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Lessons learned from crisis management of floods – elicit to learn crucial post-crisis lessons



Maren Maal and Tonje Grunnan

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English summary

The EU project ELITE (*Elicit to learn crucial post-crisis lessons*) was a Coordination and Support action project, completed in the period of January 2013 to June 2014. The project received funding from the EU's Seventh Framework Programme for research, technological development and demonstration from the grant agreement no. 312497 and had a budget of 940,434 Euros.

This report is the third of four publicly available deliverables in the ELITE project that study lessons learned from respectively forest fires, earthquakes and floods. The purpose of this report is to gather, categorize and analyze lessons learned from crisis management of *floods* in the pre-crisis phase, during the crisis and in the post-crisis phase. The report contains a background chapter with examples of major floods in Poland, Central Europe and Norway. Lessons learned from the crisis management of *floods* are identified and clustered in *common problem areas* (categories). Secondly, possible solutions or suggestions on how to best improve the common problems areas are identified. Finally, the results are presented in a compilation table including lessons learned from the most common problem areas and possible solutions within the three phases of crisis.

A workshop with crisis management experts on floods took place in Vienna, Austria, in October 2013, in order to gather empirical data for this report. A problem structuring method was used for this purpose. Furthermore, a literature review was conducted with the intention of confirming some of the findings from the workshop as well as adding new information. The experts were from the so-called ELITE Community of Practice (CoP). The CoP consists of the project's end users; a heterogeneous group of first responders, researchers, civil protection officers, representatives from NGOs etc. from various European countries.

By using the post-it method in group discussions, a number of experiences and lessons learned were gathered. The relevant lessons learned were grouped in main 'problem areas' for lessons learned, i.e. the most common problems when preparing, responding and recovering from crises. The main findings were that problems faced when managing floods could be categorized in areas such as (i) creating awareness in the population through campaigns and education, (ii) communication to the population before and during a crisis, (iii) planning and testing the plans in practice, (iv) training and making laws regarding accountability, (v) coordination and interoperability between different agencies, (vi) holistic (system) learning on how to improve in the response phase, (vii) information management, (viii) equipment and infrastructure and (ix) decision-making and financing.

Selected best practices from the crisis management of floods are mainly gathered from the CoP. The report presents best practices relating to volunteers so they do not become a burden for the emergency workers, public communication to population to increase self-protection and the use of interactive awareness raising campaigns such as computer games targeting children. A lot of these best practices are attempting to tackle problems of a general character that have been mentioned by experts in relation to all ELITE workshops; forest fires, earthquakes and floods.

Sammendrag

EU-prosjektet ELITE (*Elicit to learn crucial post-crisis lessons*) er et 'Coordination and Support action' prosjekt som ble gjennomført i perioden januar 2013-juni 2014. Prosjektet fikk støtte fra EUs syvende rammeprogram for forskning, teknologisk utvikling og demonstrasjon etter tilskuddsavtale nr. 312497 og hadde et budsjett på rundt 8 millioner kroner.

Denne rapporten er den tredje av i alt fire offentlig tilgjengelige rapporter i ELITE-prosjektet som omhandler erfaringer, eller «lessons learned», fra henholdsvis skogbranner, jordskjelv og flom. Målet med denne rapporten er å samle, identifisere, kategorisere og analysere erfaringer fra flomkatastrofer, før, under og etter flommen har funnet sted.

Rapporten inneholder et bakgrunnskapittel som viser eksempler på store oversvømmelser i Polen, Sentral-Europa og Norge. Erfaringer og læringspunkter fra flom er identifisert og kategorisert i felles problemområder knyttet til krisehåndtering av flom. Videre har mulige løsninger eller forslag på hvordan en best kan forbedre krisehåndteringsvevnen, såkalte «best practices», blitt identifisert. Avslutningsvis blir disse læringspunktene og løsningene systematisert og presentert i en oppsummeringstabell.

For å samle konkrete erfaringer fra kriser og identifisere utfordringer knyttet til de ulike fasene i en flomkatastrofe ble det arrangert en workshop med medlemmer av prosjektets sluttbrukergruppe, det såkalte Community of Practise (CoP), i Wien, Østerrike, i oktober 2013. CoP består av en heterogen gruppe av responspersonell, forskere, sivilforsvarspersonell, representanter fra frivillige organisasjoner etc., fra en rekke ulike europeiske land. Ved å bruke problemstrukturerende metode i gruppediskusjoner, slik som post-it-metoden, var vi i stand til å samle inn og kategorisere et stort antall erfaringer og lærdommer fra ulike flomkatastrofer. De mest relevante erfaringene ble gruppert i såkalte "problemkategorier" for læring, det vil si de vanligste problemene i forberedelsesfasen, under selve krisen og etter krisen. Hovedfunnet er at problemområdene identifisert i forbindelse med flom kunne bli kategorisert under temaene (i) bevisstgjøring gjennom kampanjer og utdanning, (ii) kommunikasjon til befolkningen både før og under krisen, (iii) planlegging og øvelser som tester planene, (iv) opplæring og klare lover og regler om ansvarsfordeling mellom etater, (v) koordinering og samvirke på tvers av organisasjoner og etater, (vi) holistisk læring på hvordan en kan forbedre håndteringen, (vii) Informasjonshåndtering, (viii) utstyr og infrastruktur og (ix) beslutningsprosesser og finansiering. Det ble etterpå utført en litteraturstudie for å bekrefte og/eller avkrefte funnene fra workshopen, samt å samle ytterligere informasjon.

Til slutt presenterer rapporten resultater som kan anses som mønsterpraksis når det gjelder bruken av frivillige slik at de ikke blir en byrde for redningsarbeidere, offentlig kommunikasjon til befolkningen og bruken av interaktive bevisstgjøringskampanjer som f.eks. dataspill om flomproblematikk for barn. Mange av disse eksemplene forsøker å takle problemer av generell karakter som har blitt nevnt av eksperter i forhold til alle ELITE workshopene; skogbrann, jordskjelv og flom.

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Preface

We would like to thank the participants in the *ELITE Workshop on Floods* which took place in Vienna, Austria, 8-9 October, 2013, for their valuable inputs to the report.

1 Introduction to the ELITE project

The EU project ELITE (*Elicit to learn crucial post-crisis lessons*) was a Coordination and Support action project, completed in the period of January 2013 to June 2014. The project received funding from the EU's Seventh Framework Programme for research, technological development and demonstration from the grant agreement no. 312497 and had a budget of 940,434 Euros.

ELITE was coordinated by Tecnun – Faculty of Engineering at the University of Navarra in Spain, by Dr. José Mari Sarriegi. The Norwegian Defense Research Establishment (FFI), represented by Tonje Grunnan, was the scientific lead of the ELITE project. The other consortium partners included: Gjøvik University College (Norway), International Search and Rescue Germany (ISAR) (Germany), Research Institute of the Red Cross (Austria), Main School of Fire Service (Poland), Thales Research and Technology (France), Institute of Methodologies for Environmental Research of the National Council of Research (IMAA-CNR) (Italy) and the National Association of Italian Municipalities (ANCI) - Umbria (Italy). Tonje Grunnan and Maren Maal from the BAS7-project (Protection of society 7) conducted the work on behalf of the FFI. Grunnan was the work package leader for WP4. FFI also participated actively in three other work packages.

The ELITE project has developed a prototype of a web-solution (wiki) - *a living document* - which contains information about experiences and lessons learned from natural disasters, primarily in Europe. Much of our knowledge of learning from disasters is fragmented, and the goal of the ELITE project was to collect, categorize and analyze common problem areas in all phases of a crisis, so-called *lessons learned*. The web solution is assumed to help the various actors in crisis management by creating a platform to transfer and share relevant knowledge among users, best practices and guidelines. Due to restricted time, the project focused on natural disasters such as *forest fires, earthquakes and floods*. For this reason the wiki contains mostly reports and documents related to these types of natural disasters, but it is possible to share lessons learned from other types of natural disasters.

ELITE had six work packages (WPs). *WP1* was the coordination and management of the project. *WP2* had the responsibility for arranging the workshops for the ELITE CoP. *WP3* developed the web based platform (the ELITE living document). *WP4* gathered, categorized and analyzed common problem areas and lessons learned in four reports and developed a framework for lessons learned reporting in crisis management. *WP5* mapped the learning process and developed a scientific model of learning. *WP6* disseminated the results from the ELITE project and created a handbook with lessons learned and best practices.

2 The ELITE Community of Practice (CoP)

The project was linked to an extensive group of end users from a total of 16 nations that together formed a Community of Practice (CoP). The end users consisted of a number of actors, such as operational firefighters, police and health professionals, civil protection, emergency and contingency planners at local, regional and national levels, and representatives from NGOs. The aim was to involve stakeholders who were interested in mutual learning and exchanging information, and to help establishing, validating and maintaining the living document. The ELITE CoP will be continued through the establishment of the Society of Crisis Management Community of Practice (SeCriMaCoP). The aim is to keep the living document alive by getting more crisis managers to share their experiences through this platform. The consortium partners will play a leading role in gathering more end-users and donations for the continuation of the Society. Initially, TECNUN will have the presidency in the SeCriMaCoP, while FFI will have the role as vice president. FFI will work to gather more active end users in Norway.



Figure 2.1 The ELITE Community of Practice (CoP).

3 Knowledge gathering, categorization and analysis of lessons learned

The aim of work package 4 was to gather knowledge, categorize and analyze experiences of each of the three natural disasters; forest fires, earthquakes and floods. A comprehensive literature review was conducted with the purpose of identifying the most relevant experiences and lessons learned within each disaster type. Most of the empirical data, however, was collected in four two-day workshops and one table-top/reporting exercise that the project organized for the end users. Findings from these workshops were continued and validated through questionnaires and semi-structured interviews with selected participants.

Five deliverables were produced in the work package. The first report¹ was prepared by Thales Research and Technology (TRT) and was a methodological report describing the development of categories in the ELITE web solution. The report is exempt from public dissemination. Three lessons learned reports were produced from each of the following disaster types; forest fires², earthquakes³ and floods⁴. The goal of these reports was to identify common problem areas and challenges (*lessons learned*) in each type of emergency and describe possible solutions to the problems identified (*best practices*). Furthermore, these findings were used to create a framework or guidelines, to identify the key learning points in the aftermath of large, severe crises. This framework is presented in the fifth report⁵. The final report has a holistic perspective and attempts to transfer findings across the different disaster types and draw knowledge from the previous deliverables.

As responsible for work package 4, FFI is publishing the four publicly available deliverables. This is done in order to disseminate the results and have a wider distribution, nationally and internationally. This report presents the third lessons learned report; *Floods lessons learned report*, see Appendix A.

¹ Goujon, B. (2013). *Methodological report on categorisation*. Deliverable 4.1 ELITE project. FP7-SEC. Contract no. 312497. Restricted.

² Maal, M. and Grunnan, T. (2014a). *Forest fires lessons learned report*. Deliverable D4.2. ELITE project. FP7-SEC. Contract no. 312497.

Maal, M. and Grunnan, T. (2014b). *Floods Lessons Learned Report*. Deliverable 4.4. EU FP7 ELITE (Elicit to learn crucial post-crisis lessons). Contract No: 312497.

³ Maal, M., Grunnan, T., Gallipoli, M.R., Piscitelli, S., Masi, A. and Mucciarelli, M. (2014). *Earthquake lessons learned report*. Deliverable D4.3 in the ELITE project FP7 SEC Contract No. 312497.

⁴ Maal, M. and Grunnan, T. (2014b). *Floods Lessons Learned Report*. Deliverable 4.4. EU FP7 ELITE (Elicit to learn crucial post-crisis lessons). Contract No: 312497.

⁵ Grunnan, T. and Maal, M. (2014). *Holistic analysis of lessons learned*. Deliverable 4.5. EU FP7 ELITE (Elicit to learn crucial post-crisis lessons). Contract No: 312497.

Appendix A Floods lessons learned report



ELITE

Elicit to Learn Crucial Post-Crisis Lessons

DELIVERABLE D4.4

Floods Lessons Learned Report

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Version	Date	Contributors	Sections Affected
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2	30.06.2014	FFI	Modified Deliverable D4.4 submitted to the EU

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EXECUTIVE SUMMARY

The aim of Deliverable 4.4 is to gather, categorize and analyze lessons learned from *floods* in the pre-crisis phase, during the crisis and in the post-crisis phase. This deliverable constitutes the third lessons learned report in work package 4 (WP4) in the ELITE project. Two previous lessons learned reports have focused on lessons learned from forest fires (D4.2) and earthquakes (D4.3).

The report contains:

- A background chapter with examples of major floods in Poland, Central Europe and Norway.
- Identification of lessons learned clustered in *common problem areas* (categories) in the crisis management of *floods* based on participative workshops with experts from the ELITE Community of Practice (CoP).
- Identification of possible solutions or suggestions on how to best improve the common problems areas identified.
- A compilation table including lessons learned from the most common problem areas and possible solutions.
- Selected best practices in the crisis management of floods gathered from the CoP. These best practices are also relevant for the management of other emergencies such as forest fires and earthquakes.

A workshop with crisis management experts on floods took place in Vienna, Austria, in October 2013 in order to gather empirical data for this report. A problem structuring method was used for this purpose. Furthermore, a literature review was conducted with the intention of confirming some of the findings from the workshop as well as adding new information.

By using the post-it method in group discussions, a number of experiences and lessons learned were gathered. The relevant lessons learned were grouped in main 'problem areas' for lessons learned, i.e. the most common problems when preparing, responding and recovering from crises. The problem areas defined were (i) Awareness, (ii) Communication, (iii) Planning, (iv) Training, (v) Coordination and interoperability, (vi) Holistic (System) learning, (vii) Information management, (viii) Equipment and infrastructure and (ix) Decision-making and financing.

Finally, the report presents best practices regarding volunteers, public communication and educating children. A lot of these best practices are attempting to tackle problems of a general character that have been mentioned by experts in relation to all ELITE workshops; forest fires, earthquakes and floods. Unorganized volunteers that want to help often become a burden for the emergency workers. Communication with the public has been mentioned as a major problem especially as the population lacks knowledge of self-protection during different types of crisis. A long term strategy to create awareness in the population is to target children through awareness raising campaigns.

A compilation table of the lessons learned within the three phases of crisis, identified by the ELITE workshop participants, is included, as well as a summary table of lessons learned in the final chapter.

The report was written by Maren Maal and Tonje Grunnan, both from the Norwegian Defence Research Establishment (FFI) in Norway.

We thank the participants in the *ELITE Workshop on floods* for their valuable inputs.

1. INTRODUCTION

The latest Intergovernmental Panel on Climate Change (IPCC) report is titled “Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation” (IPCC 2012). The report describes how climate changes will have an impact on the frequencies of natural disasters.

Floods are regarded as the most “dangerous, life-threatening, destructive, and certainly amongst the most frequent and costly natural disasters in terms of human hardship as well as economic loss” (Wiesenegger 2013). In Europe one must therefore protect people against the negative impacts of floods. In order to achieve this objective there are various regulations one can use; such as land use planning, constructive measurements regarding river regulations and technical constructions. Flood warning systems are also needed (ibid).

It is in this context that the overarching objective of the ELITE project is to improve European emergency preparedness, response and recovery from disasters.

1.1 The ELITE project

The aim of the ELITE project is to create a living document containing lessons learned from disasters such as forest fires, earthquakes and floods, and those that are common across these disaster types. The ELITE living document will be a publicly available web solution - a “living document” – which contains information about experiences and learning points from natural disasters in Europe from our Community of Practice (CoP¹) as well as other sources such as EU projects and national research. The ELITE CoP consists of main stakeholders in crisis management, in addition to a large group of end users, and the “living document” will be continuously updated and nurtured by the CoP for mutual learning and information sharing.

The output of work package 4 *Knowledge gathering, categorization and analysis* is three lessons learned reports on forest fires (D4.2), earthquakes (D4.3), floods (D4.4) as well as a holistic report where all tangible lessons learned are integrated using an all phases-all hazard approach (D4.4). This deliverable constitutes the third in a series of three lessons learned reports in the project. In addition, a report on categorization for the living document (D4.1) will be produced.

1.2 Research question and objective of the report

The aim of this report is to gather knowledge, categorize and analyze both primary and secondary data regarding preparing, responding and recovering from floods.

This report poses the **research question**: *What are the most relevant problems and are there any lessons learned relating to floods?*

The data collection methods are workshops and document analysis. Through workshops with the CoP it was possible to capture the newest and most relevant lessons learned and best

¹ CoPs are groups of people who share a common interest and concerns, and who expand their knowledge and expertise in this area by sharing ideas, experiences, insights, tools and best practices (Ruffner, 2010; Snyder, 2003; Wenger 2002). For more information about the CoP read Maal and Grunnan (2013).

practices on the crisis management of floods, and the findings were complemented by literature reviews.

1.3 Relevance and importance of the report

The relevance of the ELITE project becomes apparent when analysing the main conclusions drawn by IPCC. Here IPCC describes how climate changes will have an impact on the frequencies of natural disasters as mentioned above. The call describes how Europe during recent years has responded to several natural disasters as the human and financial costs of these disasters are huge. Other disasters, such as major industrial accidents, will to a large degree mobilise similar emergency preparedness resources. Therefore, the ELITE project chooses a methodology that, starting with natural disasters, will generate insights applicable to a large range of disasters, whether “natural” or “man-made”.

The end-product of the ELITE project will be the living document that becomes especially important as one today is lacking the capacity and structures to learn from previous incidents. Støldal (2013) argue that securing lessons learned in a broader regional setting seems to be lacking. Hence, there is a need of systematically analyze and gather lessons learned within your own organizations and spread it to others.

1.4 Plan for the report

The report is structured as follows:

In **chapter 2** the terms in this report will be defined and conceptualized. An outline of who are the actors in the crisis management and the different phases of a crisis will also be explored.

Chapter 3 includes methodological reflections concerning this report’s research process which consists of a literature review and the use of a problem structuring method in the ELITE workshop.

Chapter 4 includes tangible background information regarding examples of floods. The focus is on the floods in Poland in 2010, floods in central Europe 2013 and floods in Norway 2013. Many of the CoP members would refer to lessons learned from these floods in the ELITE workshop.

In **Chapter 5** the different lessons learned from floods are identified and clustered in problem areas. This is based on the information provided by the CoP experts in the workshop. The relevant problem areas for lessons learned are divided and organized according to phases; (5.1) the pre-crisis phase, (5.2) during the crisis, and (5.3) the post-crisis phase.

Chapter 6 identifies possible solutions to the lessons learned. The solutions are divided into the defined main problem areas for lessons learned; awareness, communication, planning, training, coordination, holistic (system) learning, information management, equipment and infrastructure, decision-making and financing. The chapter includes a compilation table of the lessons learned and solutions identified by the ELITE workshop participants.

Chapter 7 focuses on three best practices regarding volunteers, public communication and educating children provided by the ELITE CoP.

Chapter 8 sums up the main findings in this report.

2. MODELS, CONCEPTS AND DEFINITION OF LEARNING

This chapter will focus on who are the actors involved in crisis management and the different phases of a crisis. First, the most relevant terms used in this report will be defined.

2.1 Conceptualization and definitions

2.1.1. Learning and lessons learned

There appears to be no common agreement among researchers in crisis management on a definition of learning or lessons learned. However, it appears to be a general agreement that learning can be seen from at least three dimensions or levels: personal, interpersonal and institutional (Stern 1997:70; Sommer et al. 2013).

The ELITE project has used the National Aeronautics and Space Administration (NASA) and the European Space Agency (ESA) definition of lessons learned. Lessons learned are defined as:

“Knowledge or understanding gained through experience. A lesson must be significant in that it has a real or assumed impact on operations; valid in that it is actually and technically correct; and applicable in that it identifies a specific design, process, or decision that reduces or eliminates the potential for failures and mishaps, or reinforces a positive result”.

Regarding lessons learned, Støldal (2013) defines “lessons” as the incidents, experiences and the concrete knowledge from the incidents. “Learning”, on the other hand, can be more difficult to describe and measure. Støldal argues that when a lesson is “learned” it conveys that one has changed or confirmed certain behaviour. Therefore one must distinguish between *lessons learned* and *lessons identified*. For more information regarding different types of learning, see Maal and Grunnan (2013).

2.2 Who are the actors involved in crisis management?

There are many actors involved in managing and responding to natural disasters. The key services are the police, fire and rescue services, ambulances, emergency call centres, hospitals and the municipality crisis management organizations. In addition, civil protection units, military units (such as the Home Guard), and non-governmental organizations (NGOs) may be called upon. Regional and national authorities can become involved depending on the severity of the crises and the need for coordination.

The European countries organize their civil protection systems in different ways. An example of one way to organize the civil protection system is the Spanish Civil Protection model that conveys the most relevant actors at different levels¹:

¹ This model was provided in the 2nd ELITE workshop in Weeze, Germany, in June 2013 by one of the keynote speakers: Luis Sáenz de San Pedro Alba. The ELITE workshops will be elaborated on in section 3.2.

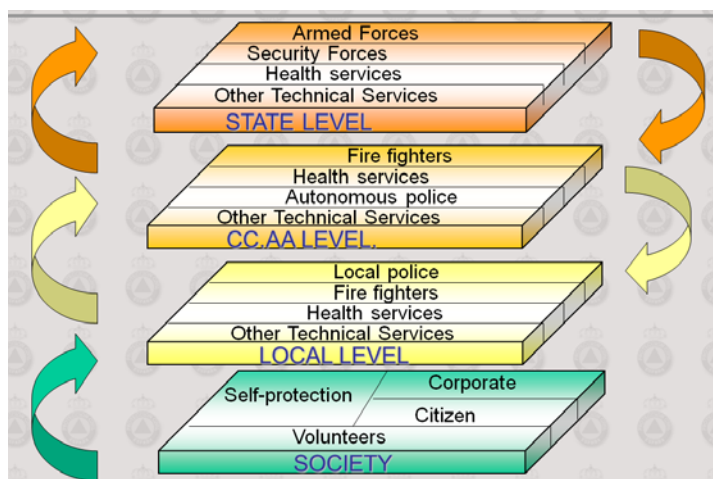


Figure 1: The Spanish Civil Protection system (Sáenz de San Pedro Alba 2013)

There is also an international aspect when it comes to natural disasters as they may affect several countries. The *EU mechanism* is a good example of cooperation across borders. The EU mechanism was established to support the mobilisation of emergency assistance from European Participating States in the event of major emergencies. There was a recognition that “EU and countries worldwide are more and more affected by natural and manmade disasters, such as earthquakes, floods, forest fires and terrorist attacks” (EU 2012:2). The EU mechanism implies that the primary responsibility for dealing with the immediate effects of a disaster lies with the country where it has occurred (EU 2012:2). Nevertheless, when the scale of the emergency overwhelms national response capacities, a disaster-struck country can benefit from civil protection assets or teams available in European countries (EU 2012:2). It is in this context interoperability becomes relevant. Put simply, interoperability is “the degree to which various organizations or individuals are able to operate together to achieve a common goal” (RAND, no date:7).

Interoperability challenges emerge between the different levels in the national and local crisis management and between different countries. The ELITE project aims to use the social network principles to create a Community of Practice to catalyse lessons learned among disparate groups of responders, crisis managers and scientists in a sustained forum that will promote best practices to save lives and to overcome interoperability challenges. In other words, ELITE wants to increase the level of coordination effectiveness among the different stakeholders/actors.

2.3 Different phases of a crisis

A general definition of crisis is when “[...] policymakers experience a serious threat to the basic structures or the fundamental values and norms of a system, which under time pressure and highly uncertain circumstances necessitates making vital decisions” (Rosenthal, Charles and t’Hart 1989:10, cited in Boin et al. 2005:2).

However, this entails both man-made and natural disasters. Natural disasters can be defined according to the extent of their impacts. The perception of the term crisis depends on the context, the ability of the involved actors to assess the situation. As noted earlier a crisis can be understood as an event that has the potential to threaten important values and undermine an actor/institution’s ability to perform its functions in a given society. Some main characteristics are that the crisis comes as a surprise or is unexpected, and there is a lack of control, time and information. Important interests are at stake and often many actors are involved. With

inadequate communication uncertainty becomes great. There is considerable pressure from the media.

In general one can outline three main phases related to a crisis, see figure 1. These phases are not clear-cut but transcends into each other.

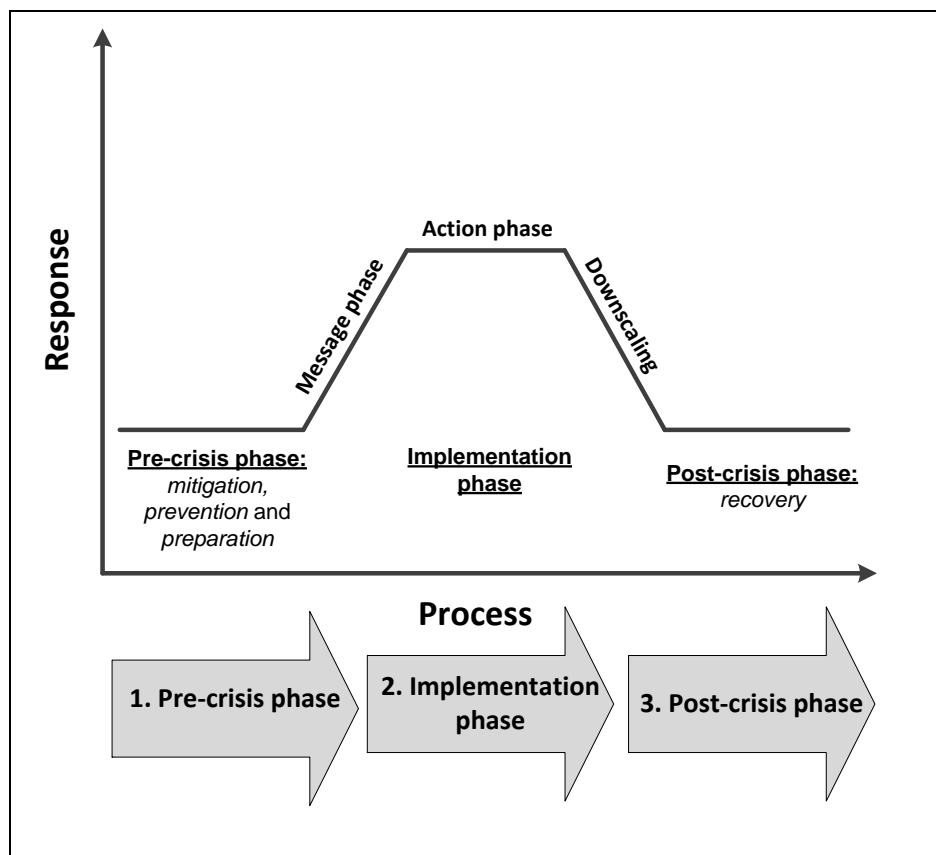


Figure 2: Phases of a crisis (based on PBS1 2011:27).

(1) Pre-crisis: Before the crisis one can work on *mitigation, prevention and preparation*. The first responders may prepare by using Standard Operating Procedures (SOPs) in relation to the method of reporting incidents, equipment available and training methods related to search and rescue (Kepka 2013).

(2) The Implementation phase (during the crisis): This phase can be divided into:

- (i) The 'Message phase' which deals with the uncertainty about *what actually happened* and the scope of the crisis.
- (ii) The 'Action phase' is the actual operation where one *responds* to the crisis
- (iii) The 'Downscaling phase': The fire professionals have control of the situation and less efforts are needed compared to the action phase.

(3) The post crisis phase: This involves a *recovery* from the crisis situation where one ensures a transition back to business-as-usual. In addition *analysis* may be necessary to investigate the steps parallel to the efforts in the implementations phase. The investigation can be directly linked to the implementation phase or detached from it and focused more on for example preparedness (pre-crisis). Other government agencies may also initiate investigations.

3. METHODOLOGICAL APPROACH

The research methods used in this report include problem structuring methods and participative observation during the floods workshop and a review of secondary and primary literature.

3.1 Problem structuring method

The ELITE consortium have designed, planned and conducted three workshops for members of the ELITE CoP¹. The third workshop on floods, which this report is based on, took place in Vienna, Austria, the 8th-9th of October 2013. The group of participants in the Vienna workshop consisted of experts from a range of end-users, such as fire fighters and other first responders, directorates, ministries and NGOs. The experts came from different geographical parts of Europe (Lang and Neuruhrer 2013).

When gathering and identifying lessons learned from crises and disasters, it is essential to structure the experiences in order to enhance learning from the disaster. Various problem structuring methods (PSM) can be used for this purpose. PSMs are particularly suitable for addressing messy and complex problem and decision situations, especially in the initial phase. The method chosen in the ELITE workshops for structured brainstorming is often called “Post-it” method or “Yellow patch” method (Eriksson 2003). The names of the method refer to the extensive use of yellow adhesive stickers as a “tool” for collecting information. The aim of this method is to gather and structure the opinions of a group of experts on important topics

In the floods workshop the post-it method was used to first *identify lessons learned and problem areas*. All experts wrote down lessons learned that they had experienced in their work on different post-its. Later the experts presented their post-its and stuck it onto the whiteboard. This would often cause discussions as the expert would often provide an example where they experienced this lesson, other experts would also share similar experiences.



Photos: Post-it exercise in Vienna and analysis session at FFI (Photographs by Maren Maal 2013)

Post-it notes with similar lessons learned were grouped and categorized under larger problem areas and it was also noted in which of the phases of a crisis this problem would occur (see

¹ The first workshop on forest fires, took place in Weeze, Germany, April 15th-16th 2013, and the second workshop on earthquakes took place in Weeze, Germany, June 25th-26th 2013.

picture from workshop). It was a participative process and all the group members got to share their views, this triggered interesting discussions as the experts came from different countries and backgrounds. The next day, the same groups had to *identify possible solutions* to the problems defined the previous day. The problem areas had been plotted into a word-table and could therefore be projected on a screen. All the problems were dealt with and each time a solution was proposed by the experts.

Finding solutions are much more difficult than finding problems. It was also interesting to note that during the first day when identifying problems all members participated actively. The second day, older and more experienced experts would attempt to promote solutions. This was also a question of mastering the language, as proposing complex solutions required a good vocabulary. Language barriers are difficult to overcome and very relevant in the context of EU projects.

Through the workshop exercises and the following discussion the consortium managed to disseminate and collect procedures, best practices; lessons learned and establish a common understanding of the possibilities for interoperability. Many of the participants from the ELITE CoP expressed that this was a great platform to meet relevant actors involved in civil protection interventions, as well an opportunity to share lessons learned and best practices.



Photos: Participative workshops in Vienna (photographs by Maren Maal 2013)

However, there are weaknesses with workshops. Various actors have different interests, thus there were instances where it was difficult to guide the discussions and create a common platform. For example, in the first workshop in April 2013, we as researchers wanted to focus on learning processes and sharing, while the practitioners wanted to focus on technical issues and equipment. In international workshops there may also be challenges related to languages as mentioned before. A consequence can be that experts with a lot of knowledge and skills may not want to participate and share their insights due to language barriers.

3.2 Literature review

On the topic of floods there are many evaluation reports conducted by humanitarian agencies on how one can better deal with large-scale floods. These reports base their findings on previous incidents like the central European floods in 2010 or the central European flood in 2013. These reports have been used to shed light and serve as background information for this report. Information from the Flood Risk Management Research Consortium has been used, as well as presentations, reports and information leaflets from experts in the ELITE CoP. Newspapers articles from broadcasters and national newspapers dealing with more specific crisis such as have also been referred to.

4. EXAMPLES OF FLOODS IN EUROPE

In Europe the most widespread floods are “river flooding”. This is “essentially a natural process that helps shape landscape” (Flood Risk Management Research Consortium (FRMRC)). Flooding is generally caused by high rainfall and the inability of land to drain water effectively. This is further aggravated when the ground is saturated, like it often is during the spring floods in May and June in Central Europe (FRMRC). Flooding frequently leads to serious water pollution and epidemiological problems. The selection of flood cases is based on the cases used by many of the experts attending the ELITE workshop on floods.

4.1 Floods in Poland 2010

In 2010 Central Europe experienced a series of devastating floods which occurred in May and June. The floods affected Austria, Czech Republic, Germany, Hungary, Slovakia, Serbia and Ukraine. However, Poland was the country that experienced the most devastating impacts. Poland's Prime Minister Donald Tusk informed the Sejm that the ongoing flooding was "the worst natural disaster in the nation's history ... without precedent in the past 160 years" (Wikipedia 2013). The big city Kraków was announced to be in a state of emergency.



Photos: The effects of floods in Poland 2010 (*Fijolek 2013*)

In the ELITE floods workshop, Fijolek from the State Fire Service in Poland (2013) had a presentation on the floods that hit Poland in two waves. The first wave hit in May with 400 liters per 1 m² (15-19.V). Fijolek described how two months worth of rain poured down over one twenty-four hour period. The second wave hit in July and there were heavy rains in the same area of Poland. Bridges and retaining walls were broken. 554 000 hectares in 2157 locations were under water.

Preventative actions had been taken place by for example raising and maintaining the levees as well as inspecting and supervising the levees. After the first flood wave the levees were reconstructed (Fijolek 2013).



Photo: Levees supported by sandbags were breached- Poland 2010 (Fijolek 2013)

Poland had preventative evacuation of people living in risk zones. This was done in boats, pontoons and by military equipment, choppers (military, police, board guards) and heavy equipment. Over 31 500 persons were evacuated and 18 000 farm animals were evacuated. In Poland one had 25 flood victims.



Photos: Evacuation in Poland 2010 (Fijolek 2013)

The rescue work included removing spills by pumping water. A lot of work consisted of humanitarian help pumping water from houses, cleaning houses, delivering water, food, medicines and clothing.

The 19th of May 2010 Poland requested EU to support Poland with 10 high efficiency pumps (minimum efficiency: 600 m³/h). One day later, the 20th of May, 5 EU member states delivered 20 pumps to Poland. The 20th of May one had 97 rescuers, 6 groups, 5 Countries UE and 20 High Efficiency pumps. The 26th of May one had 251 rescuers, 16 groups, 7 Countries UE + Ukraine (2), 49 High Efficiency pumps. The 31st of May one had 252 rescuers, 15 groups, 8 Countries UE + Ukraine (1), 48 High Efficiency pumps (see figure 2).

Resources involved during I flood wave:
18 foreign groups, 301 rescuers, 55 high efficiency pumps.

Resources involved during II flood wave:
10 foreign groups, 147 rescuers, 27 high efficiency pumps.

Country	Number of groups	Number of rescuers	Number of pumps	Efficiency of pumps [m ³ /min]
Czech Republic	5	51	5	350
France	1	16	4	54
Lithuania / Latvia / Estonia	1	19	3	24
Denmark	1	10	7	29
Germany	7	136	23	181
	5	76	15	125
Ukraine	2	70	12	82
Netherlands	1	3	1	83
Together (I and II wave)	23	381	70	928

Figure 2: Table summarising the international help recieved in Poland 2010 (Fijolek 2013)

Fijolek (2013) summarized some of the lessons learned after the floods in 2010. He argued that one must identify critical facilities, update the database of equipment in the country and abroad, review the financing of long-term rescue operations (economical aspects), expanding the rescue resources (high efficiency pumps, high power generators, sand bags, big bags and other useful equipment). It is essential to integrate all the rescue resources into a single system.



Photo: Fireman overlooking the damages from the floods in Poland 2010 (Fijolek 2013)

Central Europe often experiences spring and summer flooding in late May and early June. This commonly associated with a “track of low pressure areas, which bring low pressure and moist air from the Mediterranean Sea over Central Europe, and have led to severe flooding in the affected region before” (Wikipedia 2013).

4.2 Floods in Central Europe 2013

In 2013 in late May and early June Central Europe experienced heavy rain. This time it was primarily Germany and Austria which was affected by the extreme flooding and damages. In Germany the month of May was very wet and most of the area received twice the amount of moisture than what is usual. Soil moisture reached record high values in a large part of Germany which meant that the saturated soils led to greater runoff when the rains began (Euro4m).

The 10th of June 2013 BBC reported that “over 23,000 people were forced to leave their homes in the east German city of Magdeburg after a dam burst on the flood-swollen River Elbe” (BBC 2013). Other central European countries were affected as well and in Hungary 1,200 people had to leave their homes. 23 people died in the 2013 floods in Central Europe (Zurich 2013).

Zurich Insurance Company (2013:1) notes that the early estimates from the 2013 floods anticipate property damage costing about EUR 17 billion. For example parts of Poland's capital Warsaw were flooded after hours of heavy rain, busy motorways were flooded, and firefighters had to help stranded drivers to safety. One has attempted to protect critical infrastructure with levees, flood walls and sandbags. “This can help but do not offer complete security. Other means of protection should be considered, such as flood water retention areas along rivers” (Zurich 2013:1). Zurich (2013) concluded that it “makes little sense to rebuild structures without improving flood resilience”.

4.3 Floods in Norway 2013

The reason for including cases of recent floods in Norway is that it conveys how a flood was handled at a local level, and especially what kind of problems the municipalities and local population faced.

The 22nd of May 2013 the county of Nord-Trøndelag experienced heavy rain combined with snow melting. This increased the danger of landslides which could cause problems for the critical infrastructure, like roads and railways. When roads are closed it makes it difficult for emergency vehicles to get access to areas and people who are in need of help. Evacuation also becomes a challenge. Often small villages will become isolated.

Some lessons learned from Støstad (2013) were that it is important that the municipalities affected have a central position in the crisis management teams. This may determine whether the municipality is able to handle a crisis and is also critical for the municipality's reputation. For example good crisis communication can lead to enhanced reputation. Other positive effects are more efficient information flow between different groups (decision makers, affected municipalities, police, family members and service centers). Støstad noted that it is important to cooperate with the media. In the 2013 flood the municipality of Nord-Fron had a very good experience with using their own channels of communication like their webpage and through social media.

Støstad (2013) also noted the challenges faced during the floods. The command lines were too complex, for example when trying to request helicopters. The personnel at operational/tactic level should always think “worst case scenario” and contact more personnel than necessary. One should also aim to solve as many tasks as possible in the initial phase of the crisis. One should have clear roles in the crisis management team and have a common crisis management room with relevant actors. In this coordination room one should have the necessary equipment, a detailed map of the area affected and a board with the timeline of the crisis (Støstad 2013).



Photo: Floods in Kvam, Norway (photo by Håkon Mosvold Larsen/NTB Scanpix in VG 2013)

The Norwegian Directorate for Civil Protection (DSB) has conducted detailed research regarding a similar flood in the same area in 2011. During this flood one lost the mobile network from the Norwegian operator Telenor. The loss of the mobile network conveyed the community's and emergency services vulnerability and dependence on the electronic communication services (DSB 2012: 30). The main challenges with losing the mobile network were related to communication with the public and internal crisis management as it became difficult to contact more emergency personnel and coordinate internally.

Lack of interoperability and unclear roles became apparent. For example the police and fire department argued that they had to use personnel to conduct tasks related signage, directing traffic and information about roads. The Police argued that these were tasks that are the Norwegian Public Roads Administration responsibility (DSB 2012: 27). Clearer roles are therefore needed.

5. IDENTIFICATION OF LESSONS LEARNED IN CRISIS MANAGEMENT OF FLOODS

This chapter will identify the main lessons learned related to crisis management of floods shared by the ELITE CoP. The findings were collected by use of problem structuring method in the ELITE floods workshop in Vienna, October 2013. Lessons learned were identified within each phase of a crisis and then grouped in problem areas defined by the CoP (for more information about the process see section 3.2). The findings in this chapter are therefore divided according to the different phases of a crisis, and in line with the problem areas (as shown in figure 3).

Many of the lessons learned were the same in the different phases of the crisis, like awareness, communication and decision-making. Others were distinctive for a certain phase, like training in the pre-crisis phase and holistic system learning in the post-crisis phase.

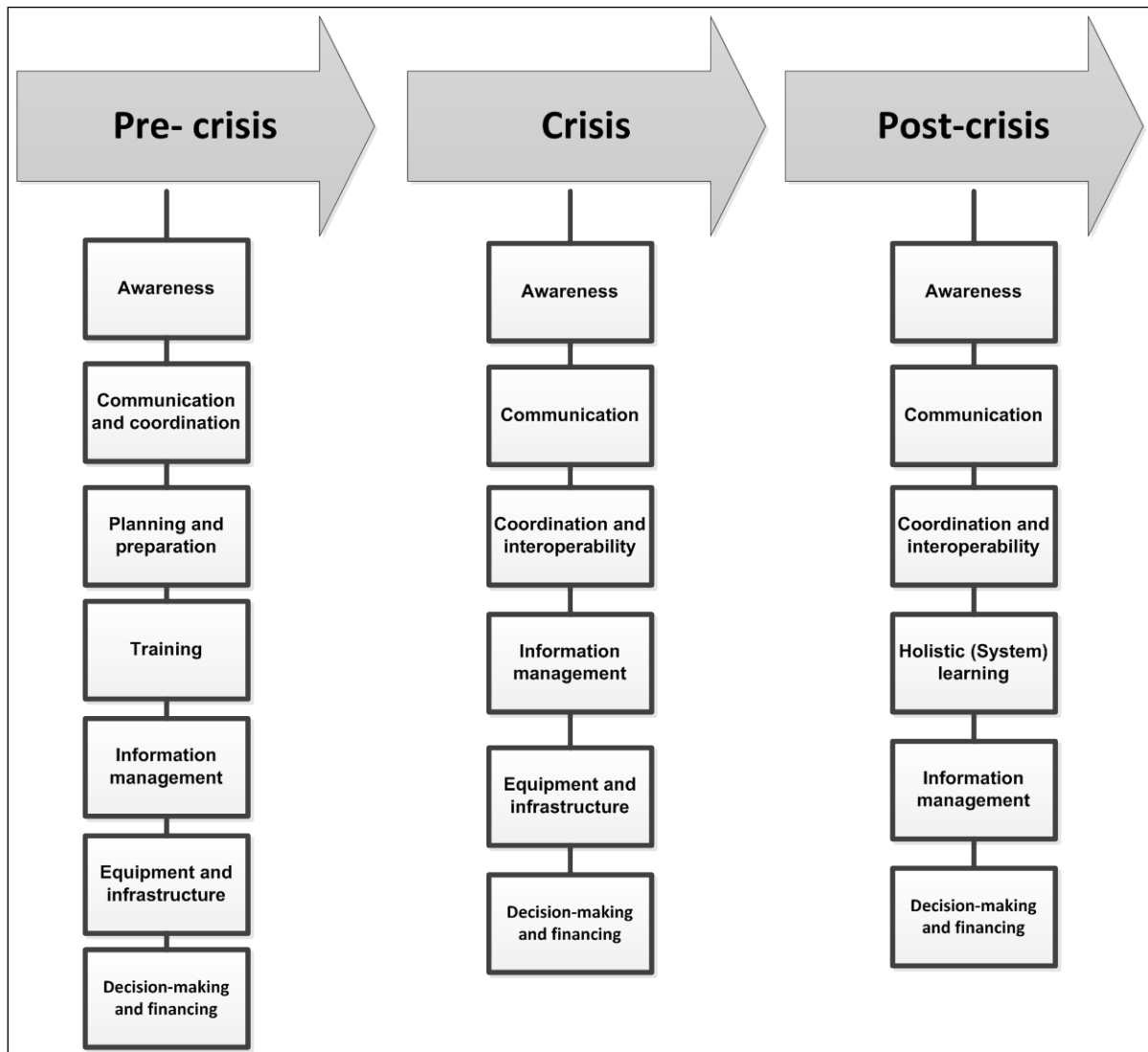


Figure 3: Outline of problem areas in the different phases of a crisis

5.1 Pre-crisis

5.1.1. Awareness

The experts noted that emergency personnel lack *situational awareness* in the pre-crisis stage, especially regarding the state of river banks and river basins. One should have weather forecasts every 24 and 48 hours with focus on air and water levels. More and accessible information on the water height is needed so that one can compare over time (50/100/200 years). The experts argued that this can allow us to make predictions.

The population lack awareness of catchment basins. The experts argued that “it did not seem like the public understood how the risk of floods can disrupt them significantly”. In other words, if you are aware of crisis it is easier to accept the limitations a flood can have on your everyday life. The experts argued that this is a combination of attitudes and risk perceptions in the population (*probability of floods* consequences of a flood*). There was uncertainty in the population related to event forecast and impact expected.

5.1.2. Communication and coordination

The experts argued that there were often problems with communication between the different crisis management actors because one did not speak the ‘same language’ due to different backgrounds or cultures. Also, there might be a problem with communication equipment which doesn’t always work during the flooding (cf. what happened in Gudbrandsdalen in Norway).

Different agencies are responsible for preparation. However, often these agencies and administrations do not coordinate between themselves argued the experts. One also lacks a stakeholder’s network that can easily be reached if a flood was to occur.

5.1.3. Planning and preparation

The planning stage is an important step towards being prepared for the disaster. There is often a lack of preparation, both when it comes to plans and equipment. The experts identified missing risk assessment plans as a major problem in the pre-crisis stage. Often one has few plans and no clear priorities of activities to be done if a flood occurs. The authorities and population also lack preparation. The experts indicated that after a major flood has occurred one often forgot the lessons learned and therefore nothing is done. There is often a lack of reporting guidelines which leads to problems for the ones writing the lessons learned reports.

The experts indicated that one lacks flood detection and plans for man-made floods and often it is difficult to find resources for necessary projects to improve planning. One needs better planning of territory, the use of land and buildings, better knowledge of the territories and the appropriate measures to inform the population. With increasing urbanization one needs to have proper flood plans and good city plans. One must also have good calculations on the backwater gorge.

Businesses in flood prone areas should have proper/effective contingency and continuity plans. General planning in municipalities must take into account the effect of human activity in flood plains.

Warning system procedures should be established before the crisis, and everybody, including children, should be trained to know the how to act in particular situations. There should be a reserve of equipment and tools, e.g. sandbags.

The experts argued that one needs to plan to have personnel and material resources for more than 24/48 hours. Systems for ensuring on-time and sufficient deliveries of e.g. sandbags have to be planned and established before the crisis.

5.1.4. Training

“There is not enough training of floods scenarios and often many practitioners ignore standards and procedures” argued the experts. There is often a lack of preparation in the sense that one should train communication structures, equipment and think of all possible situations in the pre-crisis phase. Time, interest, resources, exercise possibility and money is needed to provide training.

Not incorporating lessons learned results in no changes in the training programme of first responders and therefore no changes in the response to floods.

5.1.5. Information management

Information management is very important in all phases of a crisis but is very often not exercised. Information is not only about communication, but also about information flow and how we organize and manage all the information which comes in and what should be communicated. One needs to organize an information management tool to support the operational and technical level.

5.1.6. Equipment and infrastructure

The experts argued that the level of preparation regarding equipment and infrastructure was not satisfactory. One needs to increase the level of preparation to prevent the disruption of critical infrastructure. Most rescue teams have satellite communications, so the communication structure itself is not the problem; however, the user interface is a challenge. Cell phone networks can get overloaded. The experts argued that because of limited preparation it takes time to recover critical national infrastructure in the post crisis phase.

5.1.7. Decision-making and financing

The experts noted that it is always a question of *“whose responsibility is it to do the decision-making and financing?”* A common problem is therefore lack of responsibility and accountability. There is little decision making on relief efforts / prevention efforts and evacuation decision models. One should also have plans for the evacuation of animals, yet this is often forgotten.

In order to make smart and correct decisions one needs to have knowledge of the territory, the crisis points of floods and to be able to identify safe areas. This is often lacking. The experts argued that one lacked risk communication to the population and a risk guide for the decision-makers. The decision-makers need situational awareness of *“what is going on, and how big the flood will be”*.

The experts called for a standardization of teams and equipment. But one often experiences financial constraints and lack of political will. If a flood has not happened in a long time it can be difficult to get funding to prepare for a flood.

5.2 Crisis

5.2.1. Awareness

The experts argued that it is challenging to know how the situation will develop as floods are not 'predictable' and one can experience flash floods. Nowadays the public has high expectations on what they will receive of help and resources after and during a flood.

Knowledge, with precision, of the affected areas and the people involved, is of high importance for the responders of the crisis. Using satellites for situational awareness is essential to understand the magnitude of the crisis.

During the crisis all the emergency actors are together, and shortly after the crisis everybody is gone. There is a risk of losing important information for identifying certain lessons learned in this process.

5.2.2. Communication

During a flood one can often experience a communication collapse or an overload of the communication system. The experts argued that one often lacks information in the beginning of an intervention as well as a clear communication structure between the authorities and stakeholders regarding the response and critical infrastructure.

Many floods can slowly grow in size this can result in lack of access to the emergency area to provide information to the population and people working there. The result is that media and volunteers cannot spread information about the status of flooded areas to the broader population because they do not have access.

5.2.3. Coordination and interoperability

One expert argued that there will always be a "chaos phase" during response actions. When this chaos phase resides there are still challenges related to "how one should work together". Often rules in emergency are forgotten and there is no (or late) activation of the emergency procedures. The experts argued that this was also the case with informing the population. It was noted by the experts that it was very challenging to coordinate a response for the different administrations in the crisis management. Steering several processes at strategic, operational and tactical levels is challenging, and all involved personnel have to talk the same crisis management language.

One expert stressed the importance of having one unique headquarter and one commander of all action, as this seemed not to be the case in all countries.

Cooperation with the local community is necessary, especially when deciding when to evacuate people and also during the evacuation. Some people prefer to stay in their houses to "protect themselves".

In a crisis, many volunteers or those willing to help but not involved in emergency systems come to help. Sometimes these volunteers and civilians can create more problems if they are not being briefed and told what to do.; they can prevent the emergency personnel in doing their job, perform tasks incorrectly, and resources have to be allocated to install the volunteers. Therefore, volunteers need to be organized. However, in most cases the volunteers are of invaluable help.

5.2.4. Information management

The experts called for more analysis of the information during the flood. This is because there is false information and therefore validation of information is needed. Information flow between agencies is often unsatisfactory and information management is therefore needed. In some cases there is too much information and in other cases it is less – who has to send information to who?

The person assigned to manage information should also focus on managing media reports. Informing the public often becomes a problem as there is no proper management of reporting to the media. The media may also report false or failed warnings. It is important for the information manager to collect the right information that can be useful during the recovery of the crisis.

5.2.5. Equipment and infrastructure

The experts noted that one often lose communication infrastructure. There are often shortages of sandbags and other equipment used. The critical national Infrastructure often becomes disrupted and one experiences damage of critical infrastructures like energy, water and food supply.

A great amount of resources is needed for a very short time during crisis, and reserves will get smaller and smaller every hour. However, there may be reluctance to prepare for low possibility events and have large stocks of resources that may be unused for a long period of time.

Resources such as boats tend to be scarce. Helicopters and pilots can only work for short time periods.

Floods impede access to some places. There are no usable roads. There might be absence of potable water, which can create diseases. It has also been mentioned that not flooded areas can have snakes.

5.2.6. Decision-making and financing

During a crisis the experts argued that one often lacks funding to set up measures to solve problems. One reason is that it takes time to allocate resources to different crisis management organizations.

Therefore the crisis phase is often marked by limited resources, financial constraints and limited application of norms and standards argued the experts. Some argued that the underlying reason for financial constraints was lack of political will.

Another challenge is the adoption of urgent measures without proper planning that takes into consideration the long term and the holistic perspective.

Several experts maintained that inter-agency communications during a crisis is one of the biggest challenges; especially coordination of all teams of first responders in the disaster area. Because of limited coordination it becomes difficult to assign responsibility and later hold people/ teams accountable.

During a flood one needs to evacuate people. Often one forgets to evacuate animals. The experts wanted the decision makers to use both vertical and horizontal evacuation. Horizontal evacuation implies that one should go out of the region, vertical evacuation implies that one should go to tall areas (churches etc.).

For many countries the threshold is high for requesting international support in major crisis. The experts noted that decision makers and the political level often would argue that the country does not need international help during a major flood. This can be a problem as some European countries would have benefitted by accepting help during a large scale flood.

5.3 Post-crisis

5.3.1. Awareness

A major problem after a flood is that people build their houses and other infrastructures the same place even though it becomes clear that some areas are more flood-prone than others. Rebuilding infrastructures in the same place conveys unsatisfactory planning. It seems like people ignores this and build their houses at the exact same spot. Experts argued that this can be explained by lacking awareness.

After a crisis the authorities often do not consider the causes of floods and how to avoid them. The experts noted that organizations forget what they should do to prevent major disruptions from floods. In other words, one lacks institutional learning.

The public has high expectations regarding the recovery from floods and is not always aware of long time recovery. It can take a long time for water to disappear from the place.

5.3.2. Communication

Explaining to the public what really happened often proves to be challenge argued the experts. Often one forgets to gather information and communicate with the different actors involved. This means that lessons learned are not gathered after a crisis, which makes it difficult to improve the response for the next flood.

In this phase one must also have close contact with representatives from the media in order to inform the population of status quo. This is often not prioritized which can lead to misinformed media reports which cause confusion in the population.

5.3.3. Coordination and interoperability

The experts argue that the post-crisis phase is often forgotten by crisis managers and first responders as their job is done. However, post-crisis support to the affected area is vital after a flood in order for the population to be able to continue with 'business as usual'.

5.3.4. Holistic (System) learning

Learning happens in all phases of a crisis. The experts argued that one lacks holistic learning and when learning occurs it is isolated and at an individual level. The experts argued that after a crisis there is limited learning. This was mentioned in regards to decision makers, stakeholders and (potential) victims. Experts underlined the importance of holistic learning instead of isolated learning. However, when attempting to learn from a crisis one must not only focus on what went wrong, one must also identify good practices. In other words, one must talk about 'what went well'.

The experts argued that implementing lessons learned are limited. This causes little change in the prevention plans for floods. If information is collected there is inadequate systematization and categorization of the findings argued the experts.

5.3.5. Information management

Implementing lessons learned proves to be a challenge in the post-crisis phase. Unfortunately, the people who participated and know about the response are often not present when the analysis of the floods are discussed and written.

5.3.6. Decision-making and financing

Lessons learned are often ignored and rarely leads to implementation argued the experts. As mentioned earlier, decision makers 'allow' the public to rebuild infrastructures in flood-prone areas. There is a general lack of responsibility therefore it is difficult to keep anyone accountable.

6. IDENTIFICATION OF POSSIBLE SOLUTIONS AND COMPILATION OF FINDINGS

Section 6.1 of this chapter identifies possible solutions to the problem areas for lessons learned. The possible solutions are suggestions on how best to improve crisis management for the various challenges revealed in chapter 5. The solutions are divided into the identified main problem areas; awareness, communication, planning, training, coordination, holistic (system) learning, information management, equipment and infrastructure, decision-making and financing. The solutions have an “all phases” approach.

The findings from the post-it sessions and the identified problem areas for lessons learned and solutions are summarized in a compilation table in section 6.2.

6.1 Possible solutions

The experts in the ELITE workshop identified possible solutions to the problem areas or lessons learned addressed in chapter 5. They argued, however, that we cannot “solve” all the problems; but we can mitigate the consequences.

6.1.1. Awareness

The experts argued that one must keep the awareness alive. This can be done through education in the public domain, for example, in school education for children and young people. Japan is a good example of how to educate school children in earthquakes. One expert argued that the most important factor is to change the mind-set of people and promote self-protection. For adults it is possible to use printed documentation and risk guides. Another way of creating awareness is by having ‘Risk management days’. By establishing channels of communication to the public one can aid creating resilient communities. A part of the resilience building process includes exercises or simulation activities about risk management.

By making laws or guidelines regarding where one is allowed to build, or that organizations must gather information after a flood and have lesson learned seminars etc.

High-markers or signals which shows how tall the river reached when the flood occurred should be introduced. Criteria and standards on testing and checking the rivers should be regulated by law. The same counts for gathering information over longer time periods to be able to make statistical predictions.

Various media channels should be used to increase awareness, for example regional apps regarding risk management related to specific crisis.

6.1.2. Communication

The most important point was not to forget to inform population argued the experts. Communication to the population must be part of the plan and it must be prepared and practiced. The same tools of communication that are used on a regular basis should be used in crisis. By using channels of communication that is well-known to the public it is easier to inform the population (TV-channels, internet). For example many crisis tools are only used in a crisis and therefore the public are not checking these tools. Another aspect of today's crises is that society seems to have forgotten about its exposure to natural disasters. Years/centuries ago population seemed to be more aware of this exposure than today.

Communication is very dependent on local culture. Some countries tend to be absolutely open and sincere, while others tend to tell that everything is under control, although it is not true.

The experts argued that it is important that representatives from the scientific community on floods must feel ownership and be a part of the plan. This should be mandatory.

In order to overcome communication collapse among the first responder one should have a network dedicated for only emergency services. This is the case in the Basque Country where they have a dedicated radio frequency.

Many experts have previously mentioned that details concerning the rescue efforts are not being shared due to confidentiality issues and that this hinders learning. However, in Finland they have a law stating that have to share information about the emergency.

Regarding scientific details concerning the floods one should standardize data bases containing relevant information which can be available for the internal and external network for the scientific community and the crisis management community.

6.1.3.Planning

Specialists that can assist organizations in creating risk assessment plans are needed. This is because people do not have the knowledge or the experience to create good plans. The experts argued that one should establish a cycle of personnel that can work shifts during the crisis. In this phase one should also add personnel. Organization must create proper contingency plans and conduct exercises and simulations to become familiarized with the plans. One must conduct exercises to not forget previous lessons learned.

After an event one must carry out an analysis, this can lead to changes in the procedures or confirmation of good procedures. However, in most cases there is always something that can be changed for the better argued the experts that is why one must create a “constructive and positive environment for change”.

6.1.4.Training

Laws must be created stating clearly who has the responsibility. This is done in order to keep them accountable. This should be included in the training. The experts argued that through training one can make people feel responsible and promote private responsibility.

Different types of training should be provided depending on the trainees.

6.1.5.Coordination and interoperability

The experts argued that one must have simpler and clearer laws to facilitate interoperability between different crisis management actors. This would be better than the current laws (standard law).

It is necessary to ensure that all relevant agencies participate when attempting to coordinate before, during and after a flood. The EU should play a key role in coordinating cross border floods. Flood-prone countries can have standing cooperation agreements with neighbouring countries.

6.1.6. Holistic (System) learning

The experts argued that one should create local resilience forums that can make decisions for the local resilience building process. These forums can help to see how we should improve our response efforts argued the experts. A local resilience forum in the UK make all the stakeholders take part in these forums and they have regular meetings where they conduct table-top exercises every three months.

If there is a clear definition of responsibilities and there is one single institution which is responsible for leading the crisis response, this very significantly reduces the probability of mistakes. This also makes easier to learn from previous experiences.

6.1.7. Information management

After the crisis 'information management' is also essential, whether it is management of the information to the public regarding recovery of the crisis, or management of the information about the crisis and dissemination of lessons learned.

The workshop participants argued that it is important to produce more good quality information, instead of a lot of documents. Standardization of documents is difficult, although suggestions have been launched from the EU.

Usually one person is assigned with the task to be responsible for communication with the media and population, as well as decide if and what should be disseminated. Preferably, information should go top down and bottom up. The source of information is also a very relevant aspect. The person managing the current information is responsible for integrating and editing documents to make them understandable for both individuals and public agencies.

6.1.8. Equipment and infrastructure

Experts noted that one must update national databases of equipment in the country and abroad. This is important in order to know what type of resources that one can use in a crisis. In some countries one should expand the rescue resources; for example more high efficiency pumps, high power generators, sand bags, big bags and other useful equipment. If one were able to integrate all the rescue resources into a single system this would have solved many problems relating to equipment.

6.1.9. Decision-making and financing

In the contingency planning one should have cash reserves or a flexible mechanism for resource allocation. The experts noted the importance of giving the stakeholders the power to decide where the resources will be implemented and used. One expert argued that "we cannot take big decisions, big investment decisions after a catastrophe" and suggested creating a law that establishes a minimum quantity that should be invested in contingency planning. This is to ensure that one actually uses resources on contingency planning. Some experts pointed out that private money can also be used to improve the resilience level of public entities.

The experts underlined the necessity of getting the decision makers working together in the everyday life as this would facilitate the communication when a crisis occurs. The experts also noted the fine line between holding the decision makers accountable vs. punishing the decision makers.

6.2 Compilation of results

A compilation table with the main lessons learned (categorized in problem areas) for each crisis phase and potential solutions have been created on the basis of primary data gathered from the ELITE CoP workshop (table 1).

Problem areas	(1) Pre-crisis	(2) during a crisis	(3) post-crisis	Solutions
Awareness	<ul style="list-style-type: none"> •Lack of information about state of river ranks •High water information 50/100/200 years Lack of awareness Weather forecast and basins • Lack of awareness: if you are aware of crises it is easier to accept the limitations • Attitude / risk perception (probability * consequences) • Lack of crisis Knowledge: they do not understand that the risk can disrupt them significantly • Uncertainty related to event forecast and impact expected. 	<ul style="list-style-type: none"> •Not predictable floods / development of situation • High public expectation: what people is expecting to obtain after the flood • Public perception: • Lack of attitude: how people get involved in the crisis management. 	<ul style="list-style-type: none"> •Rebuilding infrastructures in the same place •Organization forget what should do to prevent •Institutional learning •Consider the causes to avoid them • High public expectation regarding the recovery from floods. 	<ul style="list-style-type: none"> •Keep the awareness alive •Making a law or guidelines •Education (schools of young people). Example of Japan and education in earthquakes •Changing the mind set of people to promote self-protection •Criteria and Standards on testing and checking regulated by law •Exercises or activities of simulation •Education in public domain •Risk management day • Knowledge given at the school. Courses in school for children. • Printed documentations for the adults. • Regional specific apps regarding risk management. • Serious games about risk management. •Media / channels • System cities for possible emergencies. • Creating resilient communities, becoming committed with the resilience building process and establishing some channels to send info to the public. • Having some high-markers or signals which shows how tall the river reached when the flood occurred
Communication	<ul style="list-style-type: none"> •Information to population •Communication. Speaking the same language. Problems due to different background or culture • Management of media reporting → Management of false vs. failed warnings • Providing information to the population • Lack of access to the emergency area to provide information • Lack of access to an area (media, volunteers) 	<ul style="list-style-type: none"> •Communication collapse •Establish communication structures (response stakeholders, critical infrastructures, authorities) •Information analysis •False information or validation of information •Lack of information Information flow between agencies • Management of media reporting • Management of false vs failed warnings • Lack of access to an area (media, volunteers) 	<ul style="list-style-type: none"> •Explaining to the public what really happened •Gathering of information after the crisis (lessons learned) • Media reporting • Management of false vs failed warnings • Lack of access to the emergency area to provide information •Lack of access to an area (media, volunteers) 	<ul style="list-style-type: none"> •Do not forget to inform population + part of the plan + prepared, consisted, practice •Make tool used on regularly basis (TV, internet) •Experts must feel ownership (part of the plan/mandatory) •In Finland they have a law to share information about the emergency •Network dedicated for emergency services (In Basque Country they have a dedicated radio frequency) •Standardization of the data bases (in/out the network) Use of the same communication channel

<p>Planning</p>	<ul style="list-style-type: none"> •Finding resources for necessary projects •Flood detection •Information analysis •Missing risk assessment plans •Forgotten lessons learned/nothing done •Man-made flood plans •Good and right organization •Better planning of territory and building •Care of environment •Not planning what to do/Priority •Lack of preparation (Authorities and population) •Appropriate measure to inform the population •Unknowing the territory • Proper / effective contingency business continuity plans • Proper land –use planning •Backwater calculations gorge •Personnel and material resources for more than 24/48 hours 		<ul style="list-style-type: none"> •Rebuilding of infrastructures in the same place •Implementing lessons learned •Prevention •Systematically organization of the collected information 	<ul style="list-style-type: none"> •Specialist that help others to create risk assessment plans (people didn't have knowledge) •Establish cycle of personnel (time not a problem) •Add personnel •Proper contingency plans (exercises and simulations) •Exercises not to forget lessons learned •After an event an analysis is carried out and the procedures are changed •Constructive/positive environment for change
<p>Training</p>	<ul style="list-style-type: none"> •Lack of ignored or ignored standards procedures •Training enough •Implementing lessons learned 			<ul style="list-style-type: none"> •Law must be clear on who has the responsibility (accountability) •Insurance (making people feel responsible – private responsibility) • Different types of training is essential
<p>Coordination and inter-operability</p>	<ul style="list-style-type: none"> •Different agencies are responsible for preparation •Coordination between administrations •Counterparts/stakeholders network •Lack of coordination between agencies responsible for preparation 	<ul style="list-style-type: none"> •How to work together •Rules in emergency/operation • Activation of emergency structures •Procedures/appropriate measures to inform the population •Coordination of response for different administrations • Organize volunteers •Chaos phase during response actions 	<ul style="list-style-type: none"> •Post-crisis support to the affected area 	<ul style="list-style-type: none"> •Simpler and clearer laws than the current ones (standard law) •Participation by relevant agencies. •EU should play a key role coordinating cross border problems. •Cooperation agreements • One unique headquarter and one commander of all action
<p>Holistic (System) learning</p>			<ul style="list-style-type: none"> • Holistic learning instead of isolated learning at an individual level • Lack of learning: decision makers, stakeholders, (potential) victims • Instead of just focusing only on what went wrong, also identify good 	<ul style="list-style-type: none"> •Local resilience forums: they make decisions for the local resilience building process. • Local resilience forums: help to see how we should improve. •Local resilience forums (UK): all the stakeholders take part in these forms, they have regular meetings, they make table-top exercises every three months.

			practices, what went well.	
Information management	<ul style="list-style-type: none"> • Bidirectional information flows. Operators towards the “bosses” and top down • Information management is not exercised 	<ul style="list-style-type: none"> • Collect the right information that could be useful during the recovery. • Information overload 	<ul style="list-style-type: none"> • People who know about the response are not present when the analysis reports are written. 	<ul style="list-style-type: none"> • quality, rather than quantity • Information manager has a key role • Have the right person in charge of information management • Decide which source of information is the best/most reliable • Having the right people/professionals <p>Information depending on degree of risk</p>
Equipment and infrastructure	<ul style="list-style-type: none"> • Bad level of preparation of the Critical National Infrastructure to prevent their disruption • User interface of satellite communications 	<ul style="list-style-type: none"> • Bad level of preparation of the Critical National Infrastructure to respond • Damage of critical infrastructures (energy, water) • Loss of communication infrastructures • Overloaded cell phones • Lack of resources, e.g. sandbags, boats 	<ul style="list-style-type: none"> • Bad level of preparation of the Critical National Infrastructure to recover 	<ul style="list-style-type: none"> • Logistics planning in the pre-crisis phase • Use satellites for situational awareness
Decision-making and financing	<ul style="list-style-type: none"> • Whose responsibility • If nothing is going to happen • Different holders who should react • Knowledge of territory/ crisis points of floods/ identify safe areas • Decision making on relief efforts / prevention efforts • Standardization of teams, equipment • Lack of responsibility and accountability • Situation awareness: what is going on how big will the flood be. • Planning the evacuation of animals • Evacuation decision models • Lack of Risk communication • Lack of risk guide • Self-sufficient help people • Financial constrains • Lack of political will • The country does not accept international help 	<ul style="list-style-type: none"> • Limited resources Application of norms and standards • Lack of funding to set up measures to solve the problem because we need time to allocate resources • Adoption of urgent measures without proper (holistic/long-term) planning • Coordination of first responders • When I can find my resources? • Coordination of those willing to help but not involved in emergency systems • Inter-agency communications • Lack of responsibility and accountability • Coordination of all teams in the disaster area • The own resources are less • Need for Vertical or horizontal evacuation: horizontal evacuation go out of the region, vertical evacuation go to tall areas (churches). • Evacuation of animals • Financial constrains • Lack of political will • The country does not accept international help 	<ul style="list-style-type: none"> • Too little money • Lessons learned ignored • Implementing lessons learned • Rebuilding of infrastructures in the same place • Lack of responsibility and accountability • Financial constrains • Lack of political will • The country does not accept international help 	<ul style="list-style-type: none"> • Contingency planning (including sections XXXS) • Cash reserves (Flexible mechanism for resource allocation) • Give the stakeholders the power to decide where the resources will be implemented. • Establishing a law that establishes a minimum quantity that should be invested to the contingency planning. • We cannot take big decisions, big investment decisions after a catastrophes • Getting the decision makers working together in the every day life, facilitates the communication when a crisis occurs. • Introduce decision makers within the politicians. • (Not) punishing the decision makers... • Some private money to improve the resilience level of public entities

Table 1: Compilation table of lessons learned divided in the three phases of a crisis

7. BEST PRACTISES

This chapter will identify some best practices that were mentioned by experts in the ELITE CoP during the Vienna workshop. A lot of these best practices are attempting to tackle problems of a general character that have been mentioned by experts in relation to forest fires, earthquakes and floods.

- *Unorganized volunteers that want to help often become a burden for the emergency workers. This was the case in Austria where 'spontaneous volunteers' wanted to help during a flood, but where it only caused more chaos. The Austrian Red Cross managed to structure the volunteers and unleash the potential of this workforce.*
- *Communication with the public has been mentioned as a major problem especially as the population lacks knowledge of self-protection during different types of crisis. Creating a booklet on how they can protect themselves and be prepared can potentially solve many problems.*
- *A long term strategy to create awareness in the population is to target children through awareness raising campaigns. A smart way to do this is through computer games and easy accessible information booklets.*

7.1 Best practice: Volunteers

As mentioned the Austrian Red Cross experienced difficulties with 'spontaneous' volunteers in a crisis situation. This caused more problems than it helped the first responders. During the summer 2007 the Austrian Red Cross in cooperation with Hitradio Ö3 (the biggest Austrian radio station) launched a campaign called "Team Österreich". This meant that one got willing citizens to register in a 'database for volunteers' based on their qualifications to help. Today "Team Österreich" has more than 35 000 members all over the country. "Team Österreich" is a supporting structure of the Austrian Red Cross integrating spontaneous volunteers into structured response" (Österreichs Rotes Kreuz 2013).



Photos: Team Österreich (<https://www.facebook.com/Teamoesterreich>)

All registered citizens have to take part in a short 3 hours training course dealing with disaster management. After training they go back to their normal life and ‘stand-by’ until a disaster happens. If the Austrian Red Cross need assistance, the volunteers receives text message (SMS) and email. The registered volunteers have full insurance protection like “normal” Red Cross volunteers during the crisis. Afterwards the volunteers partake in the debriefing.

This best practice conveys how the Austrian Red Cross has managed to structure the volunteers and unleash the potential of this workforce. This is a “win-win situation”; the civilians feel they can help and make a positive contribution to their country during a crisis, and the emergency workers have now more structured and specialized teams of volunteers that are easier to guide to do important tasks.

7.2 Best practice: public communication

The province of Groningen Safety Region in the Netherlands states in their Risk Guide that “If something happens, you must depend on yourself initially. The emergency services cannot be there immediately” (RiskGuide Groningen 2013). In other words, the intention with the risk Guide is to ensure that citizens prepare for the risks.

The pedagogical handbook which is targeting adults includes (i) how you will be alerted, (ii) how to stay informed, and (iii) checklists for evacuation during floods and emergency kits. Some of the main topics in the risk guide are listed here:

1. Know the risks in your surroundings
2. Organize an emergency kit
3. Think what you should do if you are evacuated
4. Think of people who need extra help
5. Read this Risk Guide through carefully



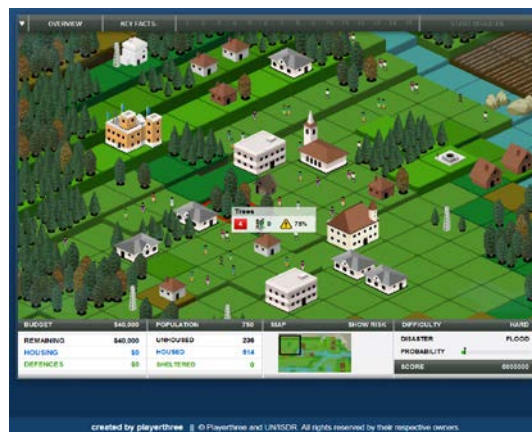
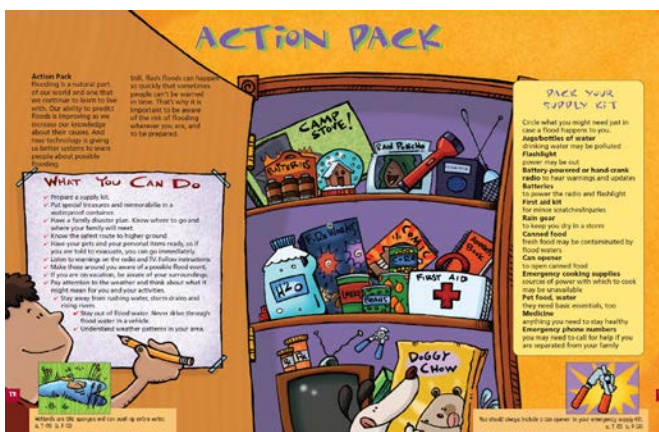
Screen shot: The Risk Guide (*RiskGuide Groningen 2013*)

This best practice conveys that education and preparation that can be compiled in a guidebook will improve the overall knowledge in the population. This will also make the public understand the importance of prevention efforts regarding floods. This can aid the population to help themselves and prepare their self-protection measures.

7.3 Best practice: educating children

The Associated Programme on Flood Management (APFM) is a joint initiative of the World Meteorological Organization and the Global Water Partnership (APFM 2013). APFM produces a wide range of materials that facilitate self-study for vocational training, advocacy workshops and public awareness building measures. The material is targeting different groups, such as flood managers, policy makers and trainers as well as teachers and children (ibid).

The APFM has produced an information booklet targeting children. The booklet includes “important-to-know facts and engaging hands-on activities” (ibid).



Screen shots: Information booklets and computer games aimed at children (APFM 2013 and ISDR 2013)

The APFM has also developed computer games. The computer games simulate realistic situations and problems and are “intended to provide knowledge and awareness to the player, while at the same time entertain him/her” (APFM 2013). One game is titled “Stop the disaster” created by International Strategy for Disaster Reduction (ISDR). ISDR argue that education is key for reducing children’s risks to disasters. The reason why children are being targeted is because they are one of the most vulnerable groups when disasters occur. ISDR argue “if we teach them from the early age about the risks posed by natural hazards, children will have a better chance to save their lives during disasters” (ISDR 2013).

The on-line game “stop the disaster” aims at teaching children how to build safer villages and cities against disasters. ISDR (2013) argue that children will learn playing “how the location and the construction materials of houses can make a difference when disasters strike and how early warning systems, evacuation plans and education can save lives”. Children are the future architects, mayors, doctors, and parents of the world of tomorrow, ISDR (2013) argue “if they know what to do to reduce the impact of disasters, they will create a safer world”.

8. SUMMARY AND CONCLUSIONS

The main scope of this report has been to present the findings from the ELITE workshop on floods in Vienna, October 2013. One of the most important tasks in the workshop was to share and identify the most relevant lessons learned (problems) related to crisis management of floods and possible solutions to the stated problems. The report has gathered and systematized knowledge on floods based on information from experts in the ELITE CoP supported by literature reviews.

The findings from the group sessions with the identification of problem areas for lessons learned in each crisis phase with solutions to the problems are summarized in a table, see *Compilation table* in chapter 6.

Some of the main lessons learned, best practices, possible solutions or suggestions for improvement are summarized in the lessons learned table below (table 2).

Problem areas for lessons learned	Lessons learned	Sources
Awareness	Some lessons learned include; making laws or guidelines regarding where one is allowed to build, or that organizations must gather information after a flood and have lesson learned seminars etc. Keep the awareness alive through (i) school education for children and young people to change their mind-set and promote self-protection, (ii) printed documentation and risk guides for adults, (iii) arranging 'Risk management days' to communicate to the public, (iv) exercises or simulation activities about risk management, (v) regional apps regarding risk management related to specific crisis.	CoP
Communication	A lesson learned is to inform the population and always include it in the plan, and it must be prepared and practiced. One should use the same tools of communication that one uses on a regular basis. First responders should have a network dedicated for only emergency services to overcome communication collapse. Create laws stating that emergency services must share information about the crisis. Standardize data bases containing relevant information which can be available for the internal and external network for the scientific community and the crisis management community.	CoP
Planning	Some lessons learned are (i) specialists assist organizations in creating risk assessment plans, (ii) establishing a cycle of personnel that can work shifts during the crisis, (iii) adding more personnel during the crisis, (iv) create proper contingency plans and conduct exercises and simulations to become familiarized with the plans, (v) carry out an analysis after a crisis to change the procedures or confirm good procedures.	CoP
Training	Lessons learned included; (i) creating laws where it is clear who has the responsibility and is accountable, (ii) through training one can make people feel responsible and promote private responsibility	CoP
Coordination and interoperability	Lessons learned included; (i) to have simpler and clearer laws to facilitate interoperability between different crisis management actors, (ii) ensure that all relevant agencies participate in coordination before, during and after a flood, (iii) the EU should play a key role in coordinating cross border floods, (iv) flood-prone countries should have standing cooperation agreements with neighboring countries.	CoP

Holistic (System) learning	The experts argued that creating local resilience forums which can make decisions on (i) how to improve our response efforts (ii) increase the local resilience building process. A best practice was from the UK who had local resilience forums that made the stakeholders have regular meetings where they conduct table-top exercises every three months.	CoP
Information management	'Information management' is essential in all phases of a crisis; whether it is (i) crisis communication to the public about recovery, (ii) information about the crisis, and (iii) dissemination of lessons learned. The person managing the current information is responsible for integrating and editing documents to make them understandable for both individuals and public agencies. However, the workshop participants argued that it is important to produce more good quality information, instead of a lot of documents and to standardize documents, even though this is difficult.	CoP
Equipment and infrastructure	Experts noted that one must update national databases of equipment in the country and abroad. This is important in order to know what type of resources that one can use in a crisis. In some countries one should expand the rescue resources; for example more high efficiency pumps, high power generators, sand bags, big bags and other useful equipment. If one were able to integrate all the rescue resources into a single system this would have solved many problems relating to equipment.	CoP
Decision-making and financing	In the contingency planning one should have cash reserves or a flexible mechanism for resource allocation. Laws should be implemented to establish a minimum quantity that should be invested in contingency planning. This is to ensure that money is actually used on contingency planning.	CoP

Table 2: Summary of relevant lessons learned gathered from the ELITE CoP

The report also contains a background chapter, based on literature reviews and presentations in the Vienna workshop, with examples of recent floods in Poland (2010) and Central Europe and Norway (both in 2013), where certain problem areas were pointed out.

Finally, some best practices regarding volunteers, public communication and educating children are presented. Problems related to organizing people coming to help in crises, lack of communication (both inter-agency and to the public) and learning from crises are all important features of emergencies and have been mentioned not only in the floods workshop, but also the previous ones on forest fires and earthquakes (Maal and Grunnan 2013; Maal et al. 2013).

BIBLIOGRAPHY

APFM (2013). Discovering floods. Last visited 09.12.2013

http://www.apfm.info/education/kids/WET_Discover_Floods_KIDs.pdf

BBC (2013). *Thousands flee flood-hit parts of Germany and Hungary*. Last visited 09.12.2013

<http://www.bbc.co.uk/news/world-europe-22835154>

Boin, Arjen, Paul 't Hart, Eric Stern and Bengt Sundelius (2005). *The Politics of Crisis Management. Public Leadership under Pressure*. Cambridge: Cambridge University Press

Bryman, Allan (2004). *Social Research Methods*. Oxford: Oxford University Press.

Eriksson, E. A. (2003). Metoder för strukturerad brainstorming [in Swedish] (Methods for structured brainstorming). ISSN 1650-1942.

EU (2012). *The European civil protection training programme*. Last visited 07.06.2013

http://ssai.interno.it/download/allegati1/training_brochure.pdf

Euro4m. *Central European flooding 2013*. Last visited 06.12.2013

http://cib.knmi.nl/mediawiki/index.php/Central_European_flooding_2013

Fijolek, Michał (2013). *Lessons learned after the flood in 2010 in Poland (incl. external support)*. Power point presentation at 3rd ELITE workshop, Vienna, Austria, October 8th.

Fylkesmannen i Oppland (2013). *Flommen 2013*. In Norwegian. Last visited 09.12.2013

<http://www.fylkesmannen.no/Oppland/Samfunnsikkerhet-og-beredskap/Krisehandtering-og-samordning/Flommen-2013/>

Flood Risk Management Research Consortium (FRMRC) (No date). *Introduction to flooding*. Power point presentation by representatives from the Environment Agency, Halcrow and Universities of Cardiff, Heriot Watt and Cambridge at the Employers' forum.

Hellevik, Ottar (2002). *Forskningsmetode i sosiologi og statsvitenskap*. Oslo: Universitetsforlaget (in Norwegian).

Hernantes, Josune (2013). *Community of Practises*. Presentation at 1st ELITE Workshop, Weeze, Germany, April 16th.

Hernantes, Josune and Bénédicte Goujon (2013). *Classification of information on disaster*. Working paper. ELITE project FP7 SEC Contract No. 312497.

IPCC (2012) - Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.). *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*. 582 pp. Cambridge: Cambridge University Press.

Kepka, Pawel (2013). *Operation Rudy*. Presentation at 1st ELITE Workshop, Weeze, Germany, April 16th.

Lang, Gert and Neuruhrer, Maria (2013). *Flood Lessons learned Workshop Report*. Deliverable D2.3 in the ELITE project FP7 SEC Contract No. 312497.

Maal, Maren and Grunnan, Tonje (2013). *Forest fires lessons learned report*. Deliverable D4.2 in the ELITE project FP7 SEC Contract No. 312497.

Maal, M., Grunnan, T., Gallipoli, M.R., Piscitelli, S., Masi, A. and Mucciarelli, M. (2013). *Earthquake lessons learned report*. Deliverable D4.3 in the ELITE project FP7 SEC Contract No. 312497.

Peter, Thomas (2005). *Capacity Building for Disaster Response - OCHA Perspective*. Last visited 15.08.2013

<http://www.unisdr.org/2005/wcdr/thematic-sessions/presentations/session5-3/ocha.pdf>

RAND (no date). *A broad definition of Interoperability*. Last visited 21.05.2013

http://www.rand.org/content/dam/rand/pubs/monograph_reports/MR1235/MR1235.chap2.pdf

RiskGuide Groningen (2013). *Risk Guide; well prepared together, You've got more going for you than you think*. Published by the Veiligheids region Groningen, the Netherlands. Last visited 11.11.2013

<http://risicowijzer.groningen.nl/print-risicowijzer/risk-guide>

Ruffner, J. W., Brodie, A. C., Holiday, C. L., and Isenberg, T. H. (2010), "Selecting and Utilizing Metrics for an Internet-Based Community of Practice" in *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, pp. 1254-1258.

Sáenz de San Pedro Alba, Luis (2013). *The Spanish Model of Civil Protection*. Powerpoint presentation in the ELITE Earthquake workshop in Weeze, Germany, 25-26 June 2013.

Snyder, W. M. and de Souza Briggs, X.(2003). *Communities of Practice: A New Tool for Government Managers*. IBM Center for the Business of Government.

Stormstruck (2013). *Strom struck a tale of two houses*. Last visited 15.08.2013

<http://www.stormstruck.org/>

Støldal, Morten (2013). "Hvordan lære lekse" in *Brannmannen*. Nr. 3 – 2013. (In Norwegian).

Støstad, Rune (2013). *Erfaringer fra flommen 2013 - Samfunnssikkerhet i Nord Trøndelag*. Last visited 09.12.2013

<http://www.fylkesmannen.no/Documents/Dokument%20FMNT/Kommunalavdelingen/Samfunnssikkerhet/Samling%20Sn%C3%A5sa2013/Erfaringer%20flommen%202013%20Rune%20St%C3%B8stad%20Nord%20Fron%20kommune.pdf?epslanguage=nb>

UNISDR (2013). *Stop the disaster game*. Last visited 09.12.2013

<http://www.stopdisastersgame.org/en/playgame.html>

VG (2013). «Mattilsynet ber flomrammede koke vannet» in VG. Last visited 18.12.2013

<http://www.vg.no/nyheter/vaer/artikkel.php?artid=10116909>

Wenger, E. C., McDermott, R., and Snyder, W. M., (2002). *Communities of practice: A guide to managing knowledge*. Cambridge, MA: Harvard Business School.

Wiesenegger (2013). *The August 2002 Flood in Salzburg/Austria-Experience gained and Lessons Learned*. Last visited 15.08.2013

<http://www.apfm.info/databases/literature/view.php?id=277>

Wikipedia (2013). 2010 Central European floods. Last visited 18.12.2013

http://en.wikipedia.org/wiki/2010_Central_European_floods

Zurich (2013). European floods: using lessons learned to reduce risks. Last visited 09.12.2013

<http://www.zurich.com/internet/main/sitecollectiondocuments/insight/european-floods-using-lessons-learned-en.pdf>

Österreichs Rotes Kreuz (2013). *Austrian Red Cross provides Assistance to Flood Victims*. Last visited 11.11.2013.

<http://www.rotekreuz.at/berichten/news/datum/2013/06/06/austrian-red-cross-provides-assistance-to-flood-vi/>

ANNEX A ABBREVIATIONS

APFM	The Associated Programme on Flood Management
CoP	Community of Practice
DSB	Norwegian Directorate for Civil Protection
ELITE	Elicit to Learn Crucial Post-Crisis Lessons
ESA	European Space Agency
EU	European Union
FFI	Norwegian Defence Research Establishment
FLA	Facilitated Learning Analysis Process
FRMRC	Flood Risk Management Research Consortium
IPCC	Intergovernmental Panel on Climate Change
ISDR	International Strategy for Disaster Reduction
MIC	Monitoring and Information Centre (in Brussels)
NASA	National Aeronautics and Space Administration
NGO	non-governmental organizations
OCHA	Office for the Coordination of Humanitarian Affairs
PSM	Problem structuring method
SAR	Search and Rescue
SOPs	Standard Operating Procedures