Driving Innovation in Crisis Management for European Resilience

D610.1 - Milestone 2 Report: Joint Experiment Design

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List of Acronyms

Abbreviation / acronym	Description
BYOD	Bring your own device
CAP	Common Alerting Protocol
CD&E	Concept Development & Experimentation
CF	Competence Framework
CIS	Common Information Space
CM	Crisis Management
CMP	Crisis Management Professionals
COP	Common Operational Picture
C&D	Communication and Dissemination
C2	Command and Control
DG ECHO	European Commission's Humanitarian aid and Civil Protection department
DOW	DRIVER Description Of Work
EC	European Commission
ECG	Experiment Coordination Group
ECML	European Crisis Management Laboratory
EDXL	Emergency Data Exchange Language
EMSI	Emergency Management Shared Information
ERCC	Emergency Response Coordination Centre
EUCPT	EU Civil Protection Team
EXPExy	DRIVER Experiment xy
FD	Final Demonstration
HLDM	High Level Decision Maker
HR	Human Resources
ICT	Information and Communication Technology
IT	Information Technology
JE	Joint Experiment
KPI	Key Performance Indicator
LLF	Lessons Learnt Framework

MS	Member States
MTF	Methodology Task Force
NATO	North Atlantic Treaty Organisation
PLOPC	Policy, Legislations, Organisations, Procedures and Capabilities
PoC	Point of Contact
PS	Participants
RDB	DRIVER Reference Data Base
RPAS	Remotely Piloted Aircraft System
SAR	Search and Rescue
SP	Subproject
SE	Subproject Experimentation campaign
SIA	Societal Impact Assessment
SOTA	State Of The Art
TAST	Technical Assistance Support Teams
TTX	Table-Top Exercise
VRC	Volunteer Reception Centre
VRH	Veiligheidsregio Haaglanden (Safety region Haaglanden)
WP	Work Package

Project Description

DRIVER evaluates solutions in three key areas: civil society resilience, responder coordination as well as training and learning.

These solutions are evaluated using the DRIVER test-bed. Besides cost-effectiveness, DRIVER also considers societal impact and related regulatory frameworks and procedures. Evaluation results will be summarised in a roadmap for innovation in crisis management and societal resilience.

Finally, looking forward beyond the lifetime of the project, the benefits of DRIVER will materialize in enhanced crisis management practices, efficiency and through the DRIVER-promoted connection of existing networks.

DRIVER Step #1: Evaluation Framework

- Developing test-bed infrastructure and methodology to test and evaluate novel solutions, during the project and beyond. It provides guidelines on how to plan and perform experiments, as well as a framework for evaluation.
- Analysing regulatory frameworks and procedures relevant for the implementation of DRIVER-tested solutions including standardisation.
- Developing methodology for fostering societal values and avoiding negative side-effects to society as a whole from crisis management and societal resilience solutions.

DRIVER Step #2: Compiling and evaluating solutions

- Strengthening crisis communication and facilitating community engagement and self-organisation.
- Evaluating solutions for professional responders with a focus on improving the coordination of the response effort.
- Benefiting professionals across borders by sharing learning solutions, lessons learned and competencies.

DRIVER Step #3: Large scale experiments and demonstration

- Execution of large-scale experiments to integrate and evaluate crisis management solutions.
- Demonstrating improvements in enhanced crisis management practices and resilience through the DRIVER experiments.

DRIVER is a 54 month duration project co-funded by the European Commission Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 607798.

Executive Summary

DRIVER is a five year project launched in May 2014 which aims to fulfil three major S&T objectives:

- Develop a distributed European Test-bed for Crisis Management (CM) capability development consisting of virtually connected exercise facilities and crisis labs where end-users, solution providers, researchers, policy makers and citizens jointly and iteratively can progress on new approaches or solutions to emerging crises management issues.
- Develop a portfolio of CM solutions focusing on the three areas of civil society resilience, professional response, and training and learning. This work builds on integrating solutions from both legacy and previous R&D work (e.g. in other European projects) in order to address more complex and thereby more realistic CM challenges.
- Enable community-building for helping to achieve a common shared understanding of Crisis Management across Europe.

This report addresses activity, outcomes and recommendations from the first 22 months of the project's work. It takes the cumulative learning from this work to propose more effective means of delivering larger trials achieving the project's objectives for a European test-bed and CM solutions directly linked to end-user needs.

In this phase of the project's work activity has focused on an extensive programme of review, experimentation and solutions development in the three focus areas of civil society resilience, strengthened response, and training and learning. A total number of 20 experiments has been undertaken to date, with others underway.

Experimentation has been focused on:

- Providing improvements to priority topics in Crisis Management;
- Demonstrating progress made by FP7 projects and legacy systems in recent years; and
- Solving capability gaps identified by CM practitioners and researchers.

Experiments have been planned with increasing complexity in order to allow researchers, solution providers and end-users to jointly trial and evaluate the potential operational added-value of proposed solutions - thereby developing the capabilities of the DRIVER Test-bed.

The project follows the general idea that the integration of different solutions into a shared working system will enable even more advancements beyond the potential of sole use. Therefore, the smaller experiments at the start of the process were designed to test single solutions or a small subset of solutions. This allows the evaluation of their potential (e.g. the operational benefit of suggested solutions) in close coordination with operational experienced experts. This activity is scheduled to be followed by two large Joint Experiments in the next period of the project's work.

Up to the original due date of this document (February 2016) DRIVER Subproject 6 (SP6) worked collaboratively with all other SPs to achieve the design of the Joint Experiments. This design has not been finalised. This was due to a variety of problems the project faced during the first two years. Due to a range of issues concerning the project's progress **concerning structure, methodology and outputs. The complexity of a project of this scale has presented substantial challenges.**

Reflecting external reviews and the iterative approach central to the DRIVER concept, a revised approach has been adopted. This splits Joint Experiments into four single trial activities which build on the achievements and lessons learnt made by the project during the first two years. A successful implementation of this approach has to go hand in hand with a project organisation which is simple, but with strong coordination of all partners.

The lessons learnt lead up to the recommendations for a new project structure and a more effective approach to enable trialling and evaluating solutions towards the three S&T goals of DRIVER. It features the main findings that much more detailed guidance with clear check points is necessary to bring the DRIVER activities to a success.

This document is divided into a series of chapters which detail experimentation design, identified challenges and lessons learnt, end-user perspectives (including gap analyses) and recommendations for the project's further **work. These are followed by an Annex which details the content and conclusions of the 24 experiments.**

1 Introduction

The aim of this document is to describe the design of the Joint Experiments as at M22 of DRIVER's work (February 2016) and how it draws on the wider experimentation work within the project.

DRIVER experiments have been conducted in three thematic dimensions: Civil Society Resilience, Strengthened Response and Training and Learning. During the first phase of the project, a series of smaller experiments were conducted to test novel solutions and procedures. While some of these experiments were conducted on a cross-dimensional level, most of them were designed with a clear focus on one of the thematic dimensions.

The DRIVER thematic experimentation activities were designed to be continued in the form of two larger Joint Experiments and one Final Demonstration. The objective being to generate added value to the previous experimentation activities by combining different solutions from each of the thematic dimensions under special consideration of their previous performance and results. The overall goal is to enable joint experimentation with solutions from the three different thematic dimensions against the background of common scenarios.

During the second project year, the consortium worked collaboratively to build the design of the Joint Experiments. Towards the end of the period, it became evident that the project could no longer follow the original approach of executing experiments of increasing complexity up to the Joint Experiments. The ambition to build experiments of the desired complexity at this stage has overstrained the responsible partners and a full design, in line with the methodology guidelines, was not possible by M22. The main identified problems are related to general formulation and implementation of the experimentation methodology as such, overall project coordination, and ambitions for Joint Experiments that were too high to be fulfilled considering platform capabilities and required resources.

This document has been revised for resubmission and now addresses a wider scope of bringing together work to date into concrete lessons learnt in order to shape the most appropriate larger-scale experiments. As this document has been rejected after the first delivery in February 2016, it has been reworked and is to be resubmitted in January 2017. This report presents an abbreviated version of the original document in Section 2, i.e. a summary of the most important results achieved during DRIVER experiments and the status of the Joint Experiment design as it was presented in February 2016.The rest of the report deals with aspects that have been most relevant to DRIVER experimental activities, expanding in some cases beyond the original reporting period of this document. It was decided to make the document a more comprehensive conclusion of all DRIVER experiments conducted up to M24 (April 2016).

The analysis of the challenges identified and lessons learnt during the first two years of DRIVER experimentation is given in Section 3. The input for this section was collected from experiment owners and former subproject leaders and has been consolidated and analysed to provide a most informing overview. Section 4 provides an end-user perspective, informing on the involvement of end-users within DRIVER experiments and their perception of the potential to close certain Crisis Management gaps with available solutions and methods. As the section is presenting the perspective

of the end-users that participated in DRIVER experiments, it cannot not be claimed to be complete in terms of a comprehensive gap analysis in Crisis Management. However, it provides relevant insights for the continuation of the project.

Section 5 concludes the document with recommendations on a new project structure and a more pragmatic approach for enabling end-users, researchers, and industrial partners to trial and evaluate novel Crisis Management solutions and to build a pan-European Test-bed.

The Annex contains details of each of the experiments undertaken up to DRIVER's M24.

2 DRIVER Experimentation

The DRIVER project is based on the idea of conducting experiments and evaluating new Crisis Management (CM) solutions in close coordination with end-users and the CM community[1].

DRIVER experimentation activities were categorised in three different experimentation types (see Table 1), each of them addressing one or multiple geographical dimensions (local, national, cross boarder and EU level). The initial thematic experiments had been organised in two rounds called the subproject experimentation campaigns 1 and 2 (SE1 and SE2). While SE1 mostly dealt with the state of the art work and the development of an inventory of existing solutions, in SE2 new experimentation with novel solutions took place. In February 2016, a total of 28 experimentation activities was planned and was partly already executed in SE1 and SE2. The third type of experiments consisted of the two joint experiments (JE1 and JE2) and the Final Demonstration (FD).

SE1	State of the art work and developing an inventory for existing solutions in each respective thematic domain	
SE2	Experimentation of novel solutions	Regional and trans-national
JE1/JE2 & FD	Integrated experiments with solutions coming from the different DRIVER dimensions	From regional to EU level

Table 1: DRIVER blocks of experimentation

The different DRIVER solutions to be used in the experiments started with different levels of maturity. Therefore, the first rounds of experiments were used to assess the maturity level of these solutions in the context of CM and to identify possible benefits and/or difficulties for their application by crisis managers. If an added value for CM operations can be assumed, the solutions should have been tested in combination with other solutions available in DRIVER and also with external solutions and legacy systems within the scope of the Joint Experiments. The objective was to facilitate learning at a system-of-systems[2] level.

DRIVER project was structured in a way that allows taking into account various aspects of experimentation. Parts of the DRIVER work were focused on the actual conducting of experiments, while other parts were fulfilling more supporting functions, like the establishment of a common experiment design and assessment methodology, the provision of supporting information, or the dissemination of results. To that aim, the project was organised in eight different subprojects (SPs)

[1] It is important to note, that in the context of DRIVER an experiment is considered in the widest sense and can consist of various experimentation activities including e.g. table-top exercises or demonstration and evaluation of technical tools (Fonio, C., et. al., D23.11 – Experiment Design Manual, DRIVER project deliverable, 2016).

[2] The term system-of-systems is used to describe a group of heterogeneous and loosely coupled local, regional and national systems able to collaborate in varying configurations and with varying levels of interoperability that is deployed to address major security tasks (Eriksson, A., et. al., D13.2 – Milestone Report 1: Subproject Experiment 2 Design, DRIVER project deliverable, 2016).

mainly divided in thematic and supporting SPs and with SP6 in charge for organizing the Joint Experiments and the Final Demonstration.

2.1 Subproject Experimentation

The execution of SE2 experiments started May 2015 and was intended to be presumed until April 2017. Figure 1 gives an overview of experiments allocated to the DRIVER platforms reflecting the status in February 2016. Detailed information about all experiments has been collected and is part of Annex of this report. Lessons learnt were analysed on the basis of the collected information and were completed by DRIVER SP leaders, end-users and experiment owners. Such considerations are outlined in Section 3 of this report.

Figure 1: Platform Overview of SE2 Experiments (Status January 2016)

The original planning of SE1 and SE2 comprised all thematic experiments planned for the first 36 months (May 2014 – April 2017) of the project. It is important to note that only few experimentation activities were planned and performed in SE1. Instead, the project started work within the three thematic dimensions – *Civil Society Resilience, Strengthened Response,* and *Training and Learning* – by creating an inventory of solutions and establishing baseline information. The solutions had been presented to the consortium and specific end-users, to initially assess their potential based on the presented functions and the collected feedback. At the same time, the thematic oriented SPs had started to document their state of the art (SOTA) work to highlight recent developments and to identify gaps in the respective dimensions ((Engelbach, W., et. al., D31.21 – SOTA & Conceptual Framework for Civil Society Resilience, DRIVER project deliverable, 2016), (Stolk, D., et. al., D41.22 – State-of-the-art Response systems, DRIVER project deliverable, 2016), (Stolk, D., et. al., D41.21 – Vision on Response 2025, DRIVER project deliverable, 2016) and (Van de Ven, J., Theunissen, N., et. al., D51.2 – Learning in Crisis Management 2025: State of the Art and Objectives, DRIVER project deliverable, 2015). The strategy for the experimentation followed by SE2 was built on the results of this solution inventory and the SOTA work.

A common framework to the design and evaluation of experiments was provided by SP2. These guidelines consisted of six basic steps for each experiment to follow when planning and conducting experiments. Where possible, experiment owners were encouraged to use the DRIVER Test-bed facilities to be updated and developed during the project. The DRIVER Test-bed was developed in parallel to the experimental activities aiming to provide methods and physical infrastructure that support the experimentation activities (cf. (Missoweit, M., D21.21 – State of the Art and Objectives for the DRIVER test-bed, DRIVER project deliverable, 2015)). During the SE campaigns, most of the experiments addressed the local or national dimension, in order to retain manageable experiments. Designing a manageable experiment was important in order to ensure valid results, hence the careful and consecutive increase of complexity.

The topics that were addressed by the experimental activities were based on the gaps that had been identified by previous FP7 projects, such as ACRIMAS and were updated during the project in accordance with the DRIVER end-users interests. The main topics addressed by the thematic experiments are summarised in Figure 2.

Figure 2: SE2 overview

2.2 Joint Experiments

The original project plan planned to end experimental activities with two large Joint Experiments that were to be conducted in 2017. The main objective of the Joint Experiments was to jointly test promising solutions in scenarios which are as realistic and as relevant as possible to the Crisis Management community. Functions and gaps to be addressed were selected through research in previous projects and the work in the thematic dimensions of DRIVER. For reasons outlined later, Joint Experiments of the desired size and complexity did not appear feasible. However, testing solutions in an operational environment that is as close to reality as possible was an idea that was highly appreciated by end-users in and outside the consortium. Reasons to deviate from the original planning are outlined in Section 3 to Section 5 also providing recommendations on how to update the concept of the project.

Despite the general recognition that the planned format and approach of the Joint Experiments had not been ideal to realise the project objectives, the first year of SP6 work had brought many positive ideas that were worth pursuing. This section outlines plans for the Joint Experiments in terms of scenarios, CM functions and solutions that were originally presented in February 2016.

The representative scenarios for the Joint Experiments were built based on the appropriate scope, the impact on society, end-users interests, prevalent disaster events and topics of the latest EU funded exercises. Two topics had already been suggested during the proposal phase for the JE scenarios. These topics were major flooding (JE1) and an ice storm impacting several countries (JE2).

For JE1 it was decided to stick to the initial topic of a major flooding. The flood has an impact on the affected population followed by cascading effects on different critical infrastructure. It was a common agreement that the flood scenario is easily scalable and can be split into several parts. In addition, JE1 was hosted by THG in a Dutch region that is naturally exposed to the risk of flooding.

For JE2 it was decided to change from the proposed ice storm scenario to the scenario of a heat wave. A heat wave results in a multitude of cascading effects including forest fires threatening and affecting both urban infrastructure as well as critical infrastructure like the power grid, also resulting in a multitude of cascading effects. The change of the initial ice storm scenario for JE2 was based on the request from a number of DRIVER platform partners, as it was a central topic especially for French (Safe Cluster), Swedish (MSB) and Polish (ITTI) CM organisations involved in the project.

It was decided that both JEs should not be conducted as one major event. Instead, one week with different experimentation activities was scheduled for each JE, but many experimentation activities should have taken place before and after this week (e.g. resilience assessment before and lessons learnt after). The experimentation activities were planned to be of different natures (computer simulation, actual enactment of Crisis Management tasks, testing the usability of the solutions, or workshops) and focus on the different Crisis Management phases (preparation, response, stabilisation and recovery).

The planning process of the JEs started with the SP6 kick-off meeting in Ispra in February 2015. Since then the coordination work of SP6 was directed to find a scope for both JEs that ensured complementarity and took into account the key areas of DRIVER. At the same time the JE leaders worked closely together with the platform owners to define scenarios and to design suitable use cases for the JEs.

The first year of SP6 work revealed that sharpening the focus of the JEs while selecting solutions and developing hypotheses and research questions for their JE participation was a demanding process which required many physical meetings, workshops and mutual experiment participation. It was not possible that end-users could identify the potential value of suggested solutions only through documentations and presentations. On the other hand, it was very hard for solution providers to propose a specific contribution by looking at a complex scenario description. Therefore, a series of meetings between solution providers, JE leaders and platform providers were organised and were already partly conducted to assist the final decision on the selection of solutions.

2.2.1 Experiment Design Joint Experiment 1

JE1 aimed at demonstrating the operational benefits for Crisis Management provided by specific solutions selected from SP3-4-5. The integrated JE1's objective was to involve a larger audience made up of stakeholders of the Crisis Management, policy makers, and governmental and civil society organisations.

JE1 was intended to test and validate several hypotheses in complex scenarios designed by several end-users. A clear focus was set on the local and regional level, also covering other levels. Key CM phases were planned to be preparation and execution, addressing the needs of end-users, involving legacy systems as well as citizens and volunteers and DRIVER platforms from SP2.

JE1 execution was planned as an experiment campaign mainly in April 2017 with rehearsals taking place in February 2017 and March 2017. It was meant to be a "hybrid experiment" consisting of on-site activities as well as of table-top exercises.

The JE1 preparation phase started in March 2015. Regular meetings and conferences were held. In addition, FRQ had an information exchange with THG on a weekly basis between May and December 2015.

The main topics of JE1 were planned to be resilience building of individuals and communities, volunteer management, crisis communication, and situation assessment. In addition, modern CM trends like usage of unmanned vehicles, higher levels of technological interoperability, and usage of communication technology were to be addressed by the experiment (Stolk, D., et. al., D41.21 – Vision on Response 2025, DRIVER project deliverable, 2016). A general set of objectives for each addressed topic was already defined:

Volunteer management

- Strengthening volunteer management through
  - Better organisation and coordination of volunteers
  - Improved interaction and information exchange between volunteers (citizens) and response staff
  - Improved collaboration of CM professionals and the public

Situation Assessment

- Using a Common Operational Picture (COP) approach
- Combining information from different sources in a common COP to support the coordination and collaboration effort
- Using advanced airborne reconnaissance technology to provide real-time information to responders
- Information gathering from the unaffiliated volunteers ("citizens as a sensor")

Interoperability

- Using the Common Information Space (CIS) to improve interoperability of tools. This allows:
  - Information exchange between different systems and organisations

- Inter-agency information sharing
- Acquisition of information from different sources

Community Resilience

- Using solutions for involving and pre-registering citizens as potential volunteers for improved preparation and resilience, and fast addressing of volunteers in the case of a crisis
- Integrating information on community resilience in the response phase to enable a more efficient coordination of the relief effort

Learning

- Demonstrating the need for methods that enhance learning and training from a competence-based perspective.

After JE1, gathered data was to be analysed and interpreted according to the predefined methods for each task, and for JE1 as a whole.

The expected outcome of JE1 should have been an evaluation of potential operational benefits for CM generated by the solutions involved in JE1. Furthermore, recommendations for further developments were to be provided to the CM community.

The selected platforms for JE1 were at the former stage of the JE1 planning:

- City of The Hague (THG) as primary platform of JE1 with focus on all Crisis Management activities addressing flooding.
- Technical relief agency (THW) as platform with focus on cooperation with THG in the flooding scenario.
- Valabre (EPLFM) as platform focussing on the training aspects of Crisis Management.
- Austrian Red Cross (ARC) as key DRIVER end-user.

JE1 was designed to be a continuation of previous experimentation activities performed within DRIVER. A rough overview of the planned solution and SE experiment involvement and their benefit in the scenario can be given. JE1 focussed on experiment EXPE42 *Interaction with Citizens*.

- EXPE42: *Interaction with Citizens,* main topic: Context-aware informing and context-aware tasking of volunteers and evaluating the value of these activities; jointly with EXPE36.2 *Crowdtasking of volunteers* to cover the complementary perspectives of response staff and citizens.

In addition, it was planned to enhance situation assessment through the use of a COP approach benefiting from advanced airborne reconnaissance. Technical solutions coming from SP4 therefore had a strong focus on volunteer management and situation assessment:

- LCMS: legacy system for sharing data throughout the CM system
- HKV flood-prediction: software for flood prediction and description of the actual situation
- DLR airborne reconnaissance: assessment of the crisis situation with usage of a Remotely Piloted Aircraft Systems (RPAS)

- **AIT crowdtasking: addressing volunteers to support Crisis Management activities and to** monitor the progress of the volunteers' activities
- **FRQ and FOI COP: supporting situation assessment and collaboration by providing a common operational picture**
- **ATOS DEWS: support effective warnings and information on several channels**
- **WWU GDACS Mobile: support information collection, processing and dissemination of information on mobile phones.**

SP3 solutions related to individual resilience building and community resilience assessment were:

- **EXPE32.1 – EXPE32.3:** *Psychosocial support tool kits*, **main topic: Train-the-trainer cascade to trainers and volunteers.**
- **EXPE33.1 & EXPE33.3:** *Level of resilience*, **main topic: Testing the impact of knowing the level of resilience in specific communities.**
- **EXPE36.1 & EXPE36.2:** *Societal dimension of volunteer management*, **main topic: Improved volunteer engagement and use of modern applications for organising and tasking volunteers.**

SP5 completed the set of solutions through specific training and learning solutions:

- **EXPE52:** *Crisis Management Professionals (CMP) trainings*, **main topic: Training of CM professionals to deal with the general public.**
- **EXPE55:** *Competence Framework (CF),* **main topic: Optimal competency profiles for different tasks.**

The main functions that were addressed by JE1 are summarised in Figure 3.

Figure 3: Main functions addressed by JE1

2.2.2 Experiment Design Joint Experiment 2

JE2 aimed at demonstrating the potential operational benefit of a more integrated European Civil Protection:

- In the command chain of professional responders, in the context of cross border operations
- In the network of Civil Protection platforms
- In the context of local government resilience
- For coherent crisis communication.

JE2 focused on high levels of CM (regional, national and EU). It was complementary of JE1, which was addressing merely regional and lower levels. The Final Demonstration was meant to cover the total scope addressed by JE1 and JE2.

An iterative refinement and validation process for JE2 was foreseen to involve preferably many stakeholders from the three groups:

- Platform owners
- End-users partners
- Solution providers from SP3-4-5

The priorities of national and EU organisations (e.g. DGECHO, ERCC) were also to be taken into account.

JE2 was not planned as a single experimentation event, but as an experimentation campaign, playing at different locations on different dates.

The campaign was planned as a series of hybrid experiments that combine workshops, training sessions, table-top exercises and simulations. Before the execution, two 1-week rehearsals had been to be conducted in order to solve any problem in advance. Other experimentation activities could have also been conducted far before or after the main activity period.

The Swedish Civil Contingency Organisation (MSB) was assigned as hosting platform for JE2.

After defining the key topics addressed by the joint experimentation, it was to define objectives that suited these broader areas. In a next step these overarching objectives were broken down to more specific hypotheses and research questions that fit to the micro experiments that were meant to be carried out during the campaign.

Key areas of improvement were identified for JE2 as:

International/inter-agency coordination & coordination and information management

- Demonstrating the interest of a better integrated high level CM system in Europe, especially in cross-border cooperation
- Using tools for situation assessment and the COP approach on a European level
- Demonstrating a common standard for the representation of information
    - Flexibility and ability to interoperate
    - Improvement of the vertical workflow (up and down) of information
- Demonstrating the technical interoperability framework (CIS) allowing the interaction between different solutions
- Demonstrating resilience assessment methods for strengthen operational efficiency

Situation assessment

- Using the COP approach for understanding specific crisis dynamics and overall status of relief effort

Crisis communication

- Demonstrating how new methods for information targeting and methods for identifying informational needs create an improved impact for communications during crises.

Learning

- Using a lessons learnt framework for:
    - Sharing and implementing lessons and best practices
    - Understanding specific crisis dynamics
    - Gathering data in an efficient way

Training

- Conducting trainings to improve the performance of high level decision makers.

JE2 was led by TCS and co-led by the assigned platform MSB. In addition, EPLFM and ITTI were also foreseen as main platforms in JE2. In addition, it was tried to also include other platforms into the experiment, even with a limited role.

JE2 was meant to be a continuation of previous experimentation activities performed within DRIVER. EXPE41 and EXPE43 both address high level situation assessment and coordination in a cross border context and had been chosen a basis for JE2:

- EXPE41: *Operational Data Lift,* main topics: Common Operational Picture (COP) approach and vertical information workflow.
- EXPE43: *Optimizing the resource allocation and tasking, with a cross border coordination facet,* main topics: Integrating a set of capacity building and tasking solutions in the context of a cross border incident.

Other SP4 experimentations that had focused on tasking and resource management, situation assessment and crisis dynamics were to contribute to the JE2 design as well:

- EXPE44: *Logistic and traffic management*, main topics: Demonstrate the operational benefit of new solutions for required logistic operations.
- EXPE45 & EXPE46: *Situation and needs assessment, early warning*, main topics: Combination of selected solutions for improved early situational awareness; platform: JRC's European Crisis Management Laboratory (ECML) acting as a backend of the Emergency Response Coordination Centre (ERCC).

SP3 solutions that had focused on broader resilience aspects were allocated to JE2:

- EXPE34.1 & EXPE34.2: *Resilience assessment*, main topics: resilience assessment to influence scenario design and experimentation planning.
- EXPE35.1 & EXPE35.2: *Crisis communication practices and message targeting,* main topics: Shared communications practices among crisis managers and with the public, identification of effective messages, information needs and channels of communication.

SP5 solutions which addressed higher levels of decision making or procedure should have been attached to JE2:

- EXPE53: *Lessons learnt Framework (LLF),* main topics: Defining performance indicators relevant to the scenario, assessing progress on these indicators, and identifying which actions expedited or impeded progress.
- EXPE54: *High Level Decision Makers (HLDM) training*, main topics: HLDM training for improved operationalisation of a decision-making.

SP2 was able to provide simulation of actors involved in an experiment. Actors were meant to actually participate in JE2 in three different stages: actual/real participation, partial simulation, or full simulation.

The main functions that were addressed by JE2 are summarised in Figure 4.

Figure 4: Main functions addressed by JE2

2.3 Conclusion

Work to date is central to informing a redesign of future major experiments in DRIVER. The general ideas and conducted preparatory work will be continued in a more focused and effective format. It is now a common agreement that the ambition of these two large events was too high in terms of complexity and scale. Experiment owners and end-users felt overwhelmed by the large number of topics and solutions that should have taken part in the experiments. The previous experimentation activities had already pushed the capacity of the platforms to their maximum. This is a valuable finding in terms of defining the scope of an ongoing European test-bed. The experimental activities of year 2 have established very good working relationships between end-users, researchers and solution providers. Hence, end-users expressed their keen interest to continue the work and to take part in the Joint Experiments.

The solutions brought by the consortium address large trends like the involvement of citizens, the use of drones in Crisis Management, or improving cooperation across organisation and across borders. By construction of the project they cover a wide span of solutions, ranging from community resilience to command and control, and from technology supported situation assessment to training of crisis managers in Europe, in an environment that is getting more and more complex every day. End-users have expressed great interest in certain solutions, but also great appreciation for the way DRIVER enables end-users to test and evaluate novel solutions in their own operational environment. While the project has to refine the general approach for producing more practical and robust results, the way DRIVER creates a collaborative working environment and acceptance for new solutions and approaches is already seen as a major achievement.

3 DRIVER Challenges and Lessons Learnt

This section gives an overview of the main challenges and the resulting lessons learnt collected during the preparation, execution and evaluation phase of the experiments up to M24. These results will be considered when designing DRIVER activities for the future. A summary of results and experiences for each experiment is given in the tables in Annex of this report. To avoid duplication, the section does not focus on single experiments, but instead identifies common challenges and issues. In this context, lessons learnt arising out of it will also be mentioned and described.

The main focus of this section is to answer the question: What were problems and key learnings in designing/ conducting and evaluating the experiments? The challenges and lessons learnt that occurred in coordinating and performing the DRIVER experiments, including aspects such as recruiting and involving volunteers, coordination with platforms and integration and interoperability of solutions, are described in detail.

The information given in the following subsections is a summary of all critical remarks reported by experiment leaders, volunteers, observers, SP leaders and platform providers involved in the experiments. In order to provide an adequate overview, the lessons learnt are divided in three categories – preparation, execution and approach and methodology – based on the six-step approach. While more detail will be found in experiment reports, experiences of the experiments have been clustered and are presented under common headings. Detailed information on the lessons learnt and findings of individual experiments can be found in the respective reports.

3.1 Experiment Preparation and Design

The preparation of the experiments made it clear that scheduling and designing DRIVER experiments had to be considered very carefully. Addressing their various related tasks sufficiently, requires significantly more resources than initially expected. Therefore, a preparation time of at least 6-9 months – depending on the size of the experiment, the underlying scenario and the involved participants – appears to be required for preparing and designing an experiment in Crisis Management. This is especially true considering that the experiments should be designed to address end-user needs and several iterations are required for interacting with them.

In general five main challenges were identified:

1. Ensuring appropriate research questions and data collection
2. Selection and availability of representative volunteer groups
3. Timely and appropriate involvement of all relevant participants
4. Creation of a realistic and useful scenario
5. Adaption and integration of solutions to the scenario

The following describes these main challenges and its respective lessons learnt for experiment preparation and design. The section concludes with a summary of the main lessons learnt (Figure 5).

Challenge 1: Ensuring appropriate research questions and data collection

The key aspect of the design of any experimentation activity and the starting point for all experiment preparations is the clarification of a research question to be answered by the experiment and the compilation of a suitable data collection plan.

In most cases, the elaboration of research questions has been discussed within the experiment teams and with the methodology team. Such questions mainly dealt with the expected functionality and the impact and usefulness on the work of potential end-users, with respect to organisation, procedures and policies. Some of the research questions can be answered by qualitative measures (mostly feedback from participants) and some by quantitative measures. For IT tools in particular, performing quantitative measures can require some specific tools (which need to be connected, and may require an integration effort) of specific development (e.g.: the logging of specific information into a specific format that is convenient for the exploitation).

The amount and type of data to be collected must be carefully considered in advance: every measurement interferes to a certain extent with the running of the actual experiment and may in this way influence the analysis. Consequently, a detailed and consistent plan for capturing all necessary input must be drawn up prior to the actual data collection, as being able to collect the data that cannot be done after the fact. If opportunities for data collection are missed, the value of the experimentation activity may be severely diminished. The preparation process would benefit from research questions formulated as early as possible and early involvement of all three main stakeholders to validate the methodology: researchers, solution providers and end-users.

The research questions as outlined in the project's original Description of Work required very substantial elaboration and consultation before activities could progress.

Challenge 2: Selection and availability of representative volunteer groups

One of the main challenges in preparing and designing experiments is the selection and the availability of representative volunteer groups, consisting of unaffiliated volunteers (citizens) and professional volunteers (Crisis Management professionals). This is a challenge common to most areas of research.

The unaffiliated volunteers can be characterised as heterogeneous group of people with a variety of age, gender, education, availability and job. Usually volunteers are willing to help in the case of a crisis situation. Their willingness to support an experiment by offering their time is not always consistent. This was, for example, noticed in SP3 experiments. To get a representative sample for questionnaires is difficult because citizens receive a lot of questionnaires nowadays and are less willing to participate. Therefore, it requires extra effort to find the needed number and profile of volunteers for an experiment. Nudging, timing and good communication plays a large role. A lesson for DRIVER in this respect was that it is worthwhile delaying timeline to wait for the right volunteers to be ready to participate. A number of approaches were used to address this challenge including the use of an existing panel which was less representative but provided a high response rate.

Professional end-users have to be distinguished into full time staff and volunteer staff. Full time staff works in Crisis Management on a daily basis in familiar environment and are employed by the organisation involved, such as fire fighters or crisis managers. Volunteer staff works on a volunteer basis and are not employed by the organisation involved. In both cases, if an experiment relies on their participation somebody else has to do their job during their participation in the experiment.

Moreover, the sampling of suitable test persons for the experiments is a challenging task. In order to make the selection easier, general categories should be defined for each experiment. For example, these questions should be answered before selecting professional volunteers (some of the questions could also be used for selecting unaffiliated volunteers):

- Which unit will most likely use the solution during a CM operation?
- Once the unit has been identified, which level of operational personnel should be engaged in the experiment (basic volunteer, squad leader, platoon leader, etc.)?
- How much operational experience should this individual have?
- What kind of test persons are required in order to explore potential benefits of innovative solutions potentially bringing added value but still requiring further improvement?
- Should the participants have a background in a specific field of interest (technically savvy, blue/white collar, etc.)?
- In which language will the experiment be conducted?
- Should the participants be male/female, differ in age and come from different regions, etc.?
- Which priority does each aspect have?

Furthermore, it is important to select individuals who are in the position to test new tools of different maturity levels which are not the ones that are being used in their daily work. Especially, professionally trained staff has the expertise which allows them to quickly judge solutions according to their applicability in the field following their current procedures and methods but sometimes it is not easy for them to detect the potential added value of some tools which are still requiring some adaptation for their deployment. This is due to the fact that Crisis Management personnel commonly perform exercises and trainings (oriented to improve the usage of current practices and tools) which do not resemble this kind of experiment (which is looking for potential room for improvement and added value that innovation can bring to procedures in place).

To foster the high commitment of participants, one of the lessons learnt during these experiments is that it is crucial to explain in detail what is expected from the experiment, and also what is expected from the participants. The principle of an experiment (as opposed to an exercise) is to set the focus on the change brought by the introduced solutions and not on the proficiency of the players. This had to be explained in order to relax the fear of many participants to be judged on their own performance in interacting with novel solutions without being trained for this extensively before. In many cases where the solution included procedures that were different from the normal operational procedures, it has been useful to have higher officers clearly explain that breaking the usual procedure was part of the experimentation and was consequently not a problem.

For recruiting volunteers, a lesson learnt by the Red Cross Red Crescent Movement's and implemented for DRIVER is that volunteer participants are far more likely to commit to experiments when their volunteer work stands to gain directly from their participation. This can be achieved though departing new skills or insights to participants but also by designing the experiment for true user-driven innovation. Volunteers are motivated to volunteer by a drive to make a positive change in society. Harnessing this drive by designing careful questions, allowing time for open-ended discussions and recruiting experiment leaders who are experienced volunteer leaders or social innovation specialists and thus able to understand and acknowledge volunteer insights as they crystallise in the course of experiments is key. In contrast to professionally trained staff, volunteers are often quick to dream big for societal change and managing this to also deliver realistic feedback requires skilled facilitators.

Finally, unexpected situations like an acute CM case can redirect professionals to their usual job, such as happened with EXPE41 where a rehearsal in December 2016 had to be postponed due to the terror attack in Paris in 2016 or with EXP42 in The Hague in which a real large fire required parts of the experiment group to return to duty. The availability of professionals for EXPE44 in Neuhausen was limited due to the refugee crisis. On the other hand, in EXPE35.2 a training in communications principles and practices was held with personnel who were simultaneously participating in a crisis response. This gave and added dimension to the quality of the interaction and its focus on real-life scenarios.

Challenge 3: Timely and appropriate involvement of all relevant participants

Another main challenge to be considered in the preparation of an experiment is the timely and appropriate involvement of all relevant participants in order to guarantee an experiment which fulfils all requirements and is in the scope of the project. Depending on the scope and type of experiment the party developing the experiment must distinguish between different groups and numbers of participants (e.g. experiment owner, platform owner, solution providers, all groups of volunteers, observers, communities, public relations etc.).

For many experiments involving professionally trained end-users it proved beneficial to consult with them very early in the scenario design in order to consider their end-user experiences, interests and needs in the scenario. If applicable, experiment owners have conducted smaller pre-runs and rehearsals, where some professional players were playing already a part of the scenario. Such activities largely supported the scenario design for the actual experiment resulting in scenarios and storylines that were closer to the operational reality and thus more interesting for other professional participants.

In order to get an interesting answer to the question "Does the solution bring an operational benefit?" it is important to enable professional participants to fully interact with the solution during the experiment. Where the solution involves a methodology or training, the use of scenarios and techniques such as role-playing, significantly improves effectiveness. In all cases, significant advance preparation of professional participants is required.

The lesson learnt from many experiments involving IT tools is that, just as in real operational life, CM professionals especially at the higher levels of command do not need to handle the tools themselves. Providing them a computer assistant who enters the data and interacts with the computer for them is a good solution that is operationally efficient and reduces the training time of involved end-users. This approach also supported overcoming the language barrier (if the assistant understands both the language of the software and the language of the end-user). Moreover it shall be noted that in many cases, it took only a few hours for younger participants who are more familiar with using software applications to become familiar with the tools that were used during experiments. This means that computer assistants can easily be recruited among younger professionals.

An approach of 'train the trainers' can be implemented and its impact measured – **thereby providing a validated means for an organisation to spread a new solution faster and more efficiently.**

In some experiments it was noticed that solution providers and end-user worked too long separately on their specific preparation tasks without exchanging information to each other. This can negatively influence the results since some solutions cannot be fully embedded into the scenario and end-users might not have the necessary training to handle the solutions during the experiment. In such cases it is hard to assess the full functionality and potential benefits of solutions. A strong coordination approach of the experiment owner has been advantageous to coordinate the many participants with various backgrounds. This includes preparation and management of strict schedules and several preparatory meetings. The organisation of F2F meetings is absolutely necessary to the success of this process.

For solutions not involving IT tools but focusing on knowledge building and the use of specific pedagogical techniques and processes, participants needed to take part in the training themselves. Creating a safe learning environment and allowing full immersion in the training is a prerequisite for obtaining valid data about their experience and learning and the effectiveness of the trainings for transfer of knowledge. The data collection methods used included a combination of qualitative (observations, semi-structured interviews and focus group discussions) and quantitative (self-assessment questionnaires) methods applied immediately after the experiments and at a 6 month follow-up time point.

With regards to the dissemination material, the film team or the press benefited from being involved early enough in the preparation of the experiment. They should also be involved early in the process because the time and effort required for discussions, drafting scenes to be recorded and preparing text for the voice-over should not be underestimated. The provision of a template for experiment videos would be useful in order to harmonize the results and minimize the design effort of these videos. This however, has to be tempered by the disturbance a film team or press representative may create to the data. Their presence does make some participants less inclined to speak openly, voice concerns or admit that they do not understand what is being presented to them.

<u>Challenge 4: Creation of a realistic and useful scenario</u>

Creating a suitable and realistic scenario that is within the scope of the project and of interest for all parties (platform provider, solution provider and end-user) is another challenging task in the preparation experiments. All of them have their own requirements and needs and want to gain a benefit in participating in the experiments. The best way is to create the scenario based on the input of end-users. End-users should be familiar with the subject and able to provide a deeper understanding of existing practices. Experiments had shown that considering a real disaster for the scenario design is very practicable in order to e.g. ensure realistic conditions, realistic data, realistic extent and realistic practice. This can be added to by fictional cascading events.

Furthermore, the scenario should suit all solutions applied to it and the affected geographical and cultural area. Not all solutions are applicable to crisis situations and management levels (operational, strategical and preparatory), or can only be implemented by an expert. The creation and design with regard to an appropriate involvement of planned solutions requires several iterations including a

significant number of physical meetings in order to insure that solutions are (correctly) embedded in the scenario.

It was also raised by practitioners that the scenarios were sometimes quite demanding in terms of information to keep track of. Although the IT tools were helpful, the practitioners were not so familiar with their capabilities and it is also required to take into account the psychological pressure on the rescuers. Practitioners would have appreciated to have additional support from the Game Conduction perspective: some sort of visual time line displaying when key information and decisions taken are expected would be of benefit.

On the other hand, the scenario helped end-users to get a scene setter and get involved with the experiment and the fields of experimentation were found relevant. Using the visualisation/simulation tools gave an excellent possibility to display new ways of conducting distributed trainings reducing the required amount of resources.

A learning experience from DRIVER is that there are significant difference between experimenting with a tool and experimenting decision making. Experiments for tools focus on ensuring that tool functionalities are used and evaluated in a systematic way. In order to do so, a sequence of decisions and actions are designed and thereby pre-determined to make sure this testing happens. This is what is known in the IT world as a scenario. It is essential to evaluate functionalities, but does not tell you if and how the tool will be used.

Crisis Management end-users test "decision making" by plotting a situation and defining the tools available This is what Crisis Management professionals understand as scenarios. Then practitioners are allowed to use whatever tool they see fit and take any decision they want. Based on these decisions and the implementation action taken, the situation evolves to the next step. We cannot predict what tools will be used, when and how, nor what will be the decisions and actions taken.

Early experiments focused on IT tools and their optional functionality; for future DRIVER more complex experiments to investigate how the tools function in decision making will be central.

Challenge 5: Adaption and integration of solutions to the scenario

Ensuring proper adaption, interoperability and implementation of technical solutions to the scenario is often a complex task. The available DRIVER solutions provide a variety of benefits at different application levels and different situations with different maturity level. Thus, it happens that some solutions require several additional (mostly technical) adaptions (e.g. implementation of additional requested functions, interfaces with other solutions, further data acquisition, data integration, other technical adaptions), to ensure a successful and appropriate usage and linkage in the experiment. However, it was noticed that sometimes solution providers faced difficulties with the required adaption and integration activities, due to lack of available resources in the initial planning.

The experiment owner has to deal with a wide range of technical issues. For a smooth operation all technical components have to work together in a well-integrated manner in order to ensure seamless team work. For this reason, all technical requirements of the planned solutions to be included in the experiment have to be considered in advance of the experiment execution and checked right before the execution. Furthermore, it has to be considered, if a huge amount of data a going to be collected, that the technical infrastructure and the provided systems are able to deal with the data volume. Also, if a lot of solutions run online it is necessary to confirm the quality of the internet connection. This should be ensured by conducting technical rehearsals, dry-runs or a pre-check of technical conditions (e.g. firewall restrictions, using solution in an external net) prior to the event.

In the context of solutions which concern new methodologies integration into wider complex experiments is a substantial challenge and is central to DRIVER's innovation. Purely technical solutions operate within well-established professional boundaries. This is rarely the case in relation to areas such as measuring resilience, managing volunteers, delivering vital psycho-social supports or communicating with the public. Building a shared-understanding of objectives and requirements across technical and non-technical participants is a central concern which must be identified in planning.

Although some of the issues were quite challenging, most experiments were able to adapt during the definition process and even during the experiment execution itself achieving a good level of satisfaction for practitioners, evaluators and observers. During the DRIVER experiments no general technical problem, which influenced the performance of the whole experiment, occurred. Solely solution-specific problems came up, which mostly could be fixed during the experiment execution. Anyhow, these technical interruptions influenced the work of the practitioners and so also the results. What turned out to be very helpful was the use of smart boards that allowed all solution activities to be displayed and recorded, which allowed all participants to observe how the solutions were used in order to solve the problems they were faced with.

The main lesson learnt to be retained in this phase is that the project should seek a stronger end-user involvement in the early phases of experiment preparation. This would ensure experiments which are better designed in order to study the operational benefits of the solutions and go well beyond demonstrating the intrinsic capabilities of such solutions.

Additional Lessons learnt are:

- The type of volunteers differs as well as their individual availabilities and motivations. Therefore, the recruiting and the number of suitable and needed materials have to be considered carefully and with respect to the scope and focus of the experiment.
- Regular meetings (as scheduled preparation workshops and/or frequent conference calls) and agreements with relevant and involved participants as well as sharp deadlines are necessary to avoid divergent and uncoordinated preparation work.
- Replaying a real disaster seems to be reasonable and should be considered in scenario designs in order to e.g. ensure realistic conditions, realistic data, realistic extent and realistic practice.
- The designed scenario should suit all solutions applied to it and the affected geographical and cultural area.
- Difficulties with the required technical adaption and integration activities can be avoided if the scenario definition with end-users is completed early enough to allow efficient planning and budget allocation well in advance.
- Technical and non-technical roles should wor to develop a shared understanding of underpinning principles for non-technical solutions.
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Figure 5: Main lessons learnt from Experiment Preparation and Design

3.2 Experiment Execution

As in the preparation phase, resources in terms of time and personnel have to be considered very carefully prior to the experiment. Especially the responsibilities and roles during an experiment have to be defined and understood by all participants. During the execution of the DRIVER experiments four main challenges were identified:

1. Maintain and ensure effective communication
2. Define and agree on roles of participants
3. Respect different levels of experiences of involved participants

In the following, the main challenges and derived lessons learnt from executing DRIVER experiments are described. These should be seen in the light of the discrepancy between the available and expected resources, and the actual resources needed to carry out the work. The main lessons learnt are summarised in Figure 6 at the end of this section.

<u>Challenge 1: Maintain and ensure effective communication</u>

One of the main challenges is the communicative and linguistic interaction while performing an experiment. In general, the challenges can be distinguished between language and communication barriers and acoustic disturbance.

One problem not to be underestimated is the language and communication barrier. Due the fact, that the experiment teams consisted of participants from different EU-countries, the common language was English. Although the English language can serve as a common basis, certain aspects or tendencies of a discussion or agreement might not always be clear instantaneously for every participant. Not all participants, such as unaffiliated or professional volunteers on local level, are comfortable speaking and working together in English. This in turn, can lead to misunderstandings and inefficiency when coordinating and carrying out the work. Moreover, workshops and trainings and other forms of interaction often need to happen in the local language, which requires translation activities and may harm the evaluation concept. In certain areas, such as communication during a crisis, the localisation of language and information is essential to conducting a valid experiment.

Misunderstandings were further implied by a different understanding and usage of some key terms. Every party (researchers, industry and crisis professional) has its specific understanding for certain terms. Important examples in this respect are the terms "experiment" and "volunteers". This ambiguity in terminology required quite some effort to establish a common understanding and to overcome these issues of semantic interoperability. Therefore, a glossary was reconciled and implemented to ensure a common understanding but it is still recommended to improve its implementation and usage.

With regard to experiments focusing on training and knowledge transfer the language barrier very quickly becomes large. It is compounded by cultural differences beyond language such as organisational structures (strictly hierarchical or flat), levels of education, differences in deference to "experts" and thereby experiment leaders, differences between volunteers and staff motivations and not least the fact that every piece of key terminology has to be considered for cultural adaptation for all elements of the experiment to ensure that the experiment asks the same question in all languages and cultures and that replies are comparable.

Further complications in communication can be an acoustic disturbance that may distract the practitioners while performing their tasks. It is important to consider this aspect and to make sure that the participants have the proper environment in which to conduct their tasks during the experiment, e.g. proper tools and technology, no excessive noise or interruptions. In this context it has also to be considered, that control groups should be separated. Otherwise they can listen to the other groups and the comparability of the groups is not ensured. This disturbance depends on the number of involved participants on-site and spatial conditions.

Challenge 2: Define and agree on roles of participants

During the execution of an experiment it is necessary that each participant is fully aware of his/her specific role and related tasks. Otherwise it happens that a lack of shared understanding with respect to roles and responsibilities occurs, resulting in problems e.g. with transfer of required data. In particular, professional volunteers have to be aware of their foreseen role, since in experiments sometimes they have to assume a different role with different responsibilities than they are used to or they have to behave differently than usual to explore some of the research questions of the experiment. Sometimes, it was also required that an actor takes on more than one role due to the lack of volunteers. To ensure a clear understanding of distribution of roles a detailed time schedule, a list with responsibilities/roles and additional checklists should be provided. In addition, agreed practice principles must be defined in advance, especially for cross-border experiments, on areas such as data to be tracked and information content.

Challenge 3: Respect the different levels of experiences of involved participants

Participants involved in the experiments have various levels of experience. This can be broken down into (a) experiences with experiments, (b) the complexity of the scenario design and (c) the knowledge about the provided solutions.

Experiments in DRIVER are intended to assess solutions which are bringing added value through innovation but usually require further development and validation. The majority of practitioners were not accustomed to this kind of experimentation due to the fact that Crisis Management personnel are more used to exercising, demonstrating and training and not familiar with the concept of experimentation as such. The main focus of exercises is to train already established practices or equipment (in many cases already available on the market). Practitioners/Volunteers have to be informed of this difference in order to take the best advantage of their expertise. Therefore, a considerable amount of time and reconciliation was necessary to raise awareness towards the framing of conditions, the way of execution and the aims of the DRIVER experiments. Many of participants have reported their appreciation for the higher level of reflection and the thereby generated insights after an event. Thus, raising awareness about new ways of testing and evaluating CM solutions can be considered as a relevant DRIVER outcome as well.

The execution of experiments showed that the scenario was sometimes too challenging or too simple for the practitioners. In some cases the testing of multiple solutions was difficult for the practitioners, despite the support by solution providers. It was suggested by practitioners to adapt, simplify and shorten the scenario design and to limit the number of gaps addressed and thereby the number of solutions tested in one experiment. This has substantial implications for the manner in which test-beds will operate.

Moreover, since DRIVER performs experiments and not exercises it is favourable to integrate additional breaks during the execution as was done in several experiments. This enables the informing of each participant about the current status of the ongoing experiment and about the most recent results. By doing so, also further steps or changes in the experiment can be explained, to reflect on the ongoing experiment through feedback rounds with all participants. This in turn, makes it possible that every party (practitioners, observers, guests etc.) is up-to-date and all involved participants are more able to understand the context of their participation in the experiment.

This is less of an issue with training or method solutions where the approaches are more commonly found in CM organisations.

In connection with the heterogeneity of the DRIVER parties (see Section 3.3), not only the experiences in experiments differ, but also the knowledge and experiences with new technical solutions are on different levels of maturity between the participants. The experiments showed that practitioners are often not used to work with modern solutions that allow, for example, direct communication, integration and display of up-to-date data coming from different sources. For the most complex solutions it took a significant amount of time, regardless of the ease of handling, until they felt confident enough of using the solutions that they could solve the tasks given to them. This instability in using the solutions by unfamiliar users can influence the analysis and evaluation of the experiment. To avoid this, there needs to be more emphasis on training, briefing or instructing participants in advance of the experiment to get practitioners familiarized with unknown solutions or solutions that require further development. In addition, this increases the end-user's acceptance and allows gathering valuable feedback upfront which in turn can be considered for the execution of the experiment.

The main lesson learnt to be retained in this experiment phase is that a clear division of roles and providing additional training would have ensured a more smooth operation during the execution, since each participant would be aware of his/her specific role and related tasks during the experiment execution.

Additional lessons learnt are:

- Communication constraints regarding language barriers and different usage of key terms should be taken into account when performing nation-wide experiments with different parties (industry, research, Crisis Management professional) in order to avoid misunderstanding and inefficiency.
- Bilingual computer assistants and local partners as translators are effective in improving accessibility.
- The DRIVER terminology should be extended and reinforced.
- Focussing on simplified and short scenarios with a limited number of solutions increases the acceptance of practitioners better than complex scenarios with a large bundle of solutions.
- The heterogeneity of the involved participants (volunteers, platform providers, solution providers, etc.) in conducting this type of experiment has to be considered to allow feasible and useful participation; otherwise the experiment results will be negatively influenced. For that, a considerable amount of time and reconciliation is necessary to make each participant accustomed with the experiment in order to participate in a constructive way.
- Preventive measures should be considered to get practitioners familiar with the proposed solutions and to avoid negative influences on the analysis and evaluation.
- An inappropriate physical environment for the experiment can disturb the practitioners in performing their tasks and should be avoided.

Figure 6: Main lessons learnt from Experiment Execution

3.3 Experimentation Approach and Methodology

The following section presents experiences and conclusions with respect to the approach and methodology of the DRIVER experiments. Lessons learnt are summarised at the end of the section in Figure 7. The main challenges with respect to the experimentation methodology identified were the following:

1. Design and Execution of an End-user Driven Solution Evaluation
2. Implementation of the DRIVER methodology
3. Evaluation

Challenge 1: Design and Execution of an End-user Driven Solution Evaluation

The scope of the DRIVER project encompasses all relevant Crisis Management lifecycle phases covering tasks and processes in the key areas of improving civil society resilience, strengthening first responders as well as training and learning of appropriate solutions. In consequence, a wide range of solution "functions" and "features" became part of the evaluation content. Accordingly, the number of potentially relevant solutions is also very high. The DRIVER Test-bed infrastructure and methodology, as key objectives of the project, need to reflect all the different and diverse solutions as its potential content.

In order to develop an appropriate Test-bed, a critical mass of "evaluation content" needed to be provided from the very beginning of the project phase. Thus, solution providers covering the wide range of functions and features became part of the DRIVER consortium. Several technical tools were part of this set of solutions and during the first year of the project, an inventory of these tools was organised. The initial evaluation approach executed during the first round of experiments became at least partly very technical. The different functions were presented to a group of evaluators, verifying the functionalities through an evaluation sheet. For this reason, the first evaluation results became sometimes more descriptive than evaluative, but the challenge is to analyse and edit the results from an application perspective rather than from a technical point as it was done during the second round of experiments. However, this process led to a first taxonomy of candidate tools, an estimation of their TRL, and a first qualitative estimation of their potential interest for operational capability.

Many DRIVER partners were already very much aware that practitioners feedback is a scarce resource but very important in order to effectively drive innovation. The time restrictions of active Crisis Management practitioners were not anticipated appropriately. Although end-users were asked to participate also in the first round of experiments, the participating persons were only partly representing (field) practitioners. There exist many different reasons why effectively practicing Crisis Management end-users are hardly able to participate in a 5-days workshop, but one of the main causes is most likely the opportunity costs to hinder the practitioners doing their core work. In addition, end-users participating in the evaluation of solutions have expressed their difficulties with e.g. evaluation criteria or very technical questions. When trying to cover both the content and the technical dimensions of the solutions, the end-users were not clear about the consequence of their feedback, which was intended to imply the selection of solutions which are meeting their realities (relevance) and needs (innovation potential) with a number of evaluation criteria. During the second round of experiments, the involvement of end-users in the evaluation process was significantly improved. After the interest of end-user organisations was raised for the solutions and methods provided by DRIVER, some experiments were prepared in a much more end-user driven way. Means for evaluation and the evaluation criteria have been developed in close interaction between end-users and experiment owners.

Challenge 2: Implementation of the DRIVER methodology

In accordance with the DoW, the overall DRIVER methodology for experimentation would be part of the DRIVER Test-bed. A six-step approach has been developed by SP2 to guide the experiment owner through the process of design, execution and evaluation. Due to the different nature and heterogeneity of the CM solutions and concepts provided by DRIVER, the six-step approach was kept on a balanced depth. The six-step approach describes the entities needed to conduct an experiment, like hypotheses and methods, participants and experiment plans, but some additional work is still required to establish a structured, valid, reliable and pragmatic methodology towards a systematic design. In the overall approach concepts were rarely operationalized and this led to a frame of reference which was more theoretical than practical.

In the end the guidance was not detailed enough and did not provide the experiment owners with complete instructions for application of the methodology within their context. Every experiment had to deliver only one document that described the experiment design, the execution and evaluation after the experiment was executed. Since experiment owners and end-users were often heavily involved in the technical planning and preparation of the experiment itself, important aspects as part of general methodology were often not addressed with enough attention. In addition it appeared that experiment owners did often understand the key elements of experimentation differently and therefore had not exactly the same focus as foreseen by the methodology developers. It is now understood that more guidance and a structured approach with intermediate milestones and gates would have been required to ensure consistent experiment designs. Also tools based on this structured approach which would enable the monitoring of the progress of experiments in a standardised way would be very useful for the management of experiments by the experiment owners as well as their monitoring by the technical leader of the project. In addition to that, more coordination effort at the level of technical project coordination would have been necessary to guide experiment owners along all phases and to review the quality and consistency of work in every step.

In many cases, experiment owners were expecting operational support methods from the Test-bed, but such could have been improved in terms of time or scope. The DRIVER Catalogue has helped experiment owners to get access to tools for scenario simulation and orchestration as well as data recording and analysis, but the development only started during year 2. Moreover, the exact share of responsibilities between SP2, experiment owners and end-users has not been fully clear. Material and intermediate work results that had to be produced during the design phase have not been specified enough. A more detailed planning of the required steps with shared responsibilities between all participants throughout the process of designing, preparing, executing an experiment would have helped to structure the interaction between SP2 and experiment owners in a more systematic way. This, in turn, would have supported experiment owners to fully access and utilise the support provided by the Test-bed.

However, it was stated by practitioners involved in the experiments that this type of experimentation and development activities gives a lot of new possibilities for Crisis Management organisations to explore and develop new capabilities and procedures and what is needed to be able to handle future complex crisis.

It was also raised that the experiment enhances understanding on how future distributed exercises could be organised, including a hosting Test-Bed (national or international), to carry out a variety of different activities ranging from experiments, training, exercises, technical integration, etc.

Aside of the experiment focus, this type of activities also adds to the DRIVER aim "Better understanding of Crisis Management in Europe", since there is time to get to know other participating organisation and how they work and reason around different matters. This applies both to national and cross-border perspectives.

Challenge 3: Evaluation

Experiment owners have reported that in addition to the difficulties in designing, planning and executing an experiment according to the DRIVER methodology additional guidance towards a common evaluation approach was required. Therefore almost every experiment had to extend the methodological guidance for evaluation of the conducted activities. These circumstances hampered the overall assessment or possible benchmarking of solutions. Thus, the experiments managed to reflect towards their specific requirements, solutions and research questions, but not always using common methods and metrics that would have allowed creating an overall picture across the experiments and solutions. The diversity of the solutions addressed by the DRIVER project (ranging from local government resilience, drone based situation assessment, command and control systems, logistics tools and training on psychosocial support) is certainly an obstacle to this harmonization but family of evaluation methods could be proposed for each type of solutions. Usability, operational benefit and cost effectiveness could be part of this panel.

The collection of feedback from the DRIVER experiments revealed to be another challenge. It has been found that the most effective way to track findings and experiences is by feedback rounds (so called "hot wash-ups") with participants directly during or after experiments. This guarantees the collection of unfiltered and direct feedback that is rich in detail and comprises additional remarks collected during the experiment as well as the collection of sentiments. Questionnaires – whether online or hand-written – are a very valuable source of information as well. However, participants have to complete the questionnaires directly after the experiment as some details and correlations observed during the execution of the experiments might not be measured anymore when the questionnaires are answered several weeks after the experiment.

Collecting data in participants' mother tongue may be necessary to them to express themselves precisely enough but also to add a layer of interpretation to the analysis. Lessons from DRIVER are that multi-method data collections where some of the techniques offering the opportunity to probe immediately (e.g. focus groups) if answers in a mother tongue are not properly translated add significant value to data. For surveys translation must be done by trusted and technically knowledge which often limits the field of available translators significantly. This is a particular issue for soft solutions such as psychosocial support.

The process of data collection requires that all relevant participants and/or processes were monitored and analysed continuously. Furthermore, concurrent testing of solutions with independencies complicates the evaluation and identification of the concrete strengths and weaknesses for every single solution provided.

The preliminary results show that evaluation means could have been improved by the DRIVER experiments. This is partly owed to the diverse interests of the involved participants mentioned above and the fact that solution providers, experiment owners and end-users had a different understanding on what should be evaluated during and after the experiments. Additionally, some of this evaluation can be based on quantitative measurement (usually technical aspects) while some other aspects can be only evaluated following a qualitative approach. A common set of evaluation criteria have been developed at the start of the project but it is required that it will be further developed throughout its lifetime. While it is true that certain evaluation criteria can only be provided by solution providers, some generic criteria should have been used in the evaluation of every CM solution, such as: the usability, the EU-added value or the cost-effectiveness. In addition, a more systematic review of the potential of solutions to solve certain gaps would have been needed. As before, more technical coordination effort would have been required, demanding the experiment owner to provide detailed evaluation plans for approval by the technical coordination.

To deal with this situation, as part of some experiments an evaluation framework was set up including four different areas: CM Actors, IT Solution/Tools, Test-bed and Simulation. This allows for covering all the different facets while keeping a shared framework, but on the other hand it is required to improve this approach to achieve further homogeneity between areas.

The main lesson learnt to be retained in this phase is that the evaluation of each experiment should be dependent on the overall methodology and it would have benefited from a clear and more practical methodological concept with a general approach, which each experiment owner can follow.

Additional lessons learnt are:

- A high diversity of interest, requirements and needs of the involved parties demands certain efforts for synchronization and coordination in order to enable seamless and effective collaboration as well as to agree on a common methodology.
- Scientific means must be improved to ensure a robust frame of reference for DRIVER activities.
- It has to be considered that certain evaluation criteria can only be given by a certain stakeholder and are not covered by general evaluation criteria. The methodological approach should deal with this heterogeneity while providing a common shared framework.
- The most effective way to track findings and experiences is by feedback rounds with participants directly during or after experiments.

Figure 7: Main lessons learnt from Experimentation Approach and Methodology

4 End-User Perspective

The DRIVER project brings together researchers, developers, and Crisis Management (CM) professionals from across Europe as the end-users of the new approaches and innovative technologies. The starting point for all innovations is based on end-user's needs and demands in order to best support their Crisis Management and operational activities. In DRIVER, several end-users are part of the consortium or are associated partners. The Test-bed provides five main platforms consisting of physical assets and other resources where testing and experimentation can be carried out. These platforms play a major role in the technology-driven experiments. All experiments in SP4 and SP6 are allocated to one of the platforms. Other end-user organisations, like the Red Cross, play a large role in all experimental activities that are focussed on civil society, training, and learning. They contributed to the definition of needs, the identification of gaps, and the design, execution and evaluation of the new approaches and innovative technologies tested during the experiments.

Therefore, a section of this report is dedicated to the end-user perspective and provides answers to the following questions:

- How are the end-users involved in the respective DRIVER activities (Section 4.1)?
- What are the main gaps for end-users that are addressed by DRIVER (Section 4.2)?

4.1 End-User Involvement in DRIVER

The most important prerequisite for the success of the project activities is a strong involvement of end-users. The direct end-user involvement in DRIVER can be summarized in the following five sets of activities, which are described in detail in this section:

1. Contributing specific knowledge and expertise on CM to define related needs and gaps
2. Supporting the design and the preparation of experiments
3. Participating in the execution of experiments
4. Evaluating the new approaches and/or innovative technologies tested during the experiments

<u>Activity 1: Contributing specific knowledge and expertise on CM to define related needs and gaps</u>

At the start of the project, end-users were invited to share their knowledge and specific expertise on CM, e.g. by contributing to the description of specific CM executing organisations, procedures and capabilities or by transferring operational knowledge to the research and development partners in the project. CM gaps are identified by mapping end-user needs to existing CM capabilities. The initial set of gaps for DRIVER project stemmed from previous FP7 projects, such as ACRIMAS and was updated during the course of the project. End-users have communicated their needs as part of the state of the art reports (cf. (Engelbach, W., et. al., D31.21 – SOTA & Conceptual Framework for Civil Society Resilience, DRIVER project deliverable, 2016), (Stolk, D., et. al., D41.22 – State-of-the-art

Response systems, DRIVER project deliverable, 2016), (Stolk, D., et. al., D41.21 – Vision on Response 2025, DRIVER project deliverable, 2016) and (Van de Ven, J., Theunissen, N., et. al., D51.2 – Learning in Crisis Management 2025: State of the Art and Objectives, DRIVER project deliverable, 2015)) and during discussions with solution providers and researchers. During the first year of DRIVER, many activities were conducted to learn about end-user needs and capabilities and to present solutions potentially addressing them. This was required to cluster and categorise solutions as well as to identify the specific functions that could potentially close identified gaps. Moreover, this exercise allowed the consortium to match solutions to specific end-users and platforms.

The gaps identified within the context of DRIVER cover a wide range of aspects relevant to Crisis Management and response. They are of technical, legal or organisational nature and were addressed in various experiments. The related gaps were confirmed by end-users and some are further described in Section 4.2.

<u>Activity 2: Supporting the design and the preparation of experiments</u>

Once the capabilities of the consortium in terms of solutions, platforms and end-users were fully identified and structured, end-users, experiment owners and solution providers teamed up to start the design and preparation of experiments. In most cases, one to two end-user organisations would play a major role in the experiments, with an involvement of more end-user organisations from in- and outside DRIVER. Naturally, end-users are the most important entity for designing and building scenarios. First, background stories are selected to match the potential hazards of the affected regions. Next, end-users build the scenario into the context of their organisation trying to make the timeline a realistic chain of events. Finally, the platform providers are responsible to ensure that practitioners with the required experience are be on hand during the execution of experiments. The process includes practitioners from organisations internal and external to the project consortium. To prepare the event itself, platform providers must be able to fully describe their assets and capabilities and conduct all necessary upgrades prior to the experiment. The end-user is responsible to add suitable legacy tools to the scenario that can be used either as a benchmark for evaluating new solutions or to evaluate the added value resulting from usage in a more integrated way.

<u>Activity 3: Participating in the execution of experiments</u>

End-users hosted the events at their premises, provided internal communication, logistics, catering and were responsible security aspects. Most of the time, they managed the practical aspects of the experiment execution. They also played the role of their own crisis managers in the scenario and operated the tested solutions during the experiment. End-users also fulfilled a key role in communication and outreach during (and after) the experiments using their own communication channels.

<u>Activity 5: Evaluating the new approaches and/or innovative technologies tested during the experiments</u>

In most experiments, end-users have been involved in the evaluation processes from the start. Depending on their knowledge and experience, end-users contributed to the design of the evaluation framework and in particular to the development of questionnaires (e.g. with respect to operational vocabulary to be used). End-user partners within and outside the DRIVER consortium have participated in the evaluation and review of a number of DRIVER experiments, providing verbal and written feedback which also informed the evaluation design for the JEs.

4.2 Gaps Confirmed by End-Users

The DRIVER experimental activities have addressed several gaps that have been identified as relevant either through previous research or during the course of the project. The feedback received made clear that these should be addressed by new and innovative solutions tested in future DRIVER activities. The following presents CM functions and related gaps, structured according to thematic areas. In addition, trends and developments of special interest as well as key findings related to these gaps from previous experiments are presented. Both will inform the design of further activities in DRIVER.

4.2.1 Crisis Communication

Communication with the public is essential for achieving good outcomes at all stages of the Crisis Management cycle. Before, during and after crisis situations, there is a huge demand to better involve different stakeholders which are not directly involved in crisis response activities. Examples include public education, early warning, and response and recovery information to be shared or collected. To effectively communicate with the public key principles have to be implemented, e.g. with respect to the use of appropriate communication channels.

During the DRIVER experiments a diverse range of end-user organisations and public stakeholders were involved. The end-users confirmed gaps in:

- Implementation of communication theory principles in a work field with limited resources, e.g. taking into account complex inter-agency structures.
- Understanding of the information needs and message impacts for different groups within the broader public.
- Gathering information from citizens and especially from the affected population about the crisis situation (e.g. techniques in social media mining).
- Feedback on the response to warnings / advice and an improved overview of the overall sentiment with a focus on cross-border situations.
- Framing of effective messages prior to incidents, which is a well-developed practice for public health professionals already.
- Updating practices in a rapidly evolving communications landscape.

The following trends and technological changes are of special interest:

- Detailed research on establishing greater clarity on the underpinning principles for effective use of communications with the purpose of achieving greater societal resilience.
- Evolution of the media in the last decade towards a more social, distributed and participative medium which enables a direct channel to people: Human-in-the-loop solutions, social media applications, internet of things and sensors to be used together with big data pattern analytics and complex event processors, layered triggers and decisions to be integrated in a public warning and alerting system (pre-crisis, but also post-crisis).
- Uncover conflicting or unverified information from different agencies or targeted misinformation from third parties.
- Generation and dissemination of information tailored to the preferences and circumstances of the recipients via various channels – and in this addressing the cultural and contextual aspects central to effective communications.

Some of the gaps described above have already been addressed by DRIVER experiments (EXPE35.1, EXPE35.2 EXPE42). The key findings can be summarized as it follows:

- Channels of communication and the cultural contexts were fundamental factors to framing successful communication. No single set of messages or actions can be appropriate through all contexts.
- A simple methodology for framing communications practices and messages is required.
- Training to establish core principles and practices across diverse structures needs to be implemented.
- Accessible tools for the selection of different alerting technologies are considered as an significant improvement to the CM community
- In the process of social media mining, a balance should be found between in-time detection of hazards or imminent escalations on the one hand and false alerting in case of rumours or trolling on the other.

4.2.1 Volunteer Management

Past observations have shown that during crisis and disaster situations as well as their aftermath, individuals and groups that are eager to help will converge on the site of the incident. The actions of these unaffiliated, spontaneous volunteers have the potential to support relief efforts but also to adversely affect them. Therefore, the management of these volunteers is an important aspect in crisis and disaster management.

Two workshops were held as part of the EXP36.1 and EXP36.2 with end-users (from the Austrian Red Cross and from German CM organisations and authorities) in preparation of the field trials. The workshop confirmed an overall need for further solutions in volunteer management, with the most urgent gaps related to:

- Registration of large numbers of volunteers on site
- Categorization of types of volunteers with respect to specific skills, expertise etc.
- Assignment of volunteers to tasks (including identification of volunteer-able tasks)

- Appropriate training of volunteers to ensure an efficient and sufficient joint work.
- Communication with emergent, grassroots volunteer groups in a structured manner
- Safety of volunteers
- Capturing volunteer data for analysis

During the workshops it was agreed that solutions addressing these gaps are required to work without extensive ICT infrastructure, should be fast to set up, and should be easy to use. Thereby the following solutions are of special interest:

- Cloud platform/services and mobile applications for providing an easy, barrier-free and instant information exchange for the management of (spontaneous) volunteers
- GUI-concepts close to commonly used product

Some of the gaps discussed above were addressed by the two solutions that are fielded in the experiments of EXPE36.1 and EXPE36.2 – the Volunteer Reception Centre (VRC) and crowdtasking. To determine these tool's suitability several workshops (in the case of VRC) and field trials (in the case of crowdtasking) where conducted, which have shown that:

- Crowdtasking is considered for the following functions by end-users (volunteer managers of relief organisations): reconnaissance, preparedness, arranging commodity donations and organising volunteers for shifts. The concept of crowdtasking was especially well received when used for reconnaissance in the field.
- Volunteer satisfaction with crowdtasking depends strongly on a regular supply of tasks and/or of status updates to reduce idle times.
- VRC is considered as a possible way of funnelling, registering, training and staging spontaneous volunteers close to the deployment site. Running a VRC can prevent un-intended counteraction to crisis-management operations.

4.2.1 Tasking and Resource Management

During the response to a crisis event different actors are involved including Command Posts/Operation Centres at different levels. Once a crisis event is triggered, an efficient management should start with clear knowledge and understanding of available staff, the type of missions so that they can execute and their capabilities, location, restrictions/limitations and other information linked to the capacity mapping concept. In addition, they are required to assign a set of organized missions and to confirm the availability and initiation to end-users. The end-users in turn need to report the fulfilment and performance of the mission so that the Operation Centre can monitor the status of both the mission and the practitioners (including its position). The interaction with practitioners during the experiments showed that they request solutions that support their work in such a demanding environment. Key gaps identified are related to:

- Provision of near real time situational information to the operation centres about the staff in the field and their perception of the crisis situation.

- Provision of near real time progress information to the operation centres about the on-going and planned tasks.
- Coordination and cooperation between CM agencies and different countries involved in a crisis event.
- Pooling and sharing of staff between agencies and/or nations.

The Emergency Management Shared Information (EMSI) Standard to exchange information between deployed Command Posts simulating different agencies and countries to deal with a crisis event was successfully tested in EXPE43. The following key findings can be summarized:

The Emergency Management Shared Information (EMSI) Standard to exchange information between deployed Command Posts simulating different agencies and countries to deal with a crisis event was successfully tested in EXPE43. The key findings are summarized in the following:

- Tracking of mobile resources by Global Navigation Satellite System (GNSS), identification of the best possible route to the final destination, and real-time information about progress of assigned missions were successfully tested.
- The use of a Test-bed to simulate some resources allows for experiments and exercises to incorporate complex environments in which the use of a full set of real resources would have been extremely demanding.
- Improvements were achieved regarding technical and functional aspects that have been required by the practitioners involved in the experiments (e.g.: adaptations to GUI).

4.2.2 Early Warning Capabilities

Early warning systems and procedures aim to improve the preparedness, and thereby the responsiveness of national authorities to crisis situations. Therefore, the task of early warning components is to provide alerts related to impending and evolving dangerous situations as well as near-real time assessment of their impacts. In the context of an integrated pan-European system, the harmonization of systems is required to improve the interoperability between and inside the member states. Intra-national and international cooperation is hampered by the lack of common approaches. For example, an important aspect of early warning awareness is related to remote sensing: yet not all areas related to Europe are equipped with sensor grids sufficient to provide the required awareness. The Mediterranean Sea area (including the Black Sea) and the North-Eastern part of the Atlantic Ocean is still in the need of a complete sea-level measurement sensor grid in order to allow providing the required amount of data for characterizing the behavior of the basin.

The conducted experiments preparation in DRIVER showed that the end-users see gaps related to:

- Capability of authorities to deal with early warning information and the translation of complex scientific information into operational language of authorities.
- Distribution of disaster warnings.
- Collaboration between several agencies involved.

Trends and developments of special interest are:

- A paradigm shift from a hazard-based early warning to an impact-based early warning.
- Integrated solutions that require less coordination effort by the operators and integrate systems into one single platform (CIS, Common Information Space).
- Standards developments (data formats and protocols)
- Faster post-processing of information from forecasting models.

EXPE35.3, EXPE45 and EXPE45, which addresses these gaps, have not performed but substantial pre-discussions with end-users have been held and have enabled the definition of key gaps.

4.2.3 Understanding Specific Crisis Dynamics

One basic challenge encountered by crisis managers is the flow of information related to a crisis. The right amount and aggregation of details and the proper combination with other information is necessary to create an understanding of the situation and its potential further development. For this purpose, awareness system and direct observations need to be complemented by:

- Knowledge about the area affected (population, vulnerability, capabilities …),
- Past disaster knowledge base and related lessons learnt,
- News related to the area, the event, or both (digested by media monitoring tools, for instance),
- Outputs from models and forecasting systems of the phenomenon itself or ancillary information (e.g. weather forecasting added to an evacuation model in case of an impending nuclear event).

An important gap that was identified is the way to exploit the content of social media to understand crisis dynamics. In some cases, social media provides a prompter awareness of the situation. E.g. from the description and the approximated location of cloud tweets it was possible to assess qualitatively an earthquake in Turkey well before the seismographic grid.

EXPE45 and EXPE53.3 intended to address this gap but the experiments remain to be conducted.

4.2.4 Understanding the Relief Effort as a Whole

To make the right decision, an incident commander or crisis manager needs first a current and comprehensive understanding of the risks faced, the resources available and any other factors that may influence a decision (e.g. the wind direction). Sharing this situational awareness within the own organisation (from field level to regional, national and EU level) and with all agencies involved (e.g. fire services, health emergency services, police) is crucial to enable a coordinated response. The Common Operational Picture (COP) can be described as an approach to collect and summarise information and to make information immediately available for all involved parties. Solutions supporting shared situation awareness are currently on their way to maturity and practical usability. But implementing a COP approach is a process, which has to be managed as a major change in the organization and in conjunction with other organisations. It requires time, communication, and training.

EXPE41 helped to initiate a change process towards a Common Operational Picture approach. The COP approach enabled the sharing of a better quality of information, and the usability of the proposed solutions has been positively evaluated. Some new gaps related to the following areas appeared as stronger priorities after the experiment:

- Sharing information with other organizations through the COP
- Adopting a standardized representation of information
- Adapting the level of detail of situational information depending on the level of hierarchy of the stakeholder
- Including social media aspects
- Supporting multi-linguist approach (menus and daybook)

4.2.5 Demand and Need Assessment

The integration of resource management systems within the awareness systems creates the means to follow the crisis dynamics and to refine the Crisis Management effort, optimizing the resource allocation, thus improving the effectiveness of the resources.

EXPE46 intended to address this gap but the experiment has not been performed yet. EXPE40 and EXPE44 addressed it and showed that an overview of the affected area with detailed information about the kind of damage, the affected infrastructures (transport infrastructure, buildings…) as well as the evolution of damage is still of high relevance for end-users.

4.2.6 Inter-Agency Information Sharing

The response to a crisis event usually requires the involvement of different bodies. This collaboration and interoperability will have to take into consideration the different territorial levels (from local to trans-national), the different types of agencies (e.g. fire-brigades, civil security, public health, police) and the different levels of command (operational, tactical and strategic) which may be involved in an EU crisis scenario. The access to accurate information is one of the most valuable assets in such a demanding situation and it is clear that due to different reasons (e.g.: type of sensors or communication means) not all the bodies can have the same information and the situational awareness could be improved through the definition of appropriate channels for sharing such information. On the other hand, it has to be remarked that the type and amount of information needed is different depending on the role that each one of the bodies is playing. Moreover, if unnecessary data is provided or if information is not displayed in a user friendly way the operator may become overwhelmed due to the stressful conditions encountered in a crisis scenario.

The interaction with practitioners during the experiments showed that they are requesting solutions that could support their work in such a demanding environment. Key gaps identified are related to:

- Common operational network to benefit from real-time and non-real-time data and to share reliable information among the agencies.
- Provision of the required bandwidth and wireless devices for practitioners on the field.
- Procedures and tools for information sharing between agencies.
- Filtering of specific relevant information for each agency.

- Information analysis capabilities.
- User friendliness of the interfaces to reduce the cognitive load of the operator.

EXPE43 and EXPE45 included the exchange of information between different agencies and even between different countries cooperating on a crisis response. The Common Information Space concept (SP4 Architecture WP42) was used to connect systems achieving technical interoperability. The amount of information exchanged showed the potential of supporting end-users. But it was raised to invent mechanisms to facilitate the work of the practitioners in terms of automatic analysis, filtering and enhanced user interfaces. Key findings are related to required improvements in the fields of:

- Context-based information sharing schemes.
- Map-available information standards.
- Additional technical tools to support inter-agency information sharing: dissemination support tools, information gateways, wrappers, accessible repositories and other means.
- Suitable training with respect to information sharing practices and tools.

4.2.7 Efficient Ways to Gather Data from First Responders

In general, the process of acquiring remote sensing information will significantly benefit from additional data, e.g. gathered by first responders deployed in the field. These data can be used to enrich the Common Operational Picture, thus allowing a better coordination of activities in the field. Apart from the technical challenges, any solution is required to be compliant with the existing procedures in order to increase its chances to be accepted by the end-users and offer significant advantages for the daily work.

The experiment preparation showed that the end-users see gaps related to:

- The design of systems/procedures for collection relevant information including priorities
- Products or systems for an efficient management of data collected during the CM.
- Solutions that automatically gather relevant data and assist in structuring these.
- Mobile solutions should be available for commonly used devices (mainly Android based) to ease the distribution and to allow the users to use their own devices (BYOD).

Trends and developments in the following areas are of special interest:

- Virtual reality can be a way to test the solutions and to train the operators in a wider range of situations with a reduced logistic effort.
- Multiplatform development environment can be addressed to develop more diffused mobile solutions.

EXPE46 intended to address this need but has not been performed yet.

4.2.8 Transport and Logistics Management

The transportation system is a crucial infrastructure and is of outstanding importance for the mobility of relief forces and the supply of personnel and goods. However, the transportation system is often first to collapse in a crisis situation. This in turn affects professional responders, who depend on functioning and reliable transport infrastructures to e.g. reach corresponding action places, to ensure evacuation or to provide the affected population as well as logistics planning with goods and services. Logistics planning approaches promise to address complex and dynamic decision problems by providing decision makers with a set of solutions and allowing them to select the best alternative based on their experience and perception of operations.

The discussions and experiments with Crisis Management practitioners, THW amongst others, showed end-users requesting a logistics and transport framework that will assist decision makers in identifying, preparing and reacting coherently to future and emerging threats including the elaboration of recommendation actions regarding logistics and transport tasks. Technical innovations should support operators in order to improve certain preparedness and management tasks before and during crisis. Key aspects related to this are:

- Up-to-date situational awareness on logistics setups, traffic situations and affected infrastructure,
- Forecasts of risks and emerging crisis situations (in order to improve preparedness),
- Provision of effective route planning,
- Supply chain risk management,
- Improvement of resource allocation,
- Provision of up-to-date information in near-real time.

After two years of DRIVER, additional gaps were identified that are related to

- Supporting collaborative logistics tasks (within and between organizations),
- Integrated transport planning (such assignment and compilation of teams or convoy scheduling),
- Location planning (in the affected areas, such as accommodation facilities for volunteers),
- Management of special transports (e.g. cold chains or rescue dogs).

EXPE44 addressed some needs described above. Although solutions covered relevant demands before and during Crisis Management, end-users requested an integration of the involved transport and logistics with other solutions. The integration of solutions into one graphical user interface (GUI) including automatic data synchronization in real operation would be a huge benefit from the end-user's perspective. Additionally, improvements regarding technical and functional aspects are required to provide and guarantee more reliable and feasible solutions (e.g. mobile version).

4.2.9 Analytic Support to Capacity Building

Capacity building denotes the preparatory process of assessing what numbers of resources of different kinds are needed for the various tasks of disaster management, how they should be organised in terms of roles and responsibilities, whether they should be centrally or locally owned, and other issues related to the overall creation of disaster management capacity.

There is a fairly mature capacity building process within the Member States and on the EU-level, but there are weaknesses pertaining to exceptional events demanding a higher number of resources and requiring deeper levels of cooperation between agencies and countries to achieve pooling and sharing of resources. Additionally, it would be desirable to improve the coherence between Member States, for example within risk assessment.

EXPE43a integrated some solutions that took advantage of Business Process Modelling to define a cross-organizational collaborative behaviour to set up the overall interactions required to solve the crisis event. This model provided good results for capacity building for single problems involving an isolated agency, but has provided best results when collaboration is required between agencies and/or Member States.

4.2.10 Capability and Capacity Mapping

Capacity mapping denotes the knowledge and understanding of the capabilities and capacities of the organisations involved. This includes information on assets, tasks, objectives, constraints, budget, logistics and competencies. One of the main issues related to this is to find a common language for describing capabilities, as well as finding processes for keeping capability catalogues up-to-date. Another main issue is to be able to follow the missions being performed by the organisations during the response phase in order to have almost real time knowledge of the capacity which is in use and the still available capacity. This information is required to the next required tasks and to avoid potential cascading effects.

The interaction with end-users during the experiments showed that gaps related to the following are still considered relevant:

- Categorization of required tasks to deal with a specific crisis type.
- Categorization of required resources to deal with a specific crisis type.
- Mapping between those tasks and resources.
- Solutions supporting the efficient monitoring of the capacity in use and the capacity still available to commit to any new missions required during the response phase.
- Improving the user friendliness of the interfaces by trying to reduce in the mean cognitive load of the operator (including filters and automatic analysis tools).

Experiment 43b took advantage of Emergency Management Shared Information (EMSI) ISO Standard. The standard attempts to keep a balance between being general enough to allow all types of missions and resources and providing a sufficient level of detail, if it is required. Additionally, the standard is able to track from organizations to single resources (e.g. helicopter, hospital bed). Some difficulties were found when dealing with different levels of granularity or for providing accurate data to describe the capability of a certain resource (e.g. number of evacuees that can be carried by a helicopter).

4.2.11 Sharing and Implementing Lessons and Best Practices

Although the necessity of lessons learnt in Crisis Management is widely recognised, there are surprisingly few examples of well-functioning processes for the collection, analysis, dissemination and implementation of lessons learnt. Such processes would ensure that relevant lessons are identified and made available to different target groups as well as in a wider cross-border/cross-national context.

Based on a number of DRIVER interviews, workshops and other events with Crisis Management practitioners there were several of issues repeatedly mentioned as crucial in terms of lessons learnt Framework for cross-sector and cross-border cooperation. Those are as follows:

- Language barrier issue – how should the language barrier be addressed? What language should be used in order to maintain effective communication?
- Structural inadequacy – how should lessons and best practices be classified in terms of different organizational structures in different European regions and countries?
- Lack of common taxonomy – given different organizational structure and workflows, classification of lessons, observations and experiences becomes vital issue. How should lessons be tagged in order to meet end-users and practitioners learning needs?
- Lack of common understanding of best practice principles and standardisation – ensuring that a diverse CM community can quickly and effectively interact.
- Need of authentication – all the information and knowledge, which is supposed to be implemented in Crisis Management should be thoroughly reviewed and the adequacy should be confirmed. Crisis Management knowledge can sometimes be highly sensitive. Thus extensive review process should be implemented;
- Lack of organizational learning culture – in vast majority of the analysed organizations structured knowledge sharing is often limited. Influencing the workflow processes of a long-established organization can be a challenging and time-consuming task. The learning process needs to be developed and adaptable to local context.
- Completeness of the information – it is of crucial importance to ensure the completeness of the information. If crisis manager is not able to fully verify the information provided, or even contact the information provider, the willingness of using the knowledge will be highly limited.

Furthermore technical solutions for learning processes should be highly intuitive in order to enable user to use it on irregular basis.

EXPE35.1 and EXPE35.2 have provided end-user input to framing methods for ensuring a common understanding of best practice principles in communication. Discussions with practitioners in DRIVER EXPE52, 53 and 55 and trials of two selected lessons learnt tools in EXPE43 enabled the project to identify key gaps related to the following for the crisis managers in terms of "Lessons Learnt Framework" and its associated tools:

- Taxonomy for gathering knowledge (lessons learnt, best practices) commonly verified and implemented

- **Verification of provided information;**
- **Sharing of information with its counterparts;**
- **User-friendliness and intuitive use of the tools**
- **Contacting information provider**

5 Conclusion and Recommendations

This section concludes the findings from the preceding sections and gives detailed recommendations for the continuation of DRIVER project with respect to the general project structure, methodology and future activities that should be conducted to address CM challenges.

5.1 Project Structure & Concept

The DRIVER project involves a novel approach and scale. Following 2 years of significant activity there is a broad range of learning which can inform a more effective concept and structure for the project.

Several issues can be attributed to the structure of the project itself and the organisation of work that was often not sufficiently transparent and defined. A more stringent approach to coordination is required to establish and implement common guidelines and processes and to overcome all arising problems of technical and organisational nature.

Trialling and evaluating solutions in experiments is the key activity of the project and within the current structure seven subprojects contribute to this with different tasks. It is therefore recommended to submit an amendment request that restructures the project and reduces the number of subprojects, while at the same time the amendment should better formalise the different roles and responsibilities within the experimental activities. The number of subprojects should be reduced to five, having three subprojects dealing with the Test-bed, CM Solutions and Trials and two additional subprojects for Project Management and Dissemination. In addition, stronger coordination is required to steer all experimental activities along the same lines and to ensure a certain quality. The proposed structure is outlined in the current version of the DRIVER project handbook (Bastos, 2017).

Furthermore, the project would benefit from a more strengthened involvement of the participating end-user organisations. The past periods have shown that not all end-user organisations are capable of taking a leading role, while others have provided invaluable support to specific experiments and in voicing the end-users needs to the consortium. It is recommended to give such capable end-user organisations a more leading and visible role within the project and to exploit their knowledge especially to improve the involvement of all end-user organisations within the project. An early systematic involvement could have ensured better designed and realistic experiments along with successful results, also in order to address the real needs in a pan-European Crisis Management. In that context, it is recommended to put more time and effort into the selection of solutions and to establish a step-by-step approach that allows the end-users to better interact with solution providers and solutions already in the early phases of experiment design and planning. The minimum target should be to match the most suitable solutions to the platforms and to derive detailed requirements from end-users. Enough time should be planned, so that solutions providers can adapt solutions in accordance with the end-user requirements. Besides, a solely demonstration of the capabilities of

DRIVER solutions should be avoided rather their operational benefits for end-users on different management levels should be displayed. Furthermore, experts, end-users and solution providers from outside the DRIVER consortium should be involved through a dedicated work package also providing financial means to allow for active contributions. Solution providers external to the project will be invited to describe and offer their solutions to the trial owners to ensure the demonstration activities are conducted by taking into account the (technological) state of the art. Project external experts and end-users will contribute with specific expertise and knowledge which ensures the relevance of the trial designs, the added value of the selected solutions and the accuracy and the validity of the evaluation results.

5.2 Methodology

The underlying methodological approach that is followed by the project is known as *Concept Development & Experimentation* (CD&E) and originates from the military domain.[3] CD&E defines a way to develop new concepts, by experiencing the challenges, developing and evaluating the new concept in a realistic setting before expensive resources are being acquired or before organisational changes are being implemented. CD&E is a creative process where a concept is developed through brainstorming, evaluation sessions and analyses combined with input from experiments.

DRIVER project aims to adapt and adjust the CD&E process to the CM domain in general and the Test-bed in particular. More specifically, the CD&E approach is used as a method that will support the evaluation of new solutions. Starting with small cases, the solution requirements increase through a higher complexity of the test cases, e.g. by adding more CM organizations, extending the period of relief operations or considering cascading effects.

It is strongly believed that adapting the CD&E approach to the CM domain is a promising way to achieve the objectives of DRIVER project in improving the capability development in CM, identification of promising solitions and creating a more shared understanding of CM across Europe. However, the project has faced several challenges with respect to the methodology in the past as reported in Section 3. Many problems can be attributed to the size and complexity of the project, leading to a sometimes slow interaction between the team working on the methodology and the teams working on the experiments. In the future, more direct involvement of the methodology team with clear assigned responsibilities needs to be mandatory for the development of all trials. At the same time the concepts and foundations of the methodological framework have to be made very clear to all partners and a common roadmap will help the consortium to better focus on the work towards all DRIVER objectives. Better communication, guidance material and trainings will support all partners to focus the experimental work also on testing, validating and updating the DRIVER methodology framework.

Providing better guidance material and training to reach a common understanding of the focus of the experimental work is only one aspect towards successful development and validation of the DRIVER

[3] According to NATO, CD&E is one of the tools enabling the structured development of creative and innovative ideas into viable solutions for capability development

methodology. In addition, stronger technical coordination and supervision is necessary to steer the experimental work into the right direction. Work results and progress need to be systematically monitored and reviewed and detailed plans for upcoming activities have to be developed and approved. This should be done in close coordination between SP Leaders and the technical coordination of the project. Trial owners will be responsible to present the current status and detailed plans for the next steps including the allocation of required tasks and actions to specific owners at every stage. In this way, the roles and responsibilities are defined and agreed among all participants in the beginning of each phase. Technical coordination should also be involved to support handling of specific problems that arise during the preparation and execution of a trial. The technical coordinator will be responsible to freeze and reconsider certain activities, if the progress does not match expectations or parties do not perform as required. Moreover the technical coordinator should ensure the streamlining of processes and activities and work constantly on the establishment of a common language and taxonomy used by all partners during the project.

It is a common agreement among consortium partners that the project has clearly identified and acknowledged the challenges and issues with respect to the development of the methodology and the DRIVER Test-bed. The last months have resulted in a much better understanding of the DRIVER objectives throughout all partners and showed clearly the way ahead. A better understanding of the DRIVER objectives and working more focused towards them as well as stronger supervision and coordination between the different DRIVER areas will be the key to the achievement of the targets.

5.3 Main challenges / Future Activities

The whole CM field is in a period of significant development of both research and practice. DRIVER is seeking to play a role in enabling a substantial step forward in innovation and practice. In total, more than 20 experiments requiring over 60 actions and involving 1750 participants were conducted during the second year. This included approximately more than 650 volunteers (70% affiliated and 30% unaffiliated in average) and 250 professionally trained end-users. Many of the related activities and results were very well perceived by the involved end-users and other stakeholders.

The challenge now is to ensure that the results of this activity are impactfully defined and disseminated and to reflect the many lessons learnt in a revised structure and work programme for the next phase of DRIVER's work.

One of the problems with the design of the Joint Experiments was the ambition to create very complex events addressing several functions at the same time by involving a large number of solutions. In addition, it was expected that the experiment methodology would support the development of evaluation means that could also measure cross-fertilisation effects resulting from a mixed use of technological and non-technological solutions. In the end, end-users did not appreciate the ambition of the Joint Experiments, as the previous experiments had already pushed some of the platforms to their limits due to the large number of involved actors and solutions. However, the areas of interest and certain gaps have been very well expressed by end-users and platform providers.

It is therefore recommended to redefine the Joint Experiments into smaller and more accessible trials which directly address the gaps which were planned within the original Joint Experiment design. These gaps should be updated and the activities within the trials should be further opened up by inviting additional external end-users and solution providers.

Four series of trials should be organized to address multiple CM gaps as defined by end-users and confirmed in the thematic experiments already undertaken.

- The first trial should address the needs related to Cross-Border Tasking and Resource Management, and could be covered by a scenario dealing with cascading effects of a heat wave.
- The second trial should focus on High Level Coordination needs based on a multiple incident scenario (man-made or not).
- The third trial should address Volunteer Management and could be covered by a scenario dealing with a large flooding and/or earthquake.
- The fourth trial should deal with Situation Assessment and Logistics potentially playing a scenario with large-scale flooding and power outage.
- The Final Demonstration could explicitly demonstrate the potential added value of proposed solutions for the EC/ERCC that could be achieved in the various crisis scenarios used in the previous trials addressing these needs.

DRIVER is capable of delivering innovation as it addresses (future) challenges with novel solutions. These solutions are both technological (e.g. common information spaces, deployment of drones, flooding simulation models, using citizens as sensors) and non-technological (e.g. providing psycho-social support, more effective communication with citizens, adapting first responders' ways of working to the available capabilities in a community). In order to select the most appropriate solutions (provided by both current DRIVER partners and external solution providers) to be tested during the trials, a transparent and end-user driven review and selection process of the solutions needs to be designed and applied.

It is recommended to establish a Solution Review Board representing the end-user and trial perspectives. The end-user perspective will cover all relevant Crisis Management bodies (local authorities, emergency services, Red Cross societies, and Non-Governmental Organizations); the trial-owners ensure the relevance of the potential solutions for the planned trial. For the review of DRIVER-internal solutions, the evaluations executed between M1 and M26 have to be compiled and prepared for being checked by the Solution Review Board. External solution providers have to be identified and notified via a call for Applications so they can apply for having their solutions incorporated in the trials. The application conditions need to be aligned with the evaluation requirements for the internal solutions in order to be comparable and prepared to be stored in the Portfolio of Solutions database.

Scenario design is dedicated to the preparation of the most appropriate scenario for the trial enabling to test the main deliveries of DRIVER which are the integrated Test-bed and the evaluated Portfolio of Solutions. The approach should be needs centered on the one hand, and solution driven on the other, as only this implies a strong focus on the weaknesses and strengths of the tested solutions (including the Test-bed itself) related to the end-users' needs. 'Solution-driven' means that the story line of the scenario has to involve crises episodes that directly address specific end-user needs. Furthermore, the scenario must be more directly linked to previous or likely events. It means that the design is based on two main elements: i) past crises, ii) analyses of changing circumstances to take into consideration the phenomena of risk evolutions. Designing scenarios close to reality is also a key requirement for keeping the end-users attention on the Trial for drawing their interest to the CM solutions as tools which potentially could bring a real value to their everyday performance as crises situation manager.

DRIVER should provide an integrated framework for innovation in CM that is designed for bringing together the abilities needed to progress further in building a resilient society: (i) innovation coming from research, (ii) industrial development & system-integration capabilities, (iii) operational knowledge and experience of crisis managers defining the CM requirements, and (iv) (via active participation and appropriate dissemination) the citizen in its different roles (individual, part of a community, public sector, infrastructure provider, media representative, or volunteer) bringing in the perspective of the actual subject of CM. The Test-bed has to provide the opportunity for bringing together the supply and demand side of different MS to iteratively trial and operationalize promising solutions, thereby also identifying research needs. By including end-users and citizens into the trials and thus the development of solutions, the acceptance and effectiveness of new solutions will be improved. In addition, understanding between different first responders of each other's cultures and the understanding of the process of CM among the general public will be fostered. At the end of the day, acceptance by end-users as much as acceptance by the receivers of CM, the European citizen, is key to innovation and, when it comes to CM, to a more resilient and adaptable society.

Finally, that effective innovation and European industrial competitiveness contains a pan-European dimension is very clear to DRIVER. By contributing – mainly via the Portfolio of Solutions and the Test-bed, but also by dedicated mapping and dissemination activities – towards more shared understanding of CM across Europe, DRIVER needs to help Europeanise the European market for CM solutions.

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Annex

This Annex contains the information and the results of the 24 experiments conducted or planned during 2015 and early 2016 (Figure 8). The information has been collected through a common template provided by DRIVER SP6.

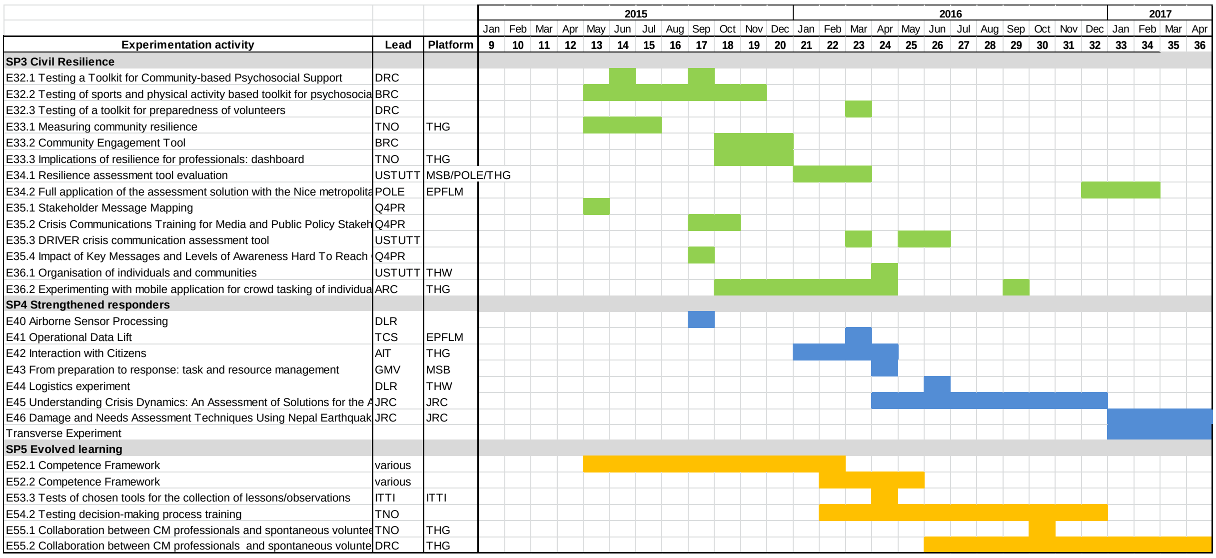

Figure 8: SE2 overview (Status January 2016)

Experiment No. 32.1	EXPE Lead DRC	Platform –	Date Jun/Sep 2015
Experiment name	*Testing a Toolkit for Community-based Psychosocial Support*		**Deliverable** *D32.2*
Involved actors	**DRC technical advisors, MDA staff and volunteers at first responder and field management levels**		
End-user	**MDA staff and volunteers at first responder and field management levels. MDA staff provided knowledge on community based psychosocial support through the cascading model. It allowed the cost effective culturally agile knowledge transfer.**		
Experiment short description	IFRC PS Centre's Toolkit for Community**-based Psychosocial Support has been implemented in a Training of Trainers (ToT) methodology. It was composed of three tiers of trainings (i.e. cascading model) which were conducted with participants (approx. 100 participants) from MDA.**		
Expected end-user benefit	**Improve the effectiveness of the cascading model as a useful method for transferring psychosocial knowledge to volunteers in CM organisations.** **We hypothesize that the cascading model is an effective method to facilitate learning among volunteers and capacitate the volunteers to implement their knowledge in their role as crisis responders.**		
Evaluation approaches and metrics	**Tier 1:** • Reaction after the training, questionnaire measuring participants' **satisfaction with the training** • **Post measurement of the knowledge of participants** • **Focus on group discussion providing qualitative information** • **Follow-up questionnaire 9 months after the training to see, if participants have implemented their knowledge and skills** **Tier 2:** • Reaction after the training, questionnaire measuring participants' **satisfaction with the training** • **Pre and post measurement of the knowledge of participants** • **Focus on group providing qualitative information** • **Semi-structured interview with facilitator after the session** **Tier 3:** • Reaction after the training, questionnaire measuring participants' **satisfaction with the training Focus Group discussion providing qualitative information** • **Semi-structured interview**		

Involved tools	IFRC PS Centre's Toolkit for Community**-based Psychosocial Support,** **http://pscentre.org/topics/training-kit-publications/**
Summary of the results	**Results show that information is retained and effectively transferred to the second and third tiers and trainers feel confident about passing the acquired knowledge to staff and volunteers. More data is currently analysed.**
Lessons learnt	**The process of recruitment of volunteers, especially at tier 3 has been the most challenging aspect of the experiment. In addition, when analysing the semi-structured interviews and the pre and post-tests, language challenges have also emerged.** **The experiment bore promising results. Nevertheless, if the knowledge is not repeated, participants will eventually forget some aspects of the trainings. Thus, it is important to conduct refresher trainings in the future to guarantee the recruitment of information. If follow-up training is not possible, it is important to conduct longer trainings in tier 1. In this way participants can become strong advocates of the program at the National Society level.**
Benefit for CM	**The data is currently analysed.**

Table 2: Experiment 32.1 Testing a Toolkit for community-based psychosocial support

Experiment No. *32.2*	EXPE Lead *BRC*	Platform –	Date *May – Nov 2015*
Experiment name	***Testing of sports and physical activity based toolkit for psychosocial support***		**Deliverable** –
Involved actors	DRC technical advisors, the British Red Cross' branch in Northern Scotland		
End-user	The British Red Cross' branch in Northern Scotland, field levels. Staff provided **knowledge on community based psychosocial support through the cascading model. It allowed the cost effective culturally agile knowledge transfer.**		
Experiment short description	IFRC PS Centre's Toolkit for sports & physical activity based psychosocial **support has been implemented in a Training of Trainers (ToT) methodology. It was composed of two tiers of trainings (i.e. cascading model) which were conducted with participants (approx. 115 participants) from the BRC in Northern Scotland.**		
Expected end-user benefit	**Improved effectiveness of the method of delivery – the cascading model – of the sports and physical activity based toolkit for psychosocial support.** **We expect the results to show the cascading model as an effective method to facilitate learning among volunteers and capacitate the volunteers to implement their knowledge in their role as crisis responders.**		
Evaluation approaches and metrics	**In contrast to EXPE32.1, this experiment tests the second and third tiers of the cascading model.** **Tier 2:** • Reaction after the training, measuring participants' **satisfaction** • **Pre and post-test measurement of the knowledge of participants** • **Focus on group discussion providing qualitative information** • **Semi-structured interview with facilitator after the session** **Tier 3:** • **Reaction after the training, measuring particip**ants' satisfaction • **Focus on group discussion providing qualitative information and semi-structured interview**		
Involved tools	IFRC PS Centre's Toolkit for sports & physical activity based psychosocial **support, http://pscentre.org/topics/moving-together/**		
Summary of the results	**Results show that knowledge is retained and effectively transferred to the third tier and trainers feel confident about passing the acquired knowledge to staff and volunteers. More data is currently analysed.**		
Lessons learnt	**A challenge of this methodology is the loss to follow-up which occurs at tier 3. At the moment, we are not able to tell the number of losses to follow-up since**		

	we are still receiving information from tier 3. However, this will not impact the results of the experiment as we are conducting a qualitative analysis.
Benefit for CM	**The data is currently analysed.**

Table 3: Experiment 32.2 Testing of sports and physical activity based toolkit for psychosocial support

Experiment No. 32.3	EXPE Lead DRC	Platform –	Date March 2016
Experiment name	*Testing of a toolkit for preparedness of volunteers*		**Deliverable** *D32.2*
Involved actors	DRC technical advisors, MDA volunteer managers and supervisors		
End-user	MDA volunteer managers and supervisors, management levels. Needs were collected to plan for and respond to the psychosocial need of volunteers.		
Experiment short description	IFRC PS Centre's Caring for Volunteers Support Toolkit was planned to be tested with volunteer managers and supervisors from MDA during a two-day training conducted by a specialist from the PS Centre.		
Expected end-user benefit	Strengthen the capacity of Red Cross/Red Crescent National Societies in responding to the psychosocial needs of volunteers by testing selected trainings. Improvement of participant's knowledge and skills and with it impacting the organisation, the volunteer management and the relations between the volunteers themselves.		
Evaluation approaches and metrics	Examining participants' response and interest in the training delivered and exploring the potential uses of the training in the field by: 1. Post-test: At the end of the training, conducting a short test to provide ideas of the participants' level of understanding of the topic. 2. Focus Group: A small group of six to 10 participants is expected to take part in the focus group which is estimated to last between 45-60 minutes. A series of open-ended questions were planned to be asked on the use of the training and its impact on the volunteer management within the organisation.		
Involved tools	IFRC PS Centre's Caring for Volunteers Support Toolkit, http://pscentre.org/topics/caring-for-volunteers/		
Summary of the results	The experiment has not yet been conducted.		
Lessons learnt	Recruitment of middle and high level senior managers was difficult. In other interventions, it might be valuable to conduct a rapid training with middle to high level volunteer managers and a longer training with local volunteer managers or supervisors.		
Benefit for CM	The experiment has not yet been conducted.		

Table 4: Experiment 32.3 Testing of a toolkit for preparedness of volunteers

Experiment No. 33.1	EXPE Lead TNO	Platform THG	Date May – Jul 2015
Experiment name	*Measuring community resilience*		Deliverable D33.3
Involved actors	Citizens of The Hague		
End-user	End-users are municipalities and Safety Regions. This study addresses the preparation phase. Professionals need insight into how citizens can be stimulated to prepare for disaster. This study provides insight into the most relevant underlying factors, and as such guidelines on how to best influence citizen behaviour towards preparatory behaviour.		
Experiment short description	We used a questionnaire of Paton (based on his Community Engagement Theory) that measures community resilience at three levels: individual (e.g. situation assessment), community (e.g. social support) and societal (e.g. trust). This questionnaire was administered in The Hague as to predict citizen preparedness.		
Expected end-user benefit	Goal of the experiment was to measure community resilience on the basis of validated indicators. The expected outcome was that community resilience would appear to be a multi-level concept and preparations of citizens can be predicted by resilience indicators. Expected end-user benefit is that it would provide guidelines how to measure community resilience and implications for influencing human behaviour. Success criterion is that indicators are predictive for citizen preparations with regard to flooding.		
Evaluation approaches and metrics	A questionnaire was filled in by about 650 citizens of The Hague. AMOS was used to describe the relations between indicators and preparatory behaviour of citizens.		
Involved tools	The study is prepared together with the platform. No infrastructural updates were required. Citizens are expected to participate in the survey.		
Summary of the results	We had a fitting model that explains preparatory behaviour through indicators at individual and community level. Compared with countries that have experienced large scale disaster (like Australia, New Zealand and Philippines) similar indicators were found. This means that the model is applicable in a European context. 'Affect' appeared to be a more important predictor than in previous studies: citizens who worry more, prepare better.		
Lessons learnt	It is always difficult to get a representative sample. We used an existing panel which is not representative of the population of The Hague, but was easy to access with a high response rate.		
Benefit for CM	Citizens are more and more encouraged to prepare for disaster. This study		

	provides insight into the most predictive underlying psychological mechanisms. For CM this means that interventions will be more effective.

Table 5: Experiment 33.1 Measuring community resilience

Experiment No. 33.2	EXPE Lead BRC	Platform –	Date Oct – Dec 2015
Experiment name	*Community Engagement Tool*		**Deliverable** *D33.2*
Involved actors	**Citizens and facilitator (e.g. Red Cross)**		
End-user	**End-users are municipalities and Safety Regions. This study addresses the preparation phase. Professionals need insight into how communities can be made more aware of their own risks and stimulated to prepare for disaster. This study tests a toolkit (CART) that can be used to increase awareness and preparatory behaviour.**		
Experiment short description	**A community engagement tool was tested in 8 rural and urban communities. The tool was based on an existing tool: CART. It was measured whether awareness and behavioural intention was influenced by a workshop in which the toolkit was applied.**		
Expected end-user benefit	**Goal of the experiment was to measure whether the CART toolkit would increase awareness and preparatory behaviour of rural and urban communities. The expected outcome was that workshops applying the toolkit would have positive effects. Expected end-user benefit is that they have a concrete, validated, tool that can be used to increase community resilience.**		
Evaluation approaches and metrics	**Workshops are held in 8 rural and urban communities. A short questionnaire is administered before and after the workshop (and again after two weeks) to evaluate effects on awareness and behaviour.**		
Involved tools	**CART toolkit**		
Summary of the results	**The workshop increases awareness and more adaptive behaviour, thereby increasing community resilience. The results were stronger for urban than for rural communities.**		
Lessons learnt	**The selection and involvement of communities takes a lot of time. It has to be done very carefully to ensure that communities feel that they have gained benefits from investing their time and effort in the workshop.**		
Benefit for CM	**If citizens are better prepared for disaster they can respond more adaptively to it and recover more quickly. This will reduce human suffering as well as costs.**		

Table 6: Experiment 33.2 Community engagement tool

Experiment No. 33.3	EXPE Lead *TNO*	Platform *THG*	Date *Oct – Dec 2015*
Experiment name	*Implications of resilience for professionals: dashboard*		**Deliverable** *D33.3*
Involved actors	CM professionals		
End-user	End-users are safety professionals at community level. This study explores whether professionals can be supported in taking community resilience into account in responding to disaster. It addresses the preparation phase. To date professionals are not trained to take resilience into account when dealing with disaster. The dashboard provides insight into vulnerability and capabilities supporting professionals in selecting strategies that utilises community resilience.		
Experiment short description	We have designed a dashboard on the basis of relevant indicators for community resilience. In several focus groups we have discussed the relevance of knowing a community's level of resilience and implications for professional procedures.		
Expected end-user benefit	Goal of the study was to explore the functionalities of the dashboard to optimally utilise community resilience. The expected outcome was that professionals would become more aware of the capacities in communities that could be used for Crisis Management. Expected end-user benefit is increased awareness of possibilities to utilise existing capacities of communities to better and quicker respond to disaster.		
Evaluation approaches and metrics	Evaluation is based on subjective judgments of experienced professionals in Crisis Management.		
Involved tools	A dashboard was designed showing vulnerability and capacities of a selected community.		
Summary of the results	Through the dashboard we could visualize the vulnerability and capabilities of communities in The Hague. The main functionality seems to be the identification of key persons in social networks. The usability of the dashboard is highly dependent on the quality of the data. It is preferred to use data from existing databases (but often at relatively high level (neighbourhood) and not all resilience indicators are currently measured). It is also suggested to explore whether data collection could be done by communities themselves (and use the dashboard as part of a wider platform for supporting communities in increasing resilience).		
Lessons learnt	It is difficult to ensure that the data in the dashboard is up-to-date, easily		

	accessible and that there is an owner who feels responsible for updating it. Professionals see the relevance of the concept but feel insecure relying on it (reliability of the data).
Benefit for CM	**When professionals would be aware of the potential of capacities in communities and be able to utilise it, Crisis Management would be more efficient, it would empower communities and reduce time and costs.**

Table 7: Experiment 33.3 Implications of resilience for professionals: dashboard

Experiment No. 34.1	EXPE Lead USTUTT	Platform MSB/Safe Cluster/THG	Date Jan – April 2016
Experiment name	*Resilience assessment tool evaluation*		**Deliverable** *D34.2*
Involved actors	Local Government Officials / City Actors		
End-user	Non Crisis Management professionals but persons involved in Crisis Management activities due to their profession in other fields • Political decision makers • City planners • Responsible of local civil institutions • All other public actors implicated in city resilience.		
Experiment short description	Test a DRIVER local government resilience assessment method for Crisis Management, evaluating the functionality and applicability of the method. The experiments aimed at evaluating the utility of the solution, the relevance of the performance model and efficiency of the different questions.		
Expected end-user benefit	*Experiment 1 Revinge and Experiment 2 Cannes:* It should promote a culture of resilience with creating a common understanding of cities actors about resilience to disasters and promote the identification of gaps. Success criteria were to receive feedback from a set of representative stakeholders on the solution and with it allowing the enhancement of the solution. *Experiment 3 The Hague:* Due to external and project-related circumstances it was not possible to receive feedback from the DRIVER platform The Hague.		
Evaluation approaches and metrics	• Operational evaluation – qualitatively within the workshop discussion round • Impact evaluation – qualitatively with a questionnaire		
Involved tools	No tools involved		
Summary of the results	*Experiment 1 – Revinge*: The experiment was evaluating the WP34 solution. It aimed to characterise and further develop the utility of the solution. It was also taken into account that subsequent experiments have to be conducted with one city in order to be able to check the process of discussion between different actors. *Experiment 2 – Cannes*: Based on the knowledge of Revinge, it was aimed at evaluating and enhancing the utility and feasibility of the solution as well. The tool needed to focus on realistic and minor actions on short term, in order to keep the people proactive. Therefore, the importance of distinguishing short-		

	time resilience and long-term resilience was highlighted. In contrast to Revinge, the participants were interested in involving other stakeholders of local resilience city. The capacity of mapping these actors at the pre-diagnosis phase was emphasised as interesting output. Experiment 3 – The Hague: Due to external and project-related circumstances it was not possible to receive feedback from the DRIVER platform The Hague yet.
Lessons learnt	*Experiment 1 Revinge:* Preparation and conduction of the experiment was good and the cooperation with the MSB DRIVER platform was perfect. The heterogeneity of the participants allowed having different perspectives on the solution. On the one hand, different cities of different areas were represented; impacts of the type of the city (size, rural, non-rural) on the perception of the characteristics of the solution can be deduced from the results. On the other hand, the perception of the different actors of the same city on different topics couldn't be assessed. Different lessons were immediately implemented. Other experiments have to be conducted with one city in order to be able to check the process of discussion between different actors of the same city on resilience topics. The key principles of the workshop program were kept with some adjustments in order to consider specific objectives of the experiments. A refinement of the questionnaires has been made in order to consider the lessons learnt from the experiment and the enhanced version of the questionnaire was later on sent to the participants of the workshop. The gathered feedback and the derived new version were used in the subsequent experiments. *Experiment 2 Cannes* In general, the experiment was well designed, organised and well perceived by the local actors. The perception of the group around the table showed some positive effects as well as negative effects. The iterative dialogue was fruitful even though too many questions remained unanswered and were not observed because a medium-sized French city is not competent on each and every field addressed. While encompassing the necessary flexibility to accommodate national diversity, the mapping of the relevant actors characterised by function on territorial resilience would be a powerful deliverable per se to identify the circulation of the information and the interdependencies between all the stakeholders. Specific and bilateral interviews would allow compiling additional information from each actor. At the end of the process, a general meeting would allow to cross-check and share information and create a community of objectives toward resilience. Currently there is no such general meeting planned, nonetheless the participants will be informed about the progress of

	the solution and will receive an updated version whenever it is possible and suitable. *Experiment 3 The Hague:* **Due to external and project-related circumstances it was not possible to receive feedback from the DRIVER platform The Hague.**
Benefit for CM	**According to the general experimentation design EXPE34.1, as first set of experiments of WP34, tries to reach the following two main test goals:** • **Test the usability of the DRIVER assessment methodology (operational evaluation).** • **Key-Questions: Can the targeted end-users and assessment participants perform the method as intended? Are the selected indicators adequate? Are the provided technological support tools adequate?** • **Evaluate the assessment tools impact (Impact evaluation).** • **Key Question: Are the end-users and participants of the assessment method empowered to improve the local resilience? Do they have a better/common understanding of existing gaps and problems?** • **Additionally the first experiments are intended to provide knowledge in the context of experiment and evaluation design for the upcoming experiments.**

Table 8: Experiment 34.1 Resilience assessment tool evaluation

Experiment No. 34.2	EXPE Lead USTUTT	Platform MSB/Safe Cluster/THG	Date Jan – April 2016
Experiment name	*Resilience assessment tool evaluation*		Deliverable D34.2
Involved actors	Local Government Officials / City Actors		
End-user	Non Crisis Management professionals but persons involved in CM activities due to their profession in other fields: • Political decision makers • City planners • Responsible of local civil institutions • All other public actors implicated in city resilience.		
Experiment short description	Second test of the DRIVER local government resilience assessment method for CM, further evaluating the functionality and applicability of the method. Following EXPE34.1 (on-going) which was to test some parts of the DRIVER local government resilience assessment method for Crisis Management with different cities, EXPE34.2 was to consist in the full implementation of the method with one city (either Nice or another city in Côte d'Azur area). The workshop was foreseen to consist of a table-top exercise (over several days), following the methodology provided within the DRIVER local governance resilience assessment tool (D34.1, D34.2). All attendees were meant to be asked to answer a set of thematic questions regarding the local resilience towards crisis situations, agreeing on common predefined answers options. By that the group step by step was to generate a common understanding of the local resilience status.		
Expected end-user benefit	Promote a culture of resilience with creating a common understanding of cities actors about resilience to disasters and promote the identification of gaps.		
Evaluation approaches and metrics	This is not yet set. However, it is most likely that mostly qualitative evaluation methods were meant to be applied (operational evaluation during the workshop discussion round and impact evaluation through a questionnaire).		
Involved tools	POLE (managing the participation of the city applying the method)		
Summary of the results	Not performed yet		
Lessons learnt	Not performed yet		
Benefit for CM	Not performed yet		

Table 9: Experiment 34.2 Full application of the assessment solution with the Nice metropolitan area

Experiment No. *E350.1*	EXPE Lead *Q4PR*	Platform –	Date *May-Oct 2015*
Experiment name	*Stakeholder Message Mapping*		Deliverable *D350.1*
Involved actors	Members of the Public divided into distinct stakeholder groups		
End-user	• All end-users who communicate with public • Strategic and operational communications • Preparation of effective information, messages and channels of communication for different groups • Easily replicable methodology for framing effective communications with distinct stakeholder groups		
Experiment short description	Based on significant advanced preparation of information, structured focus groups.		
Expected end-user benefit	Core goal is to produce an easily replicable (low expertise, cost and time impact) methodology to address need to prepare appropriate information, frame effective messaging and identify channels of communication. Expected outcome is an accessible guide to implementing the methodology. The end-user benefit is ability to address core gap in communications practice of lack of detailed advance preparation of messages, information and channels of communication appropriate to distinct stakeholder groups. Success will be experiment which identifies distinct information needs, message components and means of communicating with individuals within distinct groups.		
Evaluation approaches and metrics	Participant contributions to a series of structured focus groups will be analysed in each of the three areas (information needs, message impact and channels). This will identify common and distinct findings for different groups. Approach will follow broader and more time intensive methodology commonly used in field of public health.		
Involved tools	Tool of Stakeholder Message Mapping. Tool is open source based.		
Summary of the results	The initial summary is: • Approach was very successful in identifying distinct communication elements between different stakeholder groups and within specific groups • Desk research on set scenario allowed definition of general approach, but public feedback essential to communications impact • 7 groups, IE & DE (45 total participants)		
Lessons learnt	• Cooperation with relevant public health authorities ensured effective design of scenario and potential messages • Participants not recruited through specialist company, therefore larger		

	challenge, but saved significant resources • Minor payment for expenses essential to ensure broad participation • Necessary to adapt approach to diverse groups (including people with disabilities, non-nationals and older people)
Benefit for CM	• Full evaluation in M27 deliverable • Tool very effective in providing low-cost and specialist expertise results to shape communications at each stage of CM cycle • Tool has capacity to help deliver major theory to practice gap in framing communications practices before, during and after events

Table 10: Experiment 35.1 Stakeholder message mapping

Experiment No. *E350.2*	EXPE Lead *Q4PR*	Platform –	Date *June-Dec 2015*
Experiment name	*Training in Communication for Civil Society Resilience for senior personnel in public sector*		**Deliverable** *D350.2*
Involved actors	**Senior personnel in national organisations responsible for major emergencies.**		
End-user	• **All end-users who communicate with public** • **Strategic and operational communications** • **Ensuring ability to implement best practice principles across regional/national levels** • **Easily adaptable methodology for training in basic of principles and best practices in communications at all stages of CM cycle**		
Experiment short description	**Short expert training in principles and best practices in communication before, during and after an event.**		
Expected end-user benefit	**Short, accessible training course in communications which can be delivered without commitment of major time and financial resources. In particular, ability to ensure common principles and practices across multi-actor regional or national levels. This helps to address a core theory-to-practice gap and the low level of communications expertise available within many organisations. Current courses often involve what is viewed by non-specialist communications personnel as excessive time commitment.**		
Evaluation approaches and metrics	**Anonymous evaluation by participants allowing for quantitative and qualitative feedback. Usefulness to organisation, own role etc. to be measured. Course developed through iterative process with national crisis coordination centre.**		
Involved tools	**Tool of training course. Tool is open source based.**		
Summary of the results	**Initial summary is:** • **Course rated highly by participants** • **Of use even to those in communications role for lengthy period and who have attended other courses** • **2 groups hosted in National Emergency Coordination Centre in Dublin. All organisations participating in national-level crisis coordination structure participated. 2nd group held while national flooding emergency was underway**		
Lessons learnt	• **Development of course in cooperation with agencies crucial to impact** • **Contacting participants in advance to ask for requests for material to be covered improved impact** • **Senior personnel participate in course when it does not require too much time from them (course was ½ day and viewed as appropriate**		

	introduction)
Benefit for CM	• **Tool very effective in providing shared basic understanding or principles and best practices**

Table 11: Experiment 35.2 Training in communication for Civil Society Resilience for senior personnel in public sector

Experiment No. *35.3/350.3*	EXPE Lead *USTUTT*	Platform –	Date *March 2016, May – Jun 2016*
Experiment name	*DRIVER crisis communication assessment tool (2 rounds)*		**Deliverable** *D35.3/D350.3*
Involved actors	• representatives of different NGO's in the field of **Crisis Management** • **administrations** • **crisis managers (preferable, if such a role exists within the organisation)** • **crisis communication experts**		
End-user	• **NGOs in the field of Crisis Management** • **Administrations in the field of Crisis Management** • **Responsible authorities for crisis communication**		
Experiment short description	**Test a DRIVER crisis communication assessment tool to reflect and evaluate the functionality and applicability of the communication strategy.**		
Expected end-user benefit	**According to the general experimentation design EXPE35.3, as first round of the experiment of T35.3, tries to achieve following:** • **Understand needs and problems in the existing crisis communication guidelines and scorecards** • **Find out which alerting tools are used and how: benefits and problems** • **Check what are specific challenges in the alerting phase (response)** **The second round of experiments of T35.3 tries to reach the following two main test goals:** • **Test the usability of the DRIVER assessment tool (operational evaluation).** • **Can the assessment participants apply the tool as intended? Are the selected indicators adequate?** • Evaluate the assessment tool's impact (impact evaluation). • **Are the end-users and participants of the assessment tool empowered to improve their crisis communication? Do they have a common understanding of existing gaps and problems?** **Expected end-user benefit:** **Support representatives of NGOs, administrators and responsible authorities to reflect on previous crisis communication approaches and to prepare and execute an appropriate crisis communication strategy in current/future crisis situations.** **Success criteria:** **Value-add for end-users to prepare and execute an appropriate crisis communication strategy in event of crisis**		
Evaluation	**Operational and impact evaluation – qualitatively within the workshop**		

approaches and metrics	**discussion round**
Involved tools	**no tools involved**
Summary of the results	**Experiments not yet performed**
Lessons learnt	**Experiments not yet performed**
Benefit for CM	**Experiments not yet performed**

Table 12: Experiment 35.3 DRIVER crisis communication assessment tool (2 round)

Experiment No. *360.1*	**EXPE Lead** USTUTT	**Platform** *tbc*	**Date** *tbc*
Experiment name	*Organisation of individuals and communities*		**Deliverable** *D36.2*
Involved actors	Responders and civilians (actors) organised by the platform		
End-user	• Tbd, e.g. responding organisations such as red cross societies, fire brigades • operational level (bronze) and tactical level (silver) • steering and integration of spontaneous volunteers (SV)		
Experiment short description	Test concepts for integration of volunteer communities outside CM & individual spontaneous volunteers into CM		
Expected end-user benefit	• Compare preparedness and response phase based organisation concepts (I. Team Österreich) with response phase based organisation concepts (II. Volunteer Reception Center) for engaging volunteer communities outside CM and individual spontaneous volunteers to assist the response. • Preparedness concepts need lots of effort for maintenance volunteer pool. Influence of culture is dependent • Tested and more-less ready to use concepts for volunteer management • Success, if concepts show their specific advantages.		
Evaluation approaches and metrics	Set of quantitative measures (KPA/KPI) and qualitative methods such as interviews, structured interviews aftermath the experiments. Series of workshops with different responder organizations		
Involved tools	Several tools (more concepts) for managing SVs • Team Österreich, ARC • Volunteer Reception Centre, FEMA		
Summary of the results	Not performed yet		
Lessons learnt	Not performed yet		
Benefit for CM	Set of tools for spontaneous volunteer management		

Table 13: Experiment 360.1 Organisation of individuals and communities

Experiment No. 36.2	EXPE Lead AIT	Platform ARC/AIT	Date February 2016
Experiment name	Crowdtasking of volunteers		Deliverable D36.3
Experiment short description	As part of the EXPE36.2 experimentation campaign to test the acceptance and functionality of crowdtasking as a solution for involving untrained volunteers in Crisis Management, we use initial exploratory workshops for developing our working hypotheses and conduct two experiments: in a) Vienna and b) The Hague. The experiments are constructed such that they provide a simulated reality for, both, coordinators and volunteers, in which the proposed solution can be tested.		
Goals and expected outcomes	The overall goal is to test in how far the crowdtasking concept can be used to engage people with no prior history of volunteerism. More specifically the aim is to: • Evaluate what role crowdtasking can play in volunteer management with respect to the types of tasks and the Crisis Management lifecycle • Find the parameters that are most influential for the acceptance of tasks. • Evaluate the usability and workflow of the CrowdTasker application. On a broader scale the aim is to contextualize the role of IT supported volunteer management and to find out which role it can play in European Crisis Management systems with different degrees of voluntarism.		
Evaluation approaches and metrics	Set of quantitative measures e.g. by evaluation of download, registration and activation statistics (How many people download the app?, register for an account, accept the activation and execute at least one task, participant drop-out between downloading, registration, activation and task execution) and evaluation of the responses to an in-build online questionnaire to rate the task's difficulty and the acceptance. Additionally, qualitative measures in the form of interviews and observation of the volunteers are performed ("Think Aloud" method).		
Scenario description	Originally, it was foreseen to consider a scenario of a simulated crisis event with exhausted refugees arriving in different cities in Austria, who require assistance in the form of warm clothing and food. Due to the involvement of ARC personnel in the actual migration crisis in autumn/winter 2015/16, it was not possible to put this into practice. As an alternative, we used a more flexible approach in which typical tasks for different crisis situations were tested with volunteers acting on the streets at different locations in Austria and Germany.		
Involved tools	CrowdTasker, LifeX COP		
Involved	Corporate volunteers, pre-organised volunteers, volunteer coordinators from		

actors/participants	CM organisations, observers from DRIVER
Platform involvement	Please state the following information • Organisation of participants, both, coordinators and volunteers • Hosting the event (catering, etc.) • Development of a scenario description for the experiment
Running the experiment	• Exploratory workshop with volunteer coordinators for exploring the potential of crowdtasking in CM (December 2015, Vienna) • Technical tests (as part of EXPE 42, November 2015, Vienna) • Experiment in Feb 2016 in Vienna with corporate volunteers and Austrian Red Cross volunteer coordinators + observers from the Bavarian Red Cross and the platform in The Hague • Experiment in Apr 2016 in The Hague with the associated platform
Involvement of the supporting SPs	SP2 for reviewing the experimental setup and the methodological approach applied (Chiara Fiono); SP8 for ensuring ethical and privacy compliance issues (Marielle Kaufmann, Stine Bergs); SP1 and SP7 for supporting our dissemination activities (internally and externally)
Summary of the results	• The field test has yielded a great amount of data to be analysed, both qualitatively and quantitatively. Altogether, 748 micro-tasks were executed by volunteers and the results sent back to us. Observation of the command and control room has yielded approximately five hours of video material. An additional four hours of audio and video material is comprised of group discussions. A content analysis of this material is currently being conducted. • Feedback regarding the overall approach of CrowdTasker was positive. The majority of participants that had taken an active part in the field test stated to have had fun working with the crowdtasking tools. Red Cross affiliates opined that crowdtasking has great potential and provided numerous ideas for future development. After a fast review, observers from Fraunhofer IAO tentatively concluded that CrowdTasker features an acceptable level of usability with a SUS-Score of 70/100 (Brooke, 1996).
Problems and Lessons learnt	Apart from direct feedback regarding crowdtasking and CrowdTasker, observing experienced professionals doing their work during the field test also yielded valuable insights into organisational aspects, like division of labour and roles, when dealing with CrowdTasker – not only for us, who conducted the experiment, but also for participants from the Red Cross. Several stated that these two days gave them new impulses for organisational development and volunteer management. Main lessons learnt are: • The user interface of the CrowdTasker is user-friendly, but the workflow for tasking volunteers needs to be simplified. • Templates of typical task descriptions would make the tasking process

	more efficient. • Recruiting new volunteers via Facebook was more efficient than traditional attempts, e.g. via email.
Conclusions for the JE preparation	The experiment triggered fruitful discussions and considerations about the role of volunteers in a crisis situation, and a vivant experience exchange between the professionals with responsibility for volunteer management. This aspect will be of great relevance for transferring the experiments outcomes into a wider, European context with different volunteering cultures.

Table 14: Experiment 36.2 Crowdtasking of volunteers

Experiment No. 40	EXPE Lead DLR	Platform –	Date Sep 2015
Experiment name	*Airborne Sensor Processing*		**Deliverable** D430.22
Involved actors	DLR (19 persons from four DLR institutes) THW (1 end-user/observer) POLE (1 observer) Volunteers (DLRG, students)		
End-user	THW as end-user from in-field to regional organisational activities is interested in an advantage over paper maps as used in current practice to e.g. identify field deposits. A more accurate traffic situation to dispatch units is desirable.		
Experiment short description	The experiment validated a system for aerial image gathering and processing to support situation assessment and rescue planning by: • Aerial image assessment of a large area • Detection of people in need • Traffic assessment and management • Post-processed 3D products of a crisis area		
Expected end-user benefit	The aim of the experiment is to integrate the different ground-based and airborne systems for Aerial Sensor Processing and validate the systems' efficiency, feasibility and safety in the context of CM. The experiment provides situational data on a crisis area in reduced time and thus is able to support second responders effectively in the planning of rescue tasks. Experiment 40 showed a benefit by giving real-time aerial images of the crisis situation and a more detailed traffic situation of surrounding infrastructure.		
Evaluation approaches and metrics	The objectives of Experiment 40 are designed in line with E-OCVM. According to E-OCVM it can be assigned to V2 phase. For each scenario step of the experiment a set of objectives, success criteria, indicators and metrics have been defined to evaluate the experiment's success. The metrics include not only quantitative, but also qualitative data collection.		
Involved tools	• RPV D-CODE, DLR • 3K Camera System, DLR • U-Fly, DLR • SUMO, DLR • EmerT, DLR • KeepOperational, DLR • ZKI-Portal, DLR		
Summary of the	All success criteria of the targeted objectives were fulfilled to a medium to high		

results	extent. Furthermore, the various functionalities of the task Airborne Sensor Processing were demonstrated: aerial image assessment of a large area, detection of people in need, traffic assessment and management, and post-processed 3D products of a crisis area. Data was collected both qualitatively and quantitatively by questionnaires, data logging, and debriefing. Feedback during and after experiment execution was collected by questionnaires for pilots and second responders. Overall safety, impact of the system, feasibility, and other indicators could be rated, and free-text allowed for suggested improvements or identified limitations.
Lessons learnt	• Experiment design should include all involved partners from the very beginning, to make sure that no requirement is missing. • Dissemination effort was considerable. • Participation of experiment leaders was declared beneficial for upcoming experiments. • The status of supporting SPs at the time of Experiment 40 execution was not advanced enough to draw profit, and no support was requested.
Benefit for CM	• RPV D-CODE + 3K Camera System + U-Fly: A large area can be assessed in a short amount of time, and the decision-making process in CM could be significantly improved. • SUMO/EmerT/KeepMoving: Data are based on more than one data source, and the provided traffic information is mainly based on real-time measurements without historical or model-based components; thereby the provided traffic information is more reliable. • ZKI-Portal: Aerial imagery and derived surface models provide valuable and high quality data sources for the creation of advanced 3D information products, such as video animations and 3D-PDFs, allowing an interactive approach for the inspection of the impacted areas. CM end-users had a great benefit of the provided solutions with regard to situation awareness, monitoring and information gathering in CM.

Table 15: Experiment 40 Airborne sensor processing

<table>
<tr><td>Experiment No.
41</td><td>EXPE Lead
TNO</td><td>Platform
MSB</td><td>Date
May 2016</td></tr>
<tr><td>Awareness training</td><td colspan="2">Collaboration between CM professionals and spontaneous volunteers (response phase)</td><td>Deliverable
D550.2</td></tr>
<tr><td>Involved actors</td><td colspan="3">TCS, as experiment leader, SP2 supporting tools Point of Contact and tool provider (Large Event), FRQ as tool provider (Life-X COP), EPLFM as hosting platform, end-user, and tool provider (Asphodèle), POLE as end-user, MSB as end-user, tool provider (Lupp) and evaluator, JRC as tool provider (Crisis Wall), SP2 methodological Point of Contact, end-user and evaluator, FhG IAO as evaluator (regarding the usability)
Evaluators from Norfolk fire service (UK), North Rhein Westphalia fire service / State Fire Service Institute (Germany), CESS - Centre for European Security Strategies (Germany) partner of Ecossian FP7 project.
ESM (XVR simulator)
In total (including end-users see below) 40 people participated in the EXPE41.</td></tr>
<tr><td>End-user</td><td colspan="3">12 professional players 7 end-users organisations
• EPLFM-(Valabre), EMIZ (Zonal Headquarter), BMPP (Paris fire brigade), BMPM (Marseille fire brigade), SDIS 13 (Bouches du Rhone fire brigade), SDIS 83 (Var fire brigade), Police Nationale where acting as end-users during the experiment
• All levels were played: field level (BMPM), département level (SDIS), zonal level (EMIZ) and national level for France and Sweden as well as EU level (JRC). National levels organisation were played by département level end-users organisations
The challenge is to achieved a shared situation awareness by improving the vertical and horizontal dissemination of crisis related information in a complex cross border crisis</td></tr>
<tr><td>Experiment short description</td><td colspan="3">The experiment is comparing the way information is disseminated in a vertical and cross border chain of command with:
• the current solution - a chain of Command and Control (C2) systems including the Synergi legacy tool of the Ministry of Interior-
• with a DRIVER solution which consists in a chain of interoperating Command and Control systems including a Common Operational Picture (COP) tool which is implemented by:
a) the Thales Large Event tool
b) the Life-X COP by Frequentis.
The crisis scenario: a forest fire with cascading effect - chemical risk on a nearby village is played on the Valabre simulator (CESIR). It is played three times: once</td></tr>
</table>

	with solution 1, once with solution 2) a) and once with solution 2) b). **The benefits of the various are compared.** **N.B: a Common Operational Picture approach consists in integrating in a common situation awareness tool the information coming from various organisations involved in a crisis, and share this situation with them.**
Expected end-user benefit	• **to improve the shared situation awareness process, by improving the dissemination of information, the quality of information that is shared, and minimizing the effort required to share this information.** • **to help EPLFM (Valabre) to define methods and tools for the evaluation and validation/certification of information systems for civil protection based on their XVR simulator. This new usage is seen as a potential business model for the CESIR Centre Euro-méditerranéen de Simulation des Risques)** **The success criteria of EXPE41 are the following:** • **Is the COP functionality actually delivered by the solution?** • **Does the experiment set-up enable to measure the potential benefit of the COP approach?** • **Does it bring the expected operational benefits: is information better dissemination, faster, with a lesser effort?** • **Is the experiment a learning experience for all particpants?**
Evaluation approaches and metrics	**The evaluation is based on quantitative and qualitative information collecting.** **The quantitative evaluation aims at assessing the actual dissemination of information all through the vertical and cross border chain of command. This is assessed by tracking the information related to five turning points of the scenario, and measuring the time and quality of the information that is available to each organisation of this chain of command. This measure uses the logs of the C2 systems.** **The qualitative information aims at assessing the usability of the solution (and tools) its potential impacts (in terms of information management, organisation), the validity of the experiment set-up, credibility of the scenario, and interest of the experiment.** **This qualitative information has been collected by questionnaires distributed immediately after the experiment, and a few weeks after the experiment. Two hot wash-up debriefing sessions were organised, first with players, then with observers and evaluators.**
Involved tools	**The involved C2 tools were:** • **Large Event by Thales** • **Life-X COP by Frequentis** • **Asphodèle by EPLFM (valabre) (legacy operational tool)**

	• Lupp by MSB (legacy operational tool) • CESIR simulator by Valabre (and ESM (XVR)) (legacy operational tool) • Crisis Wall by JRC A short description of these tools can be found in D43.51 - Shared Situation. Awareness. (p15-17). More extensive descriptions will be provided in EXE41 experimentation report (D430.52). Usability assessment methodology: (used by FhG IAO): • Brooke, John. "SUS-A quick and dirty usability scale." Usability evaluation in industry 189.194 (1996): 4-7.
Summary of the results	• The COP functionality was delivered, and enabled an easier sharing of information (requiring less interactions), provided better quality information, and was faster for the cross border dimension • The usability of both COP tools has been judged as good by players. • Professional players and evaluators are satisfied by the EXPE41 and are interested in participating in subsequent experiments • EPLFM (Valabre) is satisfied by the experiment which confirmed the potential use of the CESIR simulator for the assessment of new tools or procedure • The following data have been collected: application logs (logging dated messages and dated creation of information in the COP), usability questionnaires for COP tools, feedback during the hot wash up meetings with players, and with evaluators. Questionnaire on the results of the experiment • A cold wash-up workshop is planned and an associated questionnaire relative to the type of information to be shared has been prepared The analysis of all these data will be presented in the EXPE41 report (D430.52.)
Lessons learnt	• Both Legacy field C2 had very little ability to exchange information. Specific adaptations had to be made, which enhanced the tools. • A multi-incident scenario would be interesting for a next iteration of the experiment, for the pressure it would put on the information flow and decision makers. • The information in the COP shall be presented with a level of detail that is adapted to the level of command (the higher the level the more aggregated the info). • The opportunity that was given to evaluators to interact with players was much appreciated (by both players and evaluators). • The current version of the methodology did not provide much support concerning the evaluation methods and the specific needs of IT based experiments. Some practical steps performed in EXPE41 and other SP4 experiments are seen as potential improvements of the methodology

	(e.g: technical rehearsal, operational rehearsal and, feedback workshop). • Hot wash up focus group and questionnaires would have benefited from social science related expertise. This is seen as a necessary improvement for next experiments. • The evaluation method which consists in tracking a specific piece of information corresponding to a turning point of the scenario has been validated by observers as relevant to this experiment. Yet, more directions, methods or tools to perform this task would ease the task of "live" evaluators. • The language of the experiment was mentioned as an issue for foreign evaluators.
Benefit for CM	• COP approach is validated as beneficial. • Benefit of semantic interoperability (and information standards) is highlighted • Experiment process has been well received by platform and end-users. • EPLFM (Valabre) has validated a new usage of the CESIR simulator (for the assessment of solutions or procedures). • Both COP tools are validated as promising. • General outcome for EC: a step beyond towards a more integrated CM.

Table 16: Collaboration between CM professionals and spontaneous volunteers (response phase)

Experiment No. 42 (36.2)	EXPE Lead AIT	Platform THG	Date Jan – Apr 2016
Experiment name	*Interaction with Citizens*		Deliverable D43.42
Involved actors	**CM professionals, affiliated and spontaneous volunteers**		

End-user	• **CM professionals, first responders**
	• **All phases of the Crisis Management cycle**
	End-users benefit from the tested tools, since they are facilitated to use citizens as auxiliary resources in order to improve their understanding of the situation. The addressed gaps are:
	• **Gap 1. Inform & involve society via Crisis communication**
	  ○ **Flows of validated, balanced information to the public**
	• **Gap 3. Volunteer management**
	  ○ **Co-ordination (tasking) of unaffiliated volunteers**
	• **Gap 4. Early warning capabilities**
	  ○ **Dissemination of disaster alerts**
	• **Gap 10. Acquisition of information from external sources**
	  ○ **Getting information from the public about the crisis situation and the reactions on warnings (citizens as a sensor)**
	  ○ **Information where and what kind of help is needed**		

Experiment short description	**EXPE42 (together with EXPE 36.2) is defined a series of smaller experiments** that culminate in the "urban coastal flooding" scenario where all tools and **methodologies involved in T4.3 and T3.6 are tested in parallel. These experiments aim to evaluate the usability and value of methods and tools for the interaction of professional responders with citizens and to explore the capabilities of the tools to integrate in the DRIVER system of systems for the Joint Experiments and beyond.** **The main functions to be tested are:** • **context-aware(*) and timely informing of the different sectors of society over various channels, in order to improve their understanding of the crisis situation and minimize the adverse impacts;** • **context-aware (micro-)tasking of the volunteers(+) to perform real and virtual tasks;** • **efficient gathering of the information about the situation from the volunteers; and** • **using of the information received from the volunteers to improve the situation awareness of the crisis managers and consequently their handling of the crisis**		

	(*) Context is defined by combination of the users profile, position, situation on ground and needs of the crisis managers. **(+) In** EXPE42 context, the term "volunteers" is used to emphasise the active **role of the citizens in Crisis Management. It does not imply affiliation with some organisation of first responders.**
Expected end-user benefit	**The overall goal of EXPE42 (+EXPE36.2) is to test the concepts and applications for context-aware informing and context-aware tasking of volunteers as well as to evaluate the value of these activities for both citizens and crisis managers.** **The underlying hypotheses behind the experiments are that modern ICT technology can be used to improve the societal resilience by facilitating the communication with the citizens. More specifically, we believe that this is true for the solution proposed in this experiment.** **On the one hand, the citizens can profit from context-aware communication by adjusting their behaviour, resulting in a more resilient society. On the other hand, the crisis managers can use the citizens as auxiliary resources and improve their understanding of the situation.** **Additional hypotheses are: (1) that this can be achieved without overwhelming the crisis managers; and (2) that tested methodologies and tools are complementary rather than overlapping.** **The experiment could be considered fully successful if all involved tools work perfectly and both the volunteers and the crisis managers are fully satisfied. This goal is unlikely to be met.**
Evaluation approaches and metrics	**In the first experiment during the IPRED IV in Tel Aviv, we have been collecting data from the volunteers and from the MDA staff in charge of crowdtasking through questionnaires and only for the CrowdTasker tool. The full evaluation approaches and metrics will be defined in cooperation with the SP2 team and will be based on the lessons learnt of this first experiment.**
Involved tools and Test-bed/platform	• **3020 LifeX COP, Frequentis (COP solution 1)** • **CrowdTasker, AIT (tasking solution)** • **csWeb, TNO (COP solution 2)** • **DEWS, ATOS (alerting/informing solution)** • **GDACS mobile, WWU (VGA solution)** • **MEGO, HKV (flood prediction)** • **SafeTrip, HKV (alerting/informing app solution for tourists)**
Summary of the results	**With two of the three planned experiments finalized, we have managed to collect valuable feedback on use and usability of the crowdtasking for the professional crisis managers from Israel (MDA) and from Austria (ARC).** **In the first experiment, only a small number of volunteers (approx. 15) were involved and the main feedback from the volunteers was on the technical**

	shortcomings of the tools. The second experiment in Vienna involved over 200 volunteers and mainly concentrated on experimenting with different types of the tasks and learning which task types are more or less appropriate for the unaffiliated volunteers as well as learning how to define appropriate scenario(s) and how to present the data collected from the volunteers to the crisis managers.
Lessons learnt	• Crowdtasking is a promising method with high appeal to both the volunteers and the professionals. • Experiment participants appreciated the automated "tutorial" functionality for new users of the app and the MDA experts considered the tasking interface adequate and easy to use. • Crowd manager do not have enough time to formulate the information and tasks during the exercise. The number and variety of available templates was too low. Possibility to request reoccurring tasks is missing. • Prevalence of iPhone owners from US on the IPRED conference has limited the number of volunteers among the conference participants. • Some of the app functionality, most notably event popups, has failed at some of the Android phone models. • The feedback forms for collecting the information from app and backend users were proven adequate and will be used in the future experiments with slight improvements. • Collection of app user feedback over the app itself worked, but the data could not be analysed. This was a key functional shortcoming of the crowdtasking solution consisting of AIT CrowdTasker and the FRQ COP solution
Outcomes / Benefit for CM	The Crisis Management professionals stated the usefulness of the crowdtasking approach and the CrowdTasker solution in order to coordinate unaffiliated volunteers in crisis events. Since the last experiment, involving all mentioned tools, will only be conducted in April, there are no outcomes with respect to the other tools.

Table 17: Experiment 42 (36.2) Interaction with Citizens

Experiment No. 43	EXPE Lead GMV	Platform MSB/ITTI	Date Apr 2016
Experiment name	*From preparation to response: tasking and resource management*		**Deliverable** D44.12, D44.22
Involved actors	GMV, ITTI, MSB, GMV Sistemas, ARMINES, EDI, FOI, TNO and XVR. More than 60 members of the DRIVER team were involved directly in the experiment.		
End-user	Sweden: Swedish Armed Forces, the Coastal Guard and the Swedish Maritime Agency, Swedish Migration Agency, Police Authority, Regional Health Services (Region Skåne), Blekinge Rescue Services and Ystad Municipality. Poland: Government Centre for Security, Crisis Information Centre (division of Space Research Centre), Sea Search and Rescue Service from Gdynia, Warmińsko-Mazurskie Voivodship Office in Olsztyn, Voivodship Police Headquarters Post in Olsztyn, Police Headquarters in Olsztyn, Voivodship Fire Service Headquarters Post in Olsztyn, Poviat Fire Service Headquarters Post in Elbląg, Municipal Fire Service Post in Gdańsk, Municipal Fire Service Post in Olsztyn, Voivodship Emergency Medical Services Post in Olsztyn, Helicopter Emergency Medical Service, Military Police Elbląg Division, Polish Red Cross, Great Orchestra of Christmas Charity, Polish Scouting and Guiding Association, National Defence University, Polish Naval Academy. More than 40 end-users were involved directly in the experiment.		
Experiment short description	EXPE43 is focused on the tasking and management of resources during preparation (EXPE43a) and response (EXPE43b) phases, including cross-border cooperation and information sharing between agencies and countries. The main CM functions that are relevant for this experiment are: EXP43a: • Analytic support to capacity building. • Capability and capacity mapping. EXP43b: • Tasking and resource management. • Inter-agency information sharing including cross border coordination.		
Expected end-user benefit	EXP43a: • Goal 1: Integrate a set of solutions to increase the efficiency and effectiveness of Preparation Phase in a multi-partners CM situation. • Expected outcome: Model a cross-organizational collaborative behaviour to set up the overall interactions to solve the crisis. • Expected end-user benefit: Sharing common objectives across heterogeneous entities. • Success criteria: Interaction between entities/number of total required		

	resources. • Goal 2: Simulate the crisis event, running an interactive decision-making training game. • Expected outcome: Model of the Crisis event and its dynamics. • Expected end-user benefit: Training users to react efficiently. • Success criteria: Assessment of the proposed collaborative behaviour and its potential consequences. EXP43b: • Goal 1: Integrate a set of solutions in different Coordination Centres involved in a Crisis Management Operation. • Expected outcome: Improve alignment of information between Coordination Centres. • Expected end-user benefit: Improve multinational/multiagency cooperation. • Success criteria: Amount of Information exchanged between the Coordination Centres. • Goal 2: Execute a multi-site (multinational) experiment taking advantage of the Test-bed functionalities. • Expected outcome: Multisite experiment including simulation support. • Expected end-user benefit: Resources not need to be present in a single location and simulated ones not need to take part during the exercise. • Success criteria: Number of simulated resources/number of sites.
Evaluation approaches and metrics	An evaluation framework was set up including four different areas: • IT Solution/Tools perspective. • Test-bed/infrastructure perspective. • Simulation perspective. • CM Actors perspective. Observations were collected from players, evaluators and observers including interviews, discussion sessions and questionnaires.
Involved tools	SP4 Tools: • Socrates Suite, GMV • ESS, GMV Sistemas • IO-DA, ARMINES • PROCEED, ITTI • PROTECT, EDI • SITRA, FOI • LUPP, MSB Test-bed (SP2) tools: • Net Scene, FOI • Resource Management Node, TNO

	• XVR, XVR
Summary of the results	**Coordinated experiment between two different platforms and three different locations: MSB located in Revinge and Sandö (Sweden), and the Eastern European Platform in Gdynia Naval Academy (Poland).** **Interoperability achieved between 16 instances of 10 different IT solutions.** **The Common Information Space concept (SP4 Architecture WP42) used to connect systems in 7 different Command Centres located in Gdynia (Poland) and Revinge (Sweden).** **Emergency Management Shared Information (EMSI) standard used for the technical information exchange showed is utility and some required/desired adaptations have been assessed.** **Around 4000 messages that were broadcasted to the seven different Command Posts.** **More than 2000 observations have been collected.**
Lessons learnt	**Practitioners are not accustomed to this kind of experimentation but they are more used to exercising, demonstration and training.** **Practitioners are not used to work with IT solutions and with data communications but they do work with voice (telephone/radio) communications.** **In some cases, the practitioners and the technical operators did not share a common language and so translation was required.** **Additional support from Game Conduction: visual time line displaying when key information and decisions taken are expected.** **As the experiment could be stopped, additional breaks provided opportunities to explain results of input provided by end-users.**
Benefit for CM	**The field of experimentation was found relevant.** **The scenario helped end-users to get a scene setter and get involved.** **This type of experiment and development activities gave a lot of new possibilities for Crisis Management organisations to explore and develop new capabilities and procedures.** **Experiment enhanced understanding on how future distributed exercises could be organised, including a hosting Test-bed (national or international).** **Test-beds allowed carrying out a variety of different activities ranging from experiments, training, exercises, technical integration, etc.** **Visualisation/simulation tools showed new ways of conducting distributed trainings.** **Ground Truth simulation created a great feeling of reality for participants.** Added to the DRIVER aim "Better understanding of Crisis Manageme**nt in**

	Europe", knowing other participating organisation (national and cross**-border) and their working methods.**

Table 18: Experiment 43 From preparation to response: tasking and resource management

Experiment No. 44	EXPE Lead *DLR*	Platform *THW*	Date *March 2016*
Experiment name	*Transport and Logistics Support*		Deliverable *D440.4*
Involved actors	• DLR with several Institutes as experiment leader and solutions provider • Münster University (WWU) as solution provider • THW as platform provider and host		
End-user	All professional responders who depend on transport and logistics related tasks or interested in efficient and strategic transport and logistics management support (like THW, ARC, fire fighters). The solutions address mainly tasks in the preparedness and response phase. Thereby mainly needs in the logistics are addressed.		
Experiment short description	EXPE44 deals with different logistics and transport management related topics that are related to the performance of the relief chain design, planning, and execution as well as the strategic transport and efficient routing. The combination of one scenario: flood in the city of Magdeburg, the network of one relief organization: THW, and the supply of different types of (relief) goods/persons (like sandbags, food, and volunteer units) could be used to test several configurations. The experiment was executed as a 3-day table top exercise at the THW platform where a series of simulated use cases performed by THW volunteers. Goals: • Comparing the performance of crisis managers with/without tool-suite • Demonstrating tool-suite functionalities and asses their benefits • Gaining experiences and identification of further gaps Expected outcome: • A transport management tool suite that will assist decision makers in managing efficiently the required rescue logistics and the nearby traffic flow • A logistics framework that will assist decision makers in identifying and reacting coherently to future and emerging threats and crisis situations Success Criteria: • Improved routes for logistics validated by DLR's tools • Storage and resources provision based on simulation and validation with WWU tools		
Expected end-user benefit	The experiment aims to highlight and illustrate the benefits of the logistic and traffic management tool-suite during the preparedness and response phase for crisis managers. Expected end-user benefits are: • Providing more reliable information for transport and logistics related		

	tasks • Data driven decision support helping the practitioners in exercises and in real crisis situations to utilize transport and logistics potential for decision making or instructions
Evaluation approaches and metrics	Quality benchmark in terms of questionnaires from • volunteers involved in the experiment (THW staff), • internal observers who observe how the volunteers deal with the tool Evaluation categories will be among others usability, feasibility and benefit. Quantitative benchmark in terms of comparing the results of volunteers with/without tool-suite regarding e.g. time, results, efficiency.
Involved tools	• HumLog, WWU • KeepOperational (including EmerT and SUMO functions), DLR • U-Fly/3K, DLR • ZKI-Portal, DLR
Summary of the results	All in all, the experiment was seen as a success: • THW volunteers see the provided solutions as a suitable solution for transport and logistics demands in Crisis Management. • All proposed solution functionalities were demonstrated and validated by the volunteers. • Solutions meet THW needs although special trainings to instruct the usage of the system are suggested. • THW pointed out that not all functionalities are useful for THW but would be useful for other responders. However, some improvements regarding technical and functional aspects are required to provide and guarantee more reliable and feasible solutions. According to the experiment results two main criteria must be met, in order to state the solutions as useful tools in CM: • The solutions are only useful in specific situations e.g. rural area, nationwide operations and a wide range of available (routing) alternatives. • For an efficient usage of the solutions, experienced operators are needed. A combination of all solutions is very appealing, because three areas could be covered: situational awareness, logistic and transport. The best way would be a common operational platform.
Lessons learnt	• Consider the application field of the solutions to ensure a suitable and successful contribution of all involved partners in the experiment. • Volunteers were unfamiliar with the kind of provided solutions. Therefore, some form of training/ briefing/ instruction was required. • Keep focusing on a maximum of three main topics. Otherwise scenario is not realizable.

	• Simulating a real crisis is reasonable and should be repeated in order to e.g. ensure realistic conditions, data and extent. It could be added by fictional cascading events. • Preparation workshops, frequent conference calls and regular agreements with involved participants help to facilitate a common understanding of the experiment and scenario design and ensure platform availability and availability of participants & volunteers. • At least one rehearsal should be included in the preparation phase of an experiment to guarantee a satisfactory experiment.
Benefit for CM	It was stated by the practitioners that the proposed solutions are beneficial for the THW volunteers regarding certain conditions: • performing operation in unknown areas • performing tasks with considerably calculation effort • performing nationwide operations • performing complex tasks with many alternative decision choices HumLog: Provides a multimethod simulation environment evaluating different scenarios and network settings. (strategic level) KeepOperational: Provides route options for emergency vehicles by considering current traffic and spontaneous road closing, provides a traffic prediction & simulation and displays an evacuation scenario.(strategical or operational level) ZKI-Portal: Provides 2-D and interactive 3-D emergency map products and video animations for situational awareness, support damage and needs assessment and to facilitate decision making processes. (strategical or operational level)

Table 19: Experiment 44 Transport and Logistics Support

Experiment No. 45	EXPE Lead JRC	Platform JRC	Date Mar – Oct 2016
Experiment name	*Understanding Crisis Dynamics: An Assessment of Solutions for the Analysis of a Crisis from Early Warning to Recovery Phase*		**Deliverable** *D43.32*

Involved actors	ATOS, GMV, FOI, AKV, FREQUENTIS, THALES, JRC, MSB
End-user	The tight collaboration with the ERCC led JRC thinking mainly of it and its tasks, but since they are the same of Member States National Civil Protections, the scope is quite wide. The main activity of ERCC is the international coordination of Humanitarian Aids; therefore, it needs evaluating the situation present and foreseen. All means to improve the COP are of interest.
Experiment short description	This experiment aims at assessing the use of tools during the analysis of events leading to a potential crisis. This involves using existing legacy systems; therefore, the JRC platform European Crisis Management Laboratory (ECML) was foreseen to be used, since it is already acting as a backend of the ERCC. Some of the tools are already available in the DRIVER project. The tools that concurring to the CM process were to improve the capacity to exploit the existing systems, heading toward a closer integration. It is therefore necessary to evaluate the results in terms of the aggregated products of the tool provided to a later stage of the CM process. The value of the analysis is in fact the enrichment of the information together with the extraction of the more relevant information to assist the decision making process.
Expected end-user benefit	The common aim is to produce a valuable solution evaluation (e.g. reports, graphical interfaces, alert messages) and to take informed decisions on the basis of the report produced. Goal(s) of the experiment • Solutions benchmarking Main Hypothesis and research questions • The tools improve the capacity to exploit existing systems; • The tools improve Decision Making in Crisis Management; • The tools improve information sharing and flow. Gaps addressed by the experiment • Early warning capabilities • Inter-agency information sharing • Understanding specific crisis dynamics • Acquisition of information from external sources

Evaluation approaches and metrics	The evaluation of tools was foreseen to be carried out following a qualitative-quantitative approach. On one hand a parametrical evaluation were to be carried out considering five main categories: Interoperability, Usability, Availability, Maintenance (MRO), Flexibility, and the related sub-categories. On the other end, an "open-ended" strategy should be used as a first approach to the evaluation, in order to cope with the different natures of the tools.
Involved tools	• COP, FRQ • GMV, SOCRATES • ATOS, DEWS • FOI, SITRA • HKV, DASHBOARD • MSB, RIB
Summary of the results	The experiment was not performed.
Lessons learnt	Evaluating in a coherent way such a differentiate spectrum of tools requires a significant effort to develop an abstraction of evaluating criteria.
Benefit for CM	The experiment was not performed.

Table 20: Experiment 45 Understanding crisis dynamics: An Assessment of Solutions for the Analysis of a Crisis from Early Warning to Recovery Phase

Experiment No. 46	EXPE Lead *JRC*	Platform *JRC*	Date *Nov 16 – Feb 17*
Experiment name	***Damage and Needs Assessment Techniques Using Nepal Earthquake 2015***		Deliverable *D43.12*
Involved actors	**FRQ, TNO, EDI, ITTI, FOI, EUSC, MSB, MDA, POLE, ARC, DLR**		
End-user			
Experiment short description	**The experiments will be performed within a defined scenario where 3 or 4 different methods/techniques for needs assessments were foreseen to be used:** • **remote sensing (e.g. damage assessment);** • **social/standard media monitoring;** • **on the field assessment.** **The integration of these different information sources would lead to an effective damage and needs assessment.** **The experiment was to deal with a very early needs assessment, in the early hours or days of the crisis. The needs assessment was to be done by professionals like Civil Protection analysts and UN specialists. It was meant to be done in a pre-agreed format, comparing the resulting needs assessment with pre-established quantitative and qualitative criteria.** **These three different techniques for Damage assessment could lead to a better understanding of crisis, in terms of damages and needs.**		
Expected end-user benefit	**Goal(s) of the experiment:** • **Gather empirical evidence on different approaches** • **Multiple survey services coordination** • **Damages assessment** • **Need assessment** • **Evaluation of consistency of outcomes** **Main Hypothesis and research questions:** • **Is one particular source/technology/data collection technique more accurate than another?** • Are they providing additional information that another can't provide wi**th the same speed, cost or quality?** • **What is the combined value of all used together rather than individually?** **Gaps addressed by the experiment:** • **Early warning capabilities** • **Demand and needs assessment** • **Acquisition of information from external sources**		

	• Efficient ways to gather data from first responders
	Success Criteria:
	• Need to perform functionally in the following ways:
	  ○ To coordinate the participants for the entire experiment duration,
	  ○ To distribute tasks in an effective manner, taking into account the participants' role and capabilities.
	• To keep a strong real-like participation during activities.

Evaluation approaches and metrics	• The experiment evaluation approach is based on a set of predefined objectives; technological, operational and non-technical objectives:
	  ○ technological level: the used systems and tools are evaluated
	  ○ operational level: the systems' capability to perform operations in the field are validated
	  ○ Non-technical level: the effectiveness of criteria for needs assessment is evaluated.
	• The evaluation exercise objectives and success criteria are defined by JRC and Task partners. The success criteria are adapted to special situations.

Involved tools	• COP, FRQ • FOI, SITRA • ZKI-Portal, DLR
Summary of the results	The experiment was not been performed.
Lessons learnt	The experiment was not been performed.
Benefit for CM	The experiment was not been performed.

Table 21: Experiment 46 Damage and Needs Assessment Techniques Using Nepal Earthquake 2015

Experiment No. *52.3*	EXPE Lead *FhG-IAO*	Platform *–*	Date *Feb – May 2016*
Experiment name	***SE2 experiment campaign*** ***WP52 Competence Framework***		**Deliverable** –
Involved actors	**Stakeholders that are addressed in the first row by the competence framework are representatives of HR departments and management dealing with crisis situations. Key target groups and participants are therefore: CEOs, HR managers, and training designers (at least to some extent) of ARC, FOI/MSB, TNO, THW, ARMINES, FhG-IAO**		
End-User	• **ARC, FOI/MSB, TNO, THW, ARMINES** • **Systematisation of competence management and development** • **Improvement of training and learning activities**		
Experiment short description	**The SE2 experiment campaign of WP52 focuses at the application of a set of modules of the of the WP52 competence framework developed.** **That means with the application of the CF we are creating an instance in the organization involved. An instance is an application of the competence framework in a specific Crisis Management situation, a specific process or phase of Crisis Management or for a specific occupational group.** **The competence framework helps to identify and to handle competence gaps for staff involved in CM tasks and processes in a structured manner. The competence framework can be used by experts in Crisis Management to enhance learning and training activities from a competence-based perspective. It can be implemented in an entire organization or can be used to improve already existing learning and competence-developing activities.**		
Expected end-user benefit	**In a set of experiments different modules and parts of the Competence Framework are tested (e.g. the identification of required competences of leaders of operations, the measurement of competences and the measurement of performance of leaders of operations; the identification of required competences to coordinate volunteers and the measurement of competences etc.). The objective is to provide and address different CF modules and methods** e.g. supporting “training activities” in an experimental environment. The **expected outcome is a competence framework which has been tested against the needs of the end-users and has shown its applicability.**		
Evaluation approaches and metrics	**The SE2 experiment campaign is an evaluation approach of the Competence Framework itself. Evaluation is carried out by means of questionnaires, observations, group discussions and interviews with the end-user parties.**		
Involved tools	**WP52 Competence Framework**		

	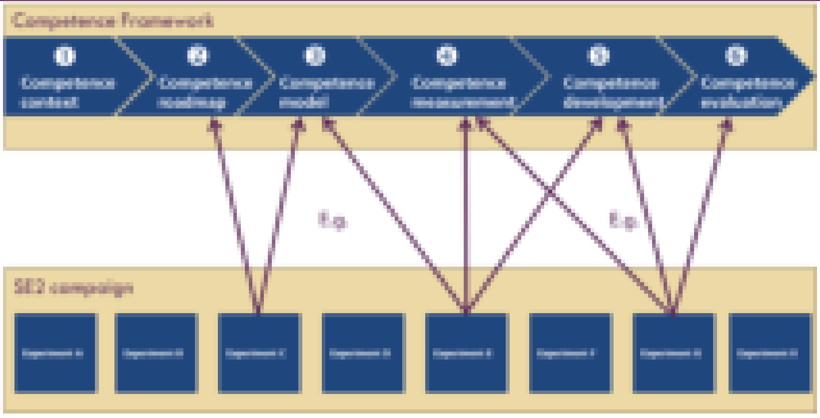
Summary of the results	The framework provides a standardized guideline to understand the importance of revealing competence needs and interlinking them with appropriate trainings based on given scenarios, processes and tasks to occur in specific crisis situations.
Lessons learnt	• The DRIVER competence framework can be used before or after crisis (not during). • Appropriate and competent representatives in the end-user organizations have to be identified. Only few have a complete overview and knowledge about the processes of competence management in the entire organization. Sometimes a series of different representatives have to be involved to make use of the competence framework as a whole.
Benefit for CM	• The competence framework contains a set of components that provide the foundations and conceptual arrangements for designing, implementing, monitoring, reviewing and continually improving competence management activities in CM in a systematic way. • Overview on competence management activities (competence context, competence roadmap, competence model, competence measurement, competence development, competence evaluation)

Table 22: Experiment 52.3 SE2 experiment campaign and WP52 Competence Framework

Experiment No. 53.3	EXPE Lead *ITTI*	Platform *ITTI*	Date *April 2016*
Experiment name	*Tests of chosen tools for the collection of lessons/observations*		**Deliverable**
Involved actors	• ITTI, FOI, MSB, EDISOFT (organizers) • Security and Crisis Management Department of the City Hall in Poznan (participant) • Security and Crisis Management Department of the Wielkopolska Region (participant) • Security and Crisis Management Department of the Tarnowo Podgórne County (participant) • Main School of Fire Service (participant) • Polish Naval Academy (participant)		
End-User	• Crisis Management Decision Makers • Regional and local level • System, methodology for creating, storing and sharing lessons learnt and knowledge • Provision of the methodology and IT tool for creating, storing and sharing lessons learnt		
Experiment short description	The main idea of the experiment is to test the chosen tools for expert group collection of lessons/observations. The main objective of the experiment is to test the efficiency and usability of tools chosen in T53.2 for identifying lessons/observations. The experiment will be based on the table-top exercise with participation of 10 CM experts from different countries in Europe. EXPE53.3 will use actual data and information from EXPE43.		
Expected end-user benefit	There are two main goals of the experiment 53.3: (i) to test the methodology for creating and sharing lessons learnt which was created within the SP5; (ii) to test the efficiency of the IT tools provided by the DRIVER technological partners in terms of creating and sharing lessons learnt based on the developed methodology. The experiment should lead involved actors two three main outcomes. Firstly, the general assessment of the methodology usefulness in terms of lessons learnt. Secondly, effectiveness assessment of the provided IT solutions in terms of gathering and sharing lessons learnt. And finally, recommendations for the future development of both methodology and IT solutions. The main end-user benefit of the experiment is increased awareness in terms of existing methodologies for creating and sharing lessons learnt as well as existing IT solutions supporting the process. End-users should have opportunity to test the effectiveness of the proposed solutions in operation.		

	The main success criteria are: • effective use of the methodology for the operational purposes; • effective use of the IT solutions for the operational purposes; • smooth and intuitive gathering and sharing lessons learnt with other participants; • possibility to create lessons learnt both in real-time and after action;
Evaluation approaches and metrics	During the experiment there will be two ways of evaluation conducted: questionnaires and written observations made by the organizers. The metrics use for the evaluation are created by the TNO and based on their vast evaluation experience.
Involved tools	LIMA2, ITTI, OCP, EDISOFT
Summary of the results	We haven't yet conducted the experiment. In April 2016 we organized a pre-experiment in order to prove the design of the experiment and choose of the tool was correct.
Lessons learnt	Main problems during preparation phase: 1. Acquiring information about the tools 2. Establishing budget for the experiment 3. Availability of the tools for training and testing and methodology adjustments 4. Organisation of the evaluation session a. Templates b. Evaluators c. Indicators 5. Acquiring real data for the scenario 6. Appropriate explanation of the lessons learnt concept to the end-users 7. Institutional differences between different participants.
Benefit for CM	The real outcome of the experiment should be evaluated after it is conducted. The pre-experiment was only a preparation to the real event which has not taken place yet.

Table 23: Experiment 53.3 Tests of chosen tools for the collection of lessons/observations

Experiment No. *550.1*	EXPE Lead *TNO*	Platform *MSB*	Date *May 2016*
Awareness training	***Collaboration between CM professionals and spontaneous volunteers (response phase)***		Deliverable *D550.2*
Involved actors	Rescue service, police, ambulance, social service		
End-user			
Experiment short description	One day training of a group of 8-10 CM professionals (from strategic to operational levels) on awareness of the option to have (spontaneous) volunteers help during a crisis. Training will touch on the following topics: Behaviour of General Public and First Responders; Laws and regulations; Daily practice; and an interactive session with a scenario in XVR to provide hands on practice.		
Expected end-user benefit	The goal of the experiment is to increase awareness that the general public might be used as a resource instead of considered a liability We expect that our training will lead to discussion and will help increase awareness of theoretical, legal, and practical consequences (positive as well as negative) of interacting with the general public. End-users are expected to benefit from interaction with the general public as they may get extra manpower during the acute phase of a crisis. The training can be considered a success if the participants indicate that they are open for new insights.		
Evaluation approaches and metrics	Evaluation will be by qualitative methods: questionnaire-based pre-post assessment of awareness. Group discussion.		
Involved tools	Description in deliverable 550.1: Training material (MSB and FOI); questionnaires; scoring form for observations; XVR, E-semble		
Summary of the results	We have run a pilot experiment showing that the set-up using XVR works to start lively discussions. Participants were positive about the training set up. Collected data consists of filled out questionnaires (paper and pen).		
Lessons learnt	Due to special circumstances a number of crisis managers had to cancel their participation shortly before the pilot experiment. This made our group a little small. Otherwise the experiment ran smoothly.		
Benefit for CM	No formal evaluation has been done yet.		

Table 24: Experiment 55.1 Collaboration between CM professionals and spontaneous volunteers (response phase)