach/flex33/MLI_SB/.

Lesca, H., Lesca, E., Lesca, N. & Caron-Fasan, M-L. 2010. *Gestion de l'information: Qualité de l'information et performances de l'entreprise*. 2nd edn. ems Management & Societe.

QGIS download: <http://hub.qgis.org/projects/quantum-gis/wiki/Download>.





Funded by:



Humanitarian Aid
and Civil Protection

Coordinator:



UN HABITAT
FOR A BETTER URBAN FUTURE



ISBN 978-92-5-108340-6



9 789251 083406

I3772E/1/04.14