Driving Innovation in Crisis Management for European Resilience

D941.31 – SP94 OVERALL EVALUATION OF THE TRIALS AND FINAL DEMO

SP94 - TRIALS

MAY 2020 (M73)

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The DRIVER+ project

Current and future challenges, due to increasingly severe consequences of natural disasters and terrorist threats, require the development and uptake of innovative solutions that are addressing the operational needs of practitioners dealing with Crisis Management. DRIVER+ (Driving Innovation in Crisis Management for European Resilience) is an FP7 Crisis Management demonstration project aiming at improving the way capability development and innovation management is tackled. DRIVER+ has three main objectives:

1. Develop a pan-European Test-bed for Crisis Management capability development:
    a. Develop a common guidance methodology and tool, supporting Trials and the gathering of lessons learnt.
    b. Develop an infrastructure to create relevant environments, for enabling the trialling of new solutions and to explore and share Crisis Management capabilities.
    c. Run Trials in order to assess the value of solutions addressing specific needs using guidance and infrastructure.
    d. Ensure the sustainability of the pan-European Test-bed.
2. Develop a well-balanced comprehensive Portfolio of Crisis Management Solutions:
    a. Facilitate the usage of the Portfolio of Solutions.
    b. Ensure the sustainability of the Portfolio of Solutions.
3. Facilitate a shared understanding of Crisis Management across Europe:
    a. Establish a common background.
    b. Cooperate with external partners in joint Trials.
    c. Disseminate project results.

In order to achieve these objectives, five Subprojects (SPs) have been established. **SP91** ***Project Management*** is devoted to consortium level project management, and it is also in charge of the alignment of DRIVER+ with external initiatives on Crisis Management for the benefit of DRIVER+ and its stakeholders. In DRIVER+, all activities related to Societal Impact Assessment are part of **SP91** as well. **SP92** ***Test-bed*** will deliver a Trial Guidance Methodology and Trial Guidance Tool supporting the design, conduct and analysis of Trials and will develop a reference implementation of the Test-bed. It will also create the scenario simulation capability to support execution of the Trials. **SP93** ***Solutions*** will deliver the Portfolio of Solutions which is a database driven web site that documents all the available DRIVER+ solutions, as well as solutions from external organisations. Adapting solutions to fit the needs addressed in Trials will be done in **SP93**. **SP94** ***Trials*** will organize four series of Trials as well as the Final Demo (FD). **SP95** ***Impact, Engagement and Sustainability***, is in charge of communication and dissemination, and also addresses issues related to improving sustainability, market aspects of solutions, and standardisation.

The DRIVER+ Trials and the Final Demonstration will benefit from the DRIVER+ Test-bed, providing the technological infrastructure, the necessary supporting methodology and adequate support tools to prepare, conduct and evaluate the Trials. All results from the Trials will be stored and made available in the Portfolio of Solutions, being a central platform to present innovative solutions from consortium partners and third parties, and to share experiences and best practices with respect to their application. In order to enhance the current European cooperation framework within the Crisis Management domain and to facilitate a shared understanding of Crisis Management across Europe, DRIVER+ will carry out a wide range of activities. Most important will be to build and structure a dedicated Community of Practice in Crisis Management, thereby connecting and fostering the exchange of lessons learnt and best practices between Crisis Management practitioners as well as technological solution providers.

Executive summary

This document presents the overall evaluation of the four Trials and Final Demonstration (Final Demo) organised in DRIVER+. The essential aim of each Trial was not only the assessment of the potential of a number of innovative solutions for Crisis Management, but also to evaluate the performance of the DRIVER+ Test-bed. The DRIVER+ Test-bed has developed within the project to carry out such trials in a practitioner-centred and systematic way. The Test-bed consist of the Trial Guidance Methodology (TGM), the Trial Guidance Tool (TGT) and the Test-bed Technical Infrastructure (TTI). Four consecutive large-scale Trials have been conducted within the project in: Warsaw (Poland) (1), Valabre (France) (2), The Hague (the Netherlands) (3), Eisenerz (Austria) (4), and a Final Demonstration took place in Warsaw (Poland) and The Hague (the Netherlands) (5).

In order to analyse the added value of the TGM, the TGT and The TTI and its progressing effectiveness during the course of the DRIVER+ project, key performance indicators (KPI's) were defined and their values were collected after each progress phase of each Trial (Preparation, Execution and Evaluation). The assessment was carried out at the end of each Trial through evaluation surveys and focus group discussions. The target group was formed by the main stakeholders attending the Trials including consortium partners and invited experts such as practitioners and expert observers. The entire evaluation picture at the end was complemented by the results of the First Impression Evaluation (FIE) held during the Final Demo.

This report is organized into five sections which present the organizational and technical conditions of the Trials and the Final Demo, the evaluation methodology of the DRIVER+ Test-bed with a strong focus on the evaluation results in a Trial to Trial perspective, and the Test-bed potential to influence Crisis Management (CM) in the EU dimension.

The major outcomes of this overall evaluation are as follows:

- The average value of all KPIs calculated for the four consecutive Trials was positive and it has constantly been increasing. An exception to this trend is the second Trial in France, which can be explained by the fact that this Trial was the first one where a very early version of the TGM was used.
- Among the ten DRIVER+ Test-bed evaluation KPIs (EU added value, usefulness, scalability, modularity, reliability, innovation, affordability, cost-effectiveness, usability and validity), which have been measured throughout all four Trials, modularity and scalability were assessed as the best features characterizing the developed Trial environment. Taking into account the average value for all four Trials, including an analysis throughout all Trial phases, all KPIs were positively assessed. Modularity and scalability were the highest evaluated features while cost-effectiveness and affordability were the lowest.
- The delivered final, mature versions of the TGM and TTI have been evaluated positively. In general, their iteratively developed versions used in the consecutive Trials showed improvements from Trial to Trial.

The FIE executed during the Final Demo was based on a cost-benefit analyses for information management processes which was modified accordingly to the event aims. The analyses related vertical communication means between civil protection modules, the EU Civil Protection Team (EU CPT) and the Emergency Response Coordination Centre (ERCC) in case of UCPM deployments. It covered seven criteria such as *usability, editability, formatting, searchability, structure, visualization* and *relevance* surveyed in the base-line and the innovation line runs. The FIE assessment was effectively used during the Final Demo and the results showed that this method can be useful for the evaluation of the information products used in Crisis Management.

The aim of the DRIVER+ Test-bed was to develop a Trial environment capable of including an EU Crisis Management dimension. This EU dimension has been measured by defining the following nine criteria: 1) cross-border situation assessment, 2) cross-border cooperation, 3) cross-border resource and logistics planning, 4) active participation of at least two international organisations, 5) active involvement of the

ERCC, 6) information exchange between the ERCC and UCPM Participating State, 7) common operational picture at the ERCC and UCPM Participating State, 8) activation of the Union Civil Protection Mechanism, and 9) explicit reference to relevant EU policies. Each of the Trials and the Final Demo were able to meet at least three of these criteria successfully, while the Final Demo covered all nine.

In reference to the final, ninth criterion, the evaluation process of each Trial and Final Demo resulted in the formulation of recommendations related to several issues relevant to specific EU policies and activities e.g.: civil protection, internal security, environmental protection, solidarity fund, industry and infrastructure, insurance, humanitarian aid, flood risk management and major industrial accident prevention, critical infrastructure protection, climate change adaptation, research and innovation.

Within the DRIVER+ project the sustainability aspect of the trialling environment was elaborated together with a possible way forward to maintain and promote the project results in the Crisis Management sector across Europe. The DRIVER+ consortium has decided to pursue a set of complementary lines of activities, e.g. focused on methodological, technical, organisational, promotional and many other aspects to ensure that the project results will be implemented in the future. The proposed way forward for the Test-bed assumes taking into account the following aspects:

- A guarantee for the free availability of the DRIVER+ products.
- Promotional and informational activities of the Test-bed have to be continued after the closure of the project.
- In order to maintain the DRIVER+ outcomes and support their permanent sustainability and continued evolution a network of Centres of Expertise (CoEs) was established.

Based on the evaluation of the overall quality and effectiveness of the Trials and Final Demonstration, it can be concluded that:

- The Test-bed can be relatively easily adjusted to the requirements of users/practitioners in trialling and finding innovations corresponding to their needs and gaps.
- The TGM in specific and the whole Test-bed in general, stimulates a comprehensive, holistic approach to a given problem. It allows Trial Owners to think of and test new alternatives for problems, solving and meeting challenges of a particular crisis situation by facilitating such processes with innovative solutions not being used before. The project showed that adequate familiarization of the practitioners with the innovative solutions, e.g. by extensive training on a solution to be trailed, as well as a further embedment of the solutions by aligning the solutions and work processes of the practitioners is highly recommended to get relevant evaluation results.
- The flexibility and scalability of the TGM and the TTI are a huge added value for the practitioners, allowing for diversities in their needs and gaps. Furthermore, the Test-bed as a whole proved to be an inclusive platform, strongly supporting collaborative work in a multi-stakeholder environment.
- The practical implementation of the TGM and the TTI may be perceived as challenging for those who are using it for the first time. Therefore, the project has developed the TGT and a Training Module which are open-sourced and freely accessible.
- The Trial Guidance Methodology Handbook is very “user-friendly” and easy to comprehend and use as a document. Moreover, an interactive version of the TGM in a form of a website has been designed and implemented in order to facilitate its successful use in practice.

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List of Acronyms

Acronym	Definition
AAR	After Action Review
AC	Action Centre
CIS	Common Information Space
CoE	Centre of Expertise
COP	Common Operational Picture
CS	Crisis Team
CSS	Common Simulation Space
ERA	European Research Area
ERCC	Emergency Response Coordination Centre
EU CPT	European Union Civil Protection (coordination) Team
EUCPM	EU Civil Protection Mechanism
EUCPx	EU Civil Protection Exercise
FIE	First Impression Evaluation
GIS	Geographic Information System
ICT	Information and Communication Technology
KPI	Key Performance Indicator
LL	Lessons Learned
OST	Observer Support Tool
PoS	Portfolio of Solutions
REA	Research Executive Agency
RQ	Research Question
T1, T2, T3, T4	Trial 1, Trial 2, Trial 3, Trial 4
TAP	Trial Action Plan
TAST	Technical Assistance and Support Team
TC	Trial Committee
TGM	Trial Guidance Methodology
TGT	Trial Guidance Tool
TM	Training Module
TMT	Trial Management Tool
TRL	Technology Readiness Level
TTI	Test-bed Technical Infrastructure
VR	Virtual Reality
W0	Workshop “0”
WP	Work Package

1. Introduction

This document presents the evaluation process and its results for the DRIVER+ Trial Guidance Methodology (TGM), the Trial Guidance Tool (TGT) and the Test-bed Technical Infrastructure (TTI). It describes their progressing effectiveness during the course of the DRIVER+ project, as well as results of the First Impression Evaluation (FIE) of the Final Demonstration (Final Demo)[1]. It explains how the data on the TGM, TGT and TTI evaluation were collected, analysed and synthetized from Trial to Trial in order to interpret them and present the final results. The overall process of designing the evaluation method utilizes reductionist thinking which starts from the general approach to reconstruct it downstream to a more specific and pragmatic approach taking into account all possible constraints, risks and time limitations (Section 3). The division of responsibilities among the different kind of evaluations within DRIVER+ (focused on TGM, TGT, TTI and FIE respectively) is highlighted. The document contains a description of the evaluation concept that has been implemented.

According to the DRIVER+ Description of Work, task **T941.3** covers the evaluation of the level of achievement reached in each **SP94** Trial regarding the planned goals. The essential aim of each Trial was not only the evaluation of the innovative potential of new solutions utilization in Crisis Management but also of the TGM, TTI and TGT performance. For this purpose, Key Performance Indicators (KPIs) were defined to assess the *EU added value, usefulness, scalability, modularity, reliability, innovation, affordability, cost-effectiveness, usability* and *validity* of the DRIVER+ Test-bed and the solutions tested. Diagnostic survey/questionnaires and focus groups were used to measure the KPIs. KPI values estimated and found for each **SP94** Trial were used to indicate the added value of the Test-bed and its progress in the course of the DRIVER+ project. In addition to the assessment based on KPIs, at the end of each Trial a concluding discussion (i.e. focus group) was conducted. The results of the overall evaluation efforts are presented in this report.

Section 2 briefly introduces the TGM, TGT and TTI and describes how they were used for and iteratively improved through their use in consecutive Trials and the Final Demo. This section includes short summaries for each Trial. Section 3 provides information about the methods of evaluation and its results. Section 4 focuses on the EU dimension and presents an overview of findings relevant to EU policies. Each part starts with a brief text block including the main outcomes. Finally, Section 5 summarises the evaluation findings related to the Test-bed and the lessons learnt applicable for future Trials. The annexes provide among others, further details on the analysis and outcome, answers to the research questions of each Trial, a summary of the lessons learned at each Trial, and summaries of the evaluation report of each individual Trial and Final Demo.

[1] The results of the First Impression Evaluation (FIE) from the Final Demonstration have already been presented in ***D947.12 Report on Trial Evaluation – Final Demo***. As that document is restricted to consortium, these results are partly presented here again.

2. Conditions of Trials and Final Demonstration

In addition to a regular Trial aim, which is to assess Crisis Management solutions, the four Trials organised within the DRIVER+ project were intended to be "testing grounds" for the evaluation of the TGM, TGT and TTI. Two Trials were conducted in 2018 (May and October), the other two in 2019 (May and September). Such time planning for Trials was made in order to carry out the evaluation in two stages: the first evaluation process was meant to relate to the first version of TGM, TGT and TTI, those used during the preparation and execution of the Trials 1 and 2, while the second process addressed the updated versions of these products used for the Trials 3 and 4. In this way the DRIVER+ methods and tools were improved in an iterative way, allowing implementations of lessons learned following from previous Trials into the next ones. The series of Trials was concluded with the Final Demo – the event that was meant to demonstrate the overall approach of trialling according to the final version of the TGM (see Figure 2.1).

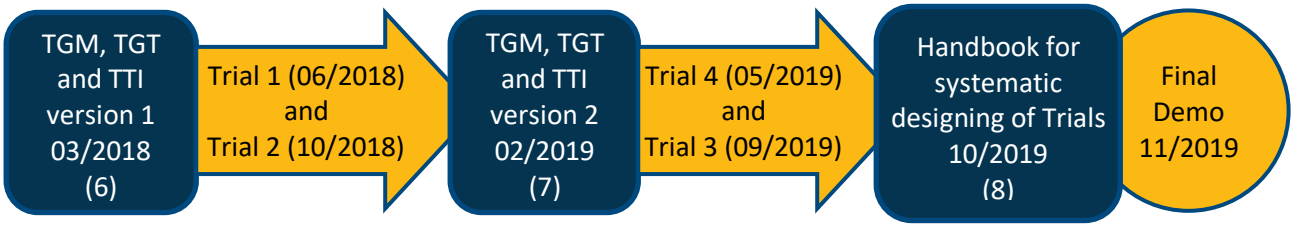

Figure 2.1: Evaluation and iterative improvement concept for TGM, TGT and TTI based on DRIVER+ Trials

2.1. Description of Trial Guidance Methodology, Test-bed Technical Infrastructure and Trial Guidance Tool

The **Trial Guidance Methodology (TGM)** is a structured approach from designing a Trial to evaluating the outcomes and identifying lessons learned. The TGM is based on an iterative "six step approach" preceded by a so-called "Step Zero", that together make up the Preparation phase of a Trial. The two complementary phases are Execution phase and Evaluation phase (see Figure 2.2).

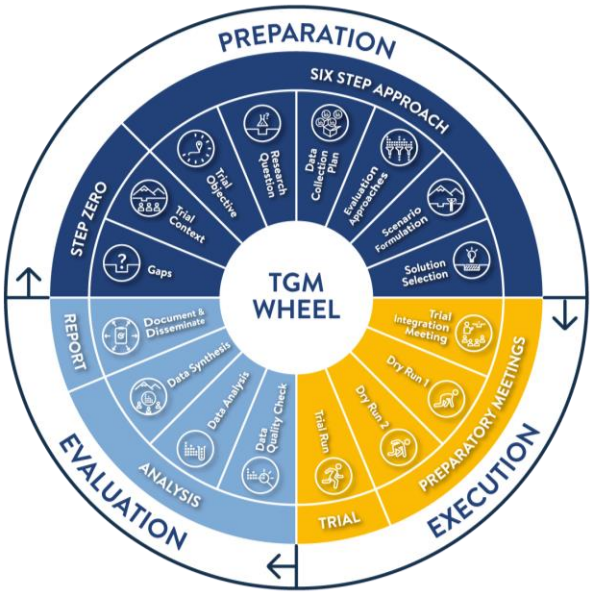

Figure 2.2: The TGM wheel illustrating the three TGM phases and steps within phases

Step Zero consists of the identification and the specification of Crisis Management gap(s) to be addressed during a Trial. The gap(s), identified and placed in a specific context by the Crisis Management practitioners (the End-Users), is the input for the six step process, which comprises: (1) identification of the Trial objective, (2) formulation of research questions, (3) formulation of data collection plan, (4) formulation of

evaluation techniques and metrics, (5) formulation of scenario and (6) selection of solutions to be trialled. The six steps may be repeated in an iterative, but not necessarily linear manner to conclude with a consistent picture of the Trial design most suited to the needs.

Once the Trial design has been accomplished, the Execution phase begins, which involves all Trial stake-holders: Trial Committee, Crisis Management practitioners and solution providers and includes three meetings

- Trial Integration Meeting aiming primarily at the integration of solutions into the practitioners' operations within the scenario and further detailing the data collection and evaluation according to the Trial objectives.
- Dry Run 1 that is the first review in practice of all Trial components and their integration: the local technical Test-bed, solutions, scenario and injects, data collection and evaluation plan, and ends with a complete rehearsal of the Trial.
- Dry Run 2, organised after the adjustments identified during Dry Run 1 are made, is the "full-dress rehearsal" of the Trial.

The Execution phase is completed by conducting the actual Trial, when the scenario is played by the practi-tioners and the evaluation data is collected. The whole process of trialling concludes with the Evaluation Phase, during which the gathered data is checked, analysed, synthesized, and disseminated.

Two subsequent versions of the TGM and TGT have been described in two DRIVER+ deliverables: **D922.21** ***Trial guidance methodology and guidance tool specifications (version 1)*** (6) and **D922.41** ***Trial guidance methodology and guidance tool specifications (version 2)*** (7). Starting from 12/2018 several versions of the TGM Handbook have been issued till the release of the final version on 10/2019 (8), also available via https://tgm.ercis.org/.

The **Test-bed Technical Infrastructure (TTI)** is a software toolbox used to support the technical aspects of Trials, and consists of various software components:

- Common Information Space (CIS) and CIS Adapters.
- Common Simulation Space (CSS) and CSS Adapters.
- Test-bed Admin Tool and security.
- Trial Management Tool (TMT).
- Time service.
- Observer Support Tool (OST).
- After Action Review (AAR).

Three subsequent versions of the Test-bed Technical Infrastructure description were issued as DRIVER+ deliverables: **D923.21** ***Test-bed reference implementation v1*** (9) together with **D923.11** ***Functional Specification of the Test-bed*** (10) , **D923.22** ***Test-bed reference implementation v2*** (11) and **D923.23** ***Final release of the test-bed reference implementation*** (12). Version 1, with limited number of components was intended to be used in Trials 1 and 2, version 2 was used in Trial 4 (with the first version of Trial Management Tool and After-Action Review tool), and the mature version 3 was used in Trial 3 and the Final Demo.

The Trial Guidance Tool (TGT) was developed in order to facilitate the usage of the DRIVER+ methodology in practice. The TGT was specified together with the TGM in **D922.21** (6) and **D922.41** (7). The final version of the TGT is available online at https://pos.driver-project.eu/en/gt/methodology/tool.

Trial Guidance Methodology (TGM) overview

Properly designing a Trial from a methodological perspective is a key to find out if and how innovative solutions can help meet Crisis Management's socio-technical needs. Before adopting potentially innovative solutions and investing time and money to figure out what fits the best, one may want to assess them in non-operational contexts (such as a Trial) using a structured approach.

For this purpose, a specific methodology called the Trial Guidance Methodology (TGM) has been developed. The TGM consists of phases (Preparation, Execution, Evaluation) and steps (six steps in the preparation phase).

The TGM is designed for Crisis Management (CM) practitioners who have identified one or more gaps or have in mind solutions that can address these gaps. The TGM allows someone who is dealing with research and innovation (e.g. works in the innovation department of a CM organization) and would like to test some solutions that can bring potential innovation, to get a sense of what the Trial entails.

The TGM has not been developed for a clear-cut professional profile. However, it directly addresses one specific context (Crisis Management) and deals with investigating and assessing innovation through a systematic and pragmatic approach making use of a broader set of tools within the DRIVER+ Test-bed. It provides the "how to", so that practitioners can rely on well-grounded arguments when exploring solutions.

The purpose of the Trial is to detect and assess the potential impact of a change on the socio-technical set-up of Crisis Management organisations. For example, the use of an app for managing resources (e.g. volunteers) in a different way is compared to legacy systems and procedures. The performance of a solution (e.g. a mobile application) is assessed in the Trial on the basis of specific performance indicators. The evaluation is carried out within a social, cultural and legal context which is a key to assess the change through the introduction of a CM solution. Moreover, the performance of the teams involved in the Trial is not subject to evaluation, as it is not an exercise. Having said that, it does not matter if one designs a simulated Trial or a table-top exercise; valid conclusions can only be inferred if a structured methodological approach is used and the "right questions" are asked. Trials are collective efforts. They imply a co-creative approach and an open mind. Therefore, workshops and tools are essential to design the Trial. Several iterations, especially in the preparation phase, may be needed. The elements of the Trial design (e.g. data collection) may be reformulated and refined a number of times, as more information about other elements (e.g. potential solutions) is revealed.

The Trial is also an evolving process: it grows "in the making", like a handcrafted artefact. The underlying assumption here is that an innovation needs to be seen not in a "tool" itself, but in the overall implementation of it in a particular context of CM organizations, relief operations, cultural and legal spaces, as well as pre-defined CM practices. Thus, a simple tool has to be seen as a broader solution - and in this sense, it is a specific "solution in the making" compared to established and working "ready-made solutions" of existing practitioners' realities. One has to devote some time to ponder what one is working on and adjust the design, if needed. One will also have to discuss with different stakeholders (see section roles): key decisions must be taken in agreement with all interested parties. One can learn from everyone involved in the process. Hence, the "solution in the making" is always determined by the fact how do you introduce it into your context. The criteria of success of the Trial depend on the design. The methodological decisions taken prior to the execution are key in determining its success. A robust design will lead you to find appropriate answers to ones needs.

TGM Handbook (8)

Within the DRIVER+ project two versions of an e-learning Training Module (TM) were designed to facilitate the use of the TGM and TGT. The first version of the Training module was planned to be delivered before Trial 1 and 2 (**D924.11 *Materials for the training module I*** (13)), the second (improved) version, before Trials 3 and 4 (**D924.12 *Materials for the training module II*** (14)). In the end, the first online version of the module was made available to the Trial Committees two months before the Updated Workshop "0" (November 2018).

2.2. Development status of Trial Guidance Methodology, Test-bed Technical Infrastructure and Trial Guidance Tool

Throughout the process of preparing, executing and evaluating the Trials and the Final Demo, different versions of the TGM, TGT and TTI at different maturity levels were deployed (Figure 2.3). This is described in the following Sections 2.2.1 – 2.2.5.

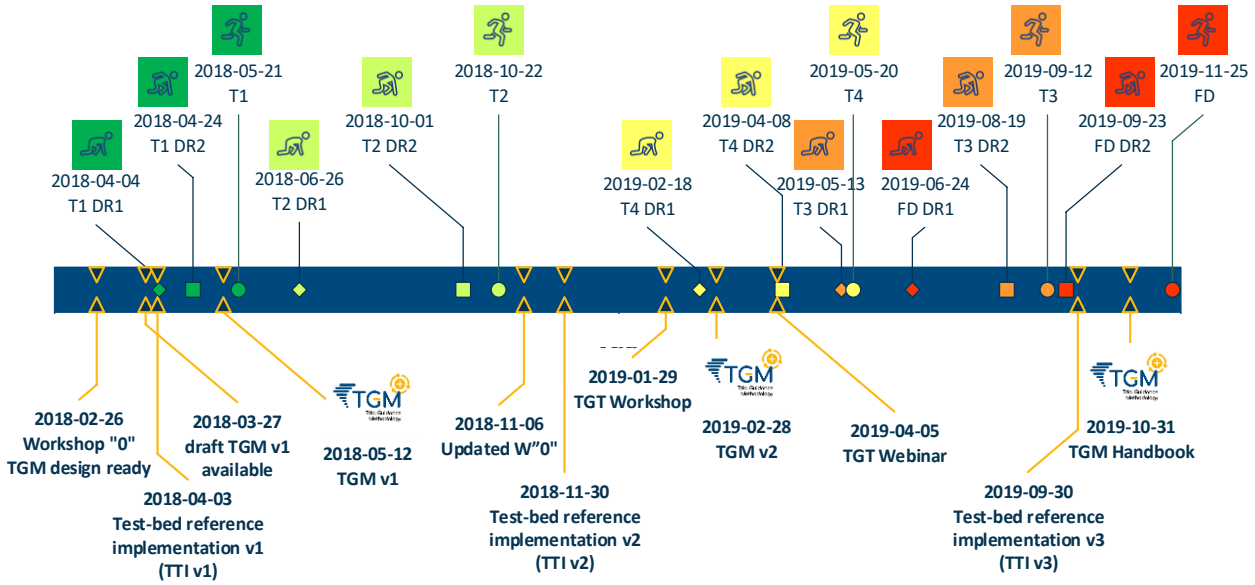

Figure 2.3: Milestones of DRIVER+ Trials' preparation and execution against the stages of TGM, TGT and TTI development

2.2.1. Trial 1 – Trial Poland

The first Trial within DRIVER+ project (Trial 1) took place on 21-25/05/2018 in Warsaw, in the premises of the Main School of Fire Service (Trial 1 Owner).

Trial 1 in a nutshell	
Trial type	Table-top and field
General purpose	Improvement of cross-border communication, coordination and resource management between different organisations and agencies from different countries, in large scale and complex (multi-event) crises resulting of cascading effects.
Participants	24 practitioners from 13 countries involved in data collection. 76 participants from 16 countries in total.
Research questions	1. How can visualisation of a chemical threat dynamics support communication and information exchange? 2. How can an integrated COP support decision-making processes at tactical and

	operational level? 3. How can models of chemical threat dynamics support taking decisions sooner, faster and better? 4. How can models of cascading effects support taking decisions that minimise the impact on people, infrastructure and environment? 5. How can cross-border resource management be supported through socio-technical solutions during multi-stakeholder long-term rescue operations? 6. How can information on needed and available resources of multiple stakeholders be shared to increase the operational performance? **Answers to these Research Questions can be found in Annex 5.1** Trial 1 - Poland**.**
Scenario outline 	A large amount of liquid toxic substance is released as a result of maintenance failure in a reservoir collecting chemical wastes. Pumping of chemical waste liquid to the reservoir cannot be switched off due to a valve failure. Dikes of the reservoir are weakened after heavy rainfall during past few days and as a consequence, the dikes break under the pressure of the substance gathered in the reservoir. The affected land includes a river that crosses the border between the two neighbouring countries
Solutions 	**3Di** (Nelen and Schuurmans, the Netherlands) enables flood forecasting on the basis of a detailed model, among others: flooding locations, water depths, and water arrival times. **SOCRATES OC** (GMV, Spain) enables the exchange and sharing of the information (expandable and customizable) among SOCRATES nodes and with other external systems enabling the reporting and tracking of events and inter-organisational tasking (mission assignment) and resource management (request, offer and transfer of resources). **Drone Rapid Mapping** (Hexagon Safety & Infrastructure, Poland) enables rapid mapping of incident/crisis area, i.e. very fast generation of orthophotomaps and 3D terrain models based on imagery acquired by any drone (RPAS) available to rescue or Crisis Management actors.

Due to the time constraint, the Preparation phase started before DRIVER+ Workshop "0" (held on 26/02-3/03/2018), which was the first occasion for the DRIVER+ Trial Committees to get acknowledged in depth with the Test-bed.

The TGM basic design was ready but not yet published and the Training module on the TGM was at the very initial stage of development, therefore the methodological team supported the Trial Committee with organising face-to-face and online workshops. The draft TGM version was made available on 27/03/2018, hence just before Dry Run 1 (4-6/04/2018). The preparation, execution and evaluation of the Trial in line with the TGM, that was still under construction, constituted a big challenge. Nevertheless, the Trial 1 Committee has implemented the initial TGM version to its best possible extent within the given timeframe in order to conduct the Trial as well as to make the first verification of the concept.

The first version of the Test-bed reference implementation (9) was made available only on the day preceding the Dry Run 1, but several components of the TTI were developed enough to be used during Trial 1: The CIS, the CSS, the Admin tool and security and the Observer Support Tool (OST).

The TGT was in the initial phase of its development and was not used in Trial 1. For the purpose of planning the Trial Action Plan (TAP) was developed, used and accepted by the Research Executive Agency (REA) as a deliverable **D943.11** ***Report on Trial Action Plan – Trial 1*** (3) (the document is restricted to a group specified by the DRIVER+ consortium).

The detailed description of Trial 1 evaluation is provided in **D943.12** ***Report on Trial Evaluation – Trial* 1** (1) (the report is restricted to a group specified by the DRIVER+ consortium); a public summary is available on the project website (15) and in Annex 10.

2.2.2. Trial 2 –Trial France

Trial 2 was executed on 22-26/10/2018 in Centre Euro-méditerranéen de Simulation des Risques (CESIR) of Valabre (Trial 2 Owner) in France.

Trial 2 in a nutshell	
Trial type	Table-top
General purpose	Improvement of cooperation and coordination between different organisations and agencies from different countries, using innovative solutions for large scale and complex (multi-event) crises.
Participants	16 practitioners from 2 countries involved in data collection. 72 participants from 14 countries in total.
Research questions	1. How to improve and maintain, in real time, a shared situational awareness by supporting the exchange of crisis-related information among agencies and organisations? 2. How to improve the coordination of fire-fighters' response operations and Emergency Medical Service rescue operations during a large forest fire with casualties? 3. How to transform raw data from social networks into actionable information directly useful to the incident commander? **Answers to these Research Questions can be found in Annex 5.2** Trial 2 - France**.**
Scenario outline	Severe wildfires in south-eastern France cause cascading effects on a chemical infrastructure: the industrial process of a plant is impacted because of power outage related to the forest fire crossing the electric lines supplying the plant, and on human settlements: a campsite is threatened by the fire, people disrespect security advices and escape the campsite on foot.
Solutions	**CrisisSuite** (Merlin, the Netherlands) enables exchange of formal and informal information, the overall tasking (task definition, progress management) and managing the overall crisis day log of all organisations involved., SITREP generation based on tasking and day log. **MDA C2** (MDA, Israel) enables call taking, dispatching Emergency Medical Services (EMS) vehicles to take the victims in charge and send them to hospital, routing EMS vehicles avoiding danger area(s), reporting on victims status and victims being sent to hospital. **SMAP** (Thales Communication Services, France) enables collection of Twitter data related to a crisis of interest, filtering down collected information to identify tweets of interest, export tweets of interest to a Common Operational Picture (COP). **LifeX COP** (Frequentis, Austria) enables a geographical Common Operational Picture based on reporting of other solutions, defining danger zone(s), managing day log.

The Trial Committee could use the first version of the TGM (6), which was originally issued during the Preparation phase of Trial 2. However, since the methodology was described in a complicated and theoretical way, which made it difficult to use in practice, and the Training module was not ready, the Trial Committee had difficulties with the implementation of the TGM in all phases of the Trial.

Similar to Trial 1, Trial 2 was based on the first Test-bed reference implementation (9) and used three of its components: The CIS, the CSS and the Admin tool and security. The OST was not used due to technical and organisational problems (limited wireless network and unavailability of an improved version during the process of Trial 2 design).

The TGT was still under development and was not used. The information and decisions made during the Preparation and Execution phases were collected in the Trial Action Plan **D944.11** ***Report on Trial Action Plan – Trial 2*** (16) (dissemination restricted to a group specified by the DRIVER+ consortium).

The detailed descriptions of Trial 2 evaluation results are included in **D944.12** ***Report on Trial Evaluation – Trial*** **2** (2) (the report is restricted to a group specified by the DRIVER+ consortium); a public summary is available on the project website (17) and in Annex 10.

2.2.3. Trial 3 –Trial Austria

The fourth implementation of the DRIVER+ Trial Guidance Methodology and the Test-bed was evaluated within Trial 3, which was held on 12-15/09/2019 in Eisenerz (Styria/Austria). (Please note that Trial 3 took place chronologically after Trial 4, but the original Trial numbering was kept in place.)

Trial 3 in a nutshell	
Trial type	Table-top and field (run in parallel to the large-scale European Civil Protection field exercise IRONORE2019)
General purpose	Enhancement of the preparedness and response to an earthquake disaster within Austria in an alpine region.
Participants	More than 100 people from 8 countries.
Research questions 	1. How to improve volunteer management, and in particular the process of managing spontaneous volunteers in terms of tasking, monitoring and locating volunteers working on the scene? 2. How to improve real-time data and information fusion to support incident commander decision making? 3. How to incorporate information from multiple and non-traditional sources (e.g. social media) so that this is of added value for decision-making, in particular for search and rescue operations in an earthquake crisis situation? 4. To which extent is psycho-social support (PSS) improving the awareness on psychological stress by crisis managers dealing with volunteers? 5. How to improve the interaction with the population / communication with the public during a large crisis? **Answers to these Research Questions can be found in Annex 5.3** Trial 3 – Austria**.**
Scenario outline 	The central area of Austria has been struck by a severe earthquake and subsequent heavy rain. The local region of Eisenerz (in Styria) is one of the most affected with missing persons, casualties, collapsed buildings, blocked roads, and endangered industries working with hazardous substances. Inhabitants have left their houses for fear of after-shocks and collapsing buildings. Lifelines such as water, food, shelter, transportation and medical care have been disrupted. Electricity and mobile networks have been severely damaged. All local and national emergency response organisations have been deployed on site (Austrian Red Cross, fire brigades, police and the army). However, due to the extension of the affected area and overwhelmed national response capacities, the Union Civil Protection Mechanism was activated. A request of international assistance was made

	with regards to medical treatment, water purification and search and rescue. Due to the difficulty of accessing the affected area and considering the impact of the disaster, there is an urgent need for humanitarian assistance and assessment. A large number of volunteers and rescue equipment is needed to cope with the increasing number of affected people i.e. for search and rescue operations, making shelter, providing medical care, water, food and transportation.
Solutions	**CrowdTasker** (AIT, Austria) enables informing citizens, eliciting contributions to the common operational picture by pre-registered parties and integrating efforts of self-organisation, which is achieved by issuing assignments and situational information to a selected crowd of citizens based on their location and skillset, as well as offering a chatbot interface for emergent groups to participate using their own organisational infrastructure (such as social media groups). **Airborne & Terrestrial Situation Awareness** (DLR, Germany) provides real-time aerial imaging to enhance situational awareness during major and large - scale disasters. Its four modules can be used as a complete system or separately enabling: (1) planning, deployment and monitoring of aerial missions, (2) acquisition and evaluation of aerial photographs in near real-time and transfer of aerial imagery via data link directly from the aircraft to a mobile ground station, (3) analysis of aerial imagery and generation of crisis information maps, (4) traffic analysis and route planning capabilities. **vieWTerra Evolution** (VWORLD, France) is a 4D Earth Viewer as well as a data & assets integration and development platform. It presents an ellipsoidal model of the Earth allowing its users to integrate their own precise datasets anywhere on the Globe, without any area coverage limitations, or to access data streams (imagery, cartography layers). **ASIGN** (AnsuR, Norway) supports the collection and communication of photos, videos, geo-texts, tracking, geo-zones, geo-alerts and assessment forms in a very bandwidth-efficient manner. Specifically, it can communicate photos and video with 99% bandwidth reduction, enabling communication even through low bandwidth cellular and satellite communication networks while maintaining full precision and accuracy. **Psychological First Aid** (Danish Red Cross, Denmark) is a one-day training course to practise the main skills needed to give good Psychological First Aid in a crisis situation. It addresses the internationally recognised principles of Look Listen Link, developed by the World Health Organisation (WHO).

The second version of the TGM (7) was made available during the Preparation phase of Trial 3, and until the Trial event the 9th version of the Trial Guidance Methodology Handbook had been issued. Moreover, the Trial Committee could take advantage of the Updated Workshop "0", which was held during Trial 3 Preparation phase.

The Test-bed achieved its mature shape before Trial 3 (and before its description was delivered as a DRIVER+ deliverable (12)) and all TTI's components were used.

At the time of Trial 3 execution, the TGT was sufficiently developed to be used and evaluated.

The Training module was not fully operational, but the Trial Committee had a possibility to take part in test trainings during the Updated Workshop "0".

The detailed descriptions of Trial 3 organisation and evaluation are provided in **D945.11 – *Report on Trial Action Plan – Trial 3*** (4) and **D945.12 – *Report on Trial Evaluation – Trial* 3** (21) (the reports are restricted to a group specified by the DRIVER+ consortium); a public summary is available on the project website (22) and in Annex 10.

2.2.4. Trial 4 – Trial The Netherlands

Trial 4, which was executed on 20-24/05/2019 at the premises of the Safety Region Haaglanden, was the third implementation of the DRIVER+ TGM and the Test-bed.

<table>
<tr><th colspan="2">Trial 4 in a nutshell</th></tr>
<tr><td>Trial type</td><td>Table-top</td></tr>
<tr><td>General purpose</td><td>Improvement of cooperation and coordination among agencies and organisations during severe flooding, using innovative solutions providing support in handling large scale and long-term crises.</td></tr>
<tr><td>Participants</td><td>37 practitioners from the Netherlands involved in data collection
140 participants from 13 countries in total</td></tr>
<tr><td>Research questions</td><td>1. How can simulation tools improve resource planning activities in large scale and long-term disaster operations?
2. How can net-centric data exchange improve information sharing between relevant parties and thus improve the shared understanding of the current situation?
3. How can simulation tools support the planning and management of a large-scale evacuation under consideration of real-time traffic information?
Answers to these Research Questions can be found in Annex 5.3 Trial 3 – Austria
Table A16: Results of fulfilment of DRIVER+ Gaps and answers for trialled Research Questions – Trial Austria
<table>
<tr><th>Gaps</th><th>Research questions</th><th>Sub-Research questions</th><th>Results</th></tr>
<tr><td rowspan="2">Volunteer Management
Insufficiencies in the management of spontaneous and affiliated volunteers at the crisis scene in terms of location, tasking, capabilities, and shift duration.</td><td>How can non-traditional information sources be used to be of added value to volunteer management with respect to managing an earthquake and heavy rain situation?</td><td>How much is CrowdTasker of added value to volunteer management with respect to managing an earthquake and heavy rain situation?</td><td rowspan="2">CrowdTasker(CT) generates the additional value related to the volunteer management with respect to managing an earthquake and heavy rain situation mostly through the ability to task volunteers as well as to receive reports with results of their actions and it is technologically operational to be used by volunteers. However, CrowdTasker doesn’t allow assigning tasks to specific individuals, nor having an automatic overview</td></tr>
<tr><td>Do socio-technical solutions improve the process of managing spontaneous volunteers in relation to accurate management</td><td>Does CrowdTasker solution improve the process of managing spontaneous volunteers in relation to accurate management procedure in terms of tasking, monitoring and</td></tr>
</table>
</td></tr>
</table>

			procedure in terms of tasking, monitoring and locating volunteers working at the scene?	locating volunteers working at the scene?	of the task's status. CrowdTasker demonstrates its potential in case of an urgent need for collecting information from population, including spontaneous volunteers. In this way CrowdTasker facilitates and extends an operational overview of the situation necessary for better decisions-making, however, with the mentioned above exception for individual tasking. Moreover, it should be noted that collaborating and communicating with emergent groups using the social media component (Telegram) has to be adopted by the tactical units (command language of tactical units is totally different to the language used in social media communication).
			*Combining answers, it may be concluded that results 3 in the context of the Gap (Volunteer management) shows that usage of CrowdTasker in the situation described in the Trial's set-up allows to **partly** close the Gap.*		
		Interaction with the population Improving the process of communication with the population, including e.g.: Micro-learning capabilities to	How can communication channels related to the earthquake event and actual crises situation be used to inform the public, and	How much can CrowdTasker properly use its communication channels related to the earthquake event and actual crisis situation to inform the public, and therefore	CrowdTasker demonstrates the potential to be used as a channel for early warning purposes. CT has the ability to send out related alarms/warnings as well as getting back alarms/warnings

		communicate to the population safety information and recommendations what can they do during a crisis. Registration of affected people. Delivering information from the public to the emergency management authorities.	therefore positively influence/impact the Crisis Management process?	positively influence/impact the Crisis Management process?	from the population. However, due to the fact that CT is a dedicated application which doesn't belong to any official or governmental organisation possessing information from monitoring systems, its usage for warning purposes is limited. The advantage of the CT is its full operability.
			What type of information has to be communicated (e.g. safety info, etc.) and what type of information has to be accepted (e.g. allow public to send emergency information, Registration of affected persons)?	What type of information has to be communicated (e.g. safety info, etc.) and what type of information has to be accepted (e.g. allow public to send emergency information, Registration of affected persons)?	CT enables bottom-up communication (such as from the spontaneous volunteers to the coordination unit/stakeholder). According to practitioners' opinion the acceptance of information is an issue for the CT at the moment (functionality to send clear alerts to staff at the entrance of a danger zone). CT lacks functionality for a proper verification of users which creates a risk of launching fake communication streams intentionally or unintentionally. Therefore, it seems to disturb the system easily. These restrictions result in limited usability of CT as a mean of communication.
			Combining answers, it may be concluded that results in the context of the Gap Communicating with the public during a large crisis shows that usage of CrowdTasker in the situation		

			*described in the Trial's set-up allows to **partly** close the Gap*.		
		Psycho-social support Lack of having the capability to measure stress and/or improve the communication and the awareness of psychological stress of those affected; especially spontaneous and affiliated volunteers.	Is psycho-social support improving the awareness on psychological stress by crisis managers dealing with volunteers?		Psychological First Aid training to team leaders increases their awareness about the stress faced by volunteers in emergencies. PFA demonstrates its potential to increase the key knowledge and skills of its participants. However, measuring exactly the added value is hard to define since some other factors need to be taken into consideration.
			Does the training with socio-technical solutions influence/affect the performance of tasks given to volunteers and related commanders?	Does Virtual Reality Psychosocial Support (VR PSS) training influence/affect the performance of tasks given to volunteers and related commanders? How much does it impact on the wellbeing after a response operation?	Comparison of the performance of tasks given to volunteers trained by VR PSS and those trained with the baseline does not show significant differences. However, participants expressed they were able to identify some signs of distress of the people who were performing the role playing (victims), but dispersion of the answers doesn't let to reliably conclude the result.
			*Combining answers, it may be concluded that results in the context of the Gap Psycho-Social support shows that usage of Psychological First Aid training in the situation described in the Trial's set-up allows to **partly** close the Gap*.		
		Real-time data and information fusion to support incident commander	Does ad-hoc generated data provide an adequate live update of the	Does the Airborne and Terrestrial Situational Awareness solution provide an	Information provided by the Airborne and Terrestrial Situational Awareness (ATSA) solution (e.g. high-

		decision-making Limits in the ability to merge and synthesise disparate data sources and models in real-time (e.g. visualisation of resources, spreading models, tactical situation, critical assets map, etc.) to support incident commander decision-making.	situation on the ground and enhance decision-making?	adequate live update of the situation on the ground and enhance decision-making?	quality photos) enhanced a proper understanding of an ongoing crisis situation. In this way ATSA supports the decision-making process, however, complete usability of ATSA for commanders in charge requires a special training on how to interpret the photos in order to recognise all various damages (for example: automatic photo/video analysing system for different types of damages).
			Does the fusion of multi-modal live data enhance the decision-making process during a crisis operation?	Does the 3D aerial data provided by the Airborne and Terrestrial Situational Awareness system shown by the 3D view from vieWTerra Evolution enhance the decision-making process compared to the traditional 2D view provided by ASIGN?	3D aerial data provided by the Airborne and Terrestrial Situational Awareness system shown by the 3D view from vieWTerra Evolution doesn't enhance the decision-making process in a sufficient way. According to practitioners in this particular Trial case the generated 3D view was characterised by too low resolution to make an appropriate benefit for the practitioners.
			Does the data fusion provide a better quality to assess the situation than the traditional legacy data models?	Does the Airborne and Terrestrial Situational Awareness map in its 2D view provide a better quality to assess the situation than the traditional	This question was not able to be answered since we didn´t manage to get Copernicus Map Data during the Trial.

				Copernicus map data?	
				Do the solutions provide interfaces for easy and understandable information exchange supporting the commanders in the field for managing an earthquake disaster?	Practitioners and observers for each tested solution (ATSA, CT, vieWTerra Evolution, ASIGN, PFA) positively or slightly positively rated their advantages which made completing task by commanders easier and (in most cases) faster which may suggest that situational awareness supported by solutions was more holistic and accurate. Additionally, the trial set-up allows to have a look for additional value to Crisis Management functions coming from the possibility of exchanging information among solutions. The results show that solutions which have user interfaces allowed in an easy way to exchange information (text, photos, videos) between commanders on the field and the commanders in the command centre to manage an earthquake.
				Are the solutions of added value in relation to sharing and communicating information (incl. decisions taken)	This question was not answered since the Austrian Red Cross was the only agency coordinating the “Command centre”

				within as well as across agencies and organizations involved to provide a common understanding of the actual earthquake situation?	on the Trial side.
			*Combining answers, it may be concluded that results in the context of the Gap Real-time data and information fusion to support incident commander decision-making shows that usage of Airborne and Terrestrial Situational Awareness system together with vieWTerra Evolution in the situation described in the Trial's set-up allows to **partly** close the Gap*.		
		Incorporating information from multiple and non-traditional sources Insufficiency in the ability to report dangerous areas and situation overview from multiple and non-traditional sources (e.g. crowdsourcing and social media) into response operations.	Do non-traditional or multiple information sources (e.g. social media) add value to decision-making in an earthquake crisis situation?	Is CrowdTasker able to take into account information from non-traditional or multiple information sources (e.g. social media) so that it is of added value for decision-making in an earthquake crisis situation?	CrowdTasker has the ability to use information from different non-traditional and multiple information sources to enhance the decision-making process of commanders in charge in the context of the earthquake scenario. CT supports the practitioners with additional information which is helpful to fulfil their tasks and to work as a team in a safe manner. It is able to collect information via dedicated application as well as using the Telegram App.
				How much is CrowdTasker of added value related to the enhancement and accuracy of the situational and operational	CrowdTasker generates the additional value related to the enhancement and accuracy of the situational and operational picture

			picture? Does it positively influence the search and rescue operations (e.g. speed, accuracy, etc.)?	mostly through the ability to use information from different non-traditional and multiple information sources. Secondly, by providing a benefit in bottom-up communication, especially launched by spontaneous volunteers who can provide and enrich the operational picture with their information (data, observations, etc.).
		*Combining answers, it may be concluded that results in the context of the Gap - Incorporating information from multiple and non-traditional sources) shows that usage of CrowdTasker in the situation described in the Trial's set-up allows to **fully** (with minor exceptions) close the Gap*.		

Annex 5.4 Trial 4 – The Netherlands.

Scenario outline	An extremely high tide at the coast coincides with an expected storm. On top of that there is a moderate probability of technical failure of the shipping lock at Scheveningen. A potential breach of the coastal defences at Scheveningen may result in the flooding of large areas of The Hague (with water depths up to 2 meters). Thousands of people are at risk of being trapped. The water inflow affects the vital infrastructure and result in loss of power, drinking water and heating in the area.
Solutions	**3Di** (Nelen and Schuurmans, the Netherlands) enables flood forecasting on the basis of a detailed model, among others: flooding locations, water depths, and water arrival times. **SIM-CI** (SIM-CI, the Netherlands) enables prediction of cascading effects on critical infrastructure (power, telecommunication and public transport). **Airborne and Terrestrial Situational Awareness** (DLR, Germany) enables an overview of actual flood state based on aerial images, route calculations to avoid the flooded area, provision of damage assessment maps in 2D and 3D based on the derived inundated area.

The second version of the TGM (7) was issued only during the Execution phase of Trial 4, however the Trial Committee could use the first five iterative versions of the Trial Guidance Methodology Handbook issued from 12/2018 to 5/2019. Moreover, during the Preparation phase the Updated Workshop "0" was held (6-9/11/2018), which was devoted i.e. to reinforce understanding and implementation of the TGM in Trial preparation as well as to share the Lessons Learned by Trial 1 (Poland) and Trial 2 (France) Committees.

Trial 4 was based on the second Test-bed reference implementation (11); hence all TTI components were used.

The TGT was available during the Execution phase, but the tool was not ready to be used for the Trial planning and execution.

The first (not fully operational) version of the TGM Training module was available – an online training was offered in 10/2018, a face-to-face training session was organised within the Updated Workshop "0" in 11/2018.

The detailed descriptions of Trial 4 organisation and evaluation may be found in **D946.11** ***Report on Trial Action Plan – Trial 4*** (18) and **D946.12** ***Report on Trial Evaluation – Trial*** **4** (19) (the reports are restricted to a group specified by the DRIVER+ consortium); a public summary is available on the project website (20) and in Annex 10.

2.2.5. Final Demonstration

The Final Demo, which took place on 25-29/11/2019 in Warsaw, Poland [The Main School of Fire Service (SGSP) and the Space Research Centre, Polish Academy of Sciences (SRC PAS)] and in The Hague, the Netherlands (The Safety Region Haaglanden), was designed to serve as a conclusive presentation of DRIVER+ products in action. In fact, the mature versions of TGM, TTI and TGT were used during the Final Demo preparation, execution and evaluation.

Final Demo in a nutshell	
Trial type	Table-top
General purpose	Improvement of cross-border communication, coordination and resource management between different organisations and agencies from different countries, in large scale and complex (multi-event) crises resulting of cascading effects.
Participants	37 practitioners from 14 countries involved in data collection 155 participants from 17 countries in total
Research questions	1. How to combine information from different operating actors to increase the EUCPT and the EUCP Modules situational awareness? 2. For this purpose, how to combine systematized reporting methods, communicators, GIS portals and a cloud data storage to improve information exchange? (EUCPT Common Information Space) 3. How to optimize communication between descending and ascending (taking over) EUCP Teams? 4. Can access to the EUCPT Common Information Space improve situational awareness of the ERCC? 5. How to optimise the EUCPT to ERCC situation reporting? 6. How can access to recent geoinformation data (i.e. satellite maps, aerial ortho-photomaps, 3D models) and related analytical products affect the decision-making processes of the EUCP Modules team leaders? 7. How to optimise access to such data and products? **Answers to these Research Questions can be found in Annex 5.5** Final Demo**.**
Scenario outline	Large-scale forest fires are spreading in a fictional non-EU country Driverstan. Since the domestic response capabilities are insufficient to cope with the emergency, Driverstan requests assistance from the EU Civil Protection Mechanism. The EUCPM is activated and as a consequence a EUCPT and six EUCP Modules from different European countries combat the fires and organise the evacuation of a large refugee camp. The ERCC coordinates the deployment and delivery of assistance.
Solutions	**CrisisSuite** (Merlin, the Netherlands) – solution tested within Trial 2

	**SOCRATES OC** (GMV, Spain) – solution tested within Trial 1 **Drone Rapid Mapping** (Hexagon Safety & Infrastructure, Poland) – solution tested in Trial 2 **vieWTerra Evolution** – solution tested within Trial 1 **Field Reporting Tool** (JRC) enables sharing of geo-referenced information from the field including multimedia content.

Since the two institutions leading the preparatory activities, the SRC PAS and the SGSP, were responsible for Trials coordination (SRC PAS) and validation of the TGM, the TTI and the TGT (SGSP) within the whole DRIVER+ project, they had the possibility to participate in the process of the TGM development, all phases of Trials 1 - 4 and collection of Lessons Learned from previous Trials. Additionally, the majority of Final Demo Trial Committee members had experience from participation in previous Trials.

The organisational aspects and the result of evaluation executed within the Final Demo may be found in **D947.11** ***Report on Trial Action Plan – Final Demo*** (23) and **D947.12** ***Report on Trial Evaluation – Final Demo*** (5) (the reports are restricted to a group specified by the DRIVER+ consortium). The Final Demo catalogue is available on the project website (24) and a short public summary is included in Annex 10.

2.3. An overview of the DRIVER+ Trials' results

Answers to the Research Questions, which are explored in the Crisis Management dimension, are influenced by the Trial and Solution dimensions. The Trial dimension is validated since it influences the practitioners' performance and through this generates an impact on collected data. All of these aspects, e.g. safety, good internet connection (if needed), the possibility of participating by all invited practitioners or clearness of the scenario, can interfere with the findings in the Crisis Management dimension. All aspects related to the actual run of the Trial need to be considered (generic and specific), written down and linked to the relevant KPIs. Similar to the Trial dimension, the Solution dimension also interferes with the Crisis Management dimension. To investigate an impact of the trialled solutions on Crisis Management (CM dimension), there is a need to assess the solutions preparation and performance towards their potential influence on the Crisis Management findings revealed during the Trial. To make this possible, the set of KPIs based on ISO 9241-11 and CM functions for each of the DRIVER+ Trials were taken into account. It clearly means that the results are valid for a particular Trial context and its organizational aspects. Naturally, a simulated reality always mirrors the Crisis Management reality only to a certain extent. Therefore, monitoring and measuring these aspects in Trial and Solution dimensions are crucial to assess if Crisis Management findings of a Trial are justified to be generalised to a broader context. A proper evaluation of the Trial and Solution dimension is crucial in order to identify potential biases generated during a Trial run, and further on to assess their impact on Crisis Management dimension findings. Besides, formulating sub-Research Questions is highly valuable since they enable to decompose each Research Question on more specific elements of such highly complex and complicated problems as Crisis Management processes in order to understand and analyse them in depth.

In this respect, making a complex Trial with more than one Gap and more than one solution may lead to the situation that the Trial is not always able to cover fully all the Gaps, find complete answers for all Research Questions or meet all objectives. Therefore, few of the Crisis Management (CM) Gaps and Research Questions are still open to be investigated further; however, the Trials at least put a new light on them in order to facilitate future surveys. All Gaps and related Research Questions from all Trials as well as the levels of achievement are presented in Annex 5 – Results of fulfilment of DRIVER+ Gaps and answers for trialled Research Questions (more details can be found in the respective evaluation reports **D943.12** (1), **D944.12** (2), **D945.12** (21), **D946.12** (19), **D947.12** (5) or in the public summaries of Trial 1 (15), Trial 2 (17), Trial 3 (22) , Trial 4 (20) and Final Demo catalogue (24), as well as in Annex 10.

3. Evaluation of Trial Guidance Methodology, Test-bed Technical Infrastructure and Trial Guidance Tool

The DRIVER+ Trials were events organised in order to evaluate:

- The Trial Guidance Methodology (TGM), the Trial Guidance Tool (TGT) as well as the Test-bed Technical Infrastructure (TTI) during all three Trial phases.
- The impact of the solutions used during the Trial on Crisis Management.

There was data collected in order to have a valuable evaluation which provides information needed for further improvement of the quality and usability of the DRIVER+ Test-bed, and to identify Lessons-Learnt after each Trial. In the following subsections the concept of the evaluation method is introduced (Sections 3.1, 3.2, 3.3, 3.4) and the Observer Support Tool used for data collection is described (Section 3.5). The important part of this section introduces results of the evaluation of the TGM, TGT and TTI made for all Trials (Sections 3.6, **Error! Reference source not found.**) as well as results of First Impression Evaluation made for the Final Demo (Section 0).

3.1. Evaluation method

In order to conduct the measures correctly, qualitative and quantitative indicators demonstrating the level of achievement reached were defined. Key Performance Indicators (KPIs) to quantify the added value of the Test-bed environment (TGM, TTI and TGT), and the respective solutions taking into account the EU added value, usefulness, scalability, modularity, reliability, innovation, affordability, cost-effectiveness, usability and validity.

Data collected for validation of the Test-bed environment (TGM, TTI, TGT) has come from the evaluation of:

- Use of the TGM (with description provided in **D922.21** ***Trial guidance methodology and guidance tool specifications (version 1)*** (6)**, D922.41** ***Trial guidance methodology and guidance tool specifications (version 2)*** (7) and finally, in the TGM Handbook **D922.42** ***Handbook for systematic designing of Trials*** (8) implemented within **WP922** ***Guidance Methodology and Guidance Tool***).
- Use of the TGT (supporting the application of the TGM, implemented within **WP933** ***DRIVER+ Online platforms***).
- Use of the TTI during execution of each Trial, where stakeholders were collaborated in trialling and evaluating impact of used solutions on CM.

To enable the formulation of conclusions regarding the Test-bed described above, it was important that the data, which had to be acquired and analysed, was independent from:

- Type and level of maturity of solutions which were evaluated during the Trial.
- Crisis Management procedures applied by practitioners during the Trial.
- Level of competence of practitioners being involved in the Trial.
- Level of competence of users of the methodology being involved in the preparation, execution and evaluation of the Trial.

The results of these evaluations were fed back to the respective WPs involved in improving the Trial Guidance Methodology (**WP922**), the Trial Guidance Tool (**WP933**) and the reference implementation of the Test-bed Technical Infrastructure (**WP923** ***Test-bed infrastructure***). The evaluation process in DRIVER+ concerns the application and utilisation of solutions. In Sections 3.2 - 3.3 the evaluation concept based on the three-dimension approach (Trial, Solutions and Crisis Management) is presented.

3.2. General approach to the Test-bed evaluation within Trials

From the perspective of a general approach to formulate conclusions independent of the Trials' constrains, data collected during the evaluation of the TGM, TTI and TGT was cross-analysed. A qualitative survey was conducted in which experts could give their opinions about the effectiveness and improvement of the Test-bed and its components (TGM, TTI, TGT). This qualitative data was transformed into quantitative parameters (KPIs) in order to use statistical methods to obtain valid conclusions.

Figure 3.1 shows the general evaluation method for analysing the effectiveness and usability of the Test-bed.

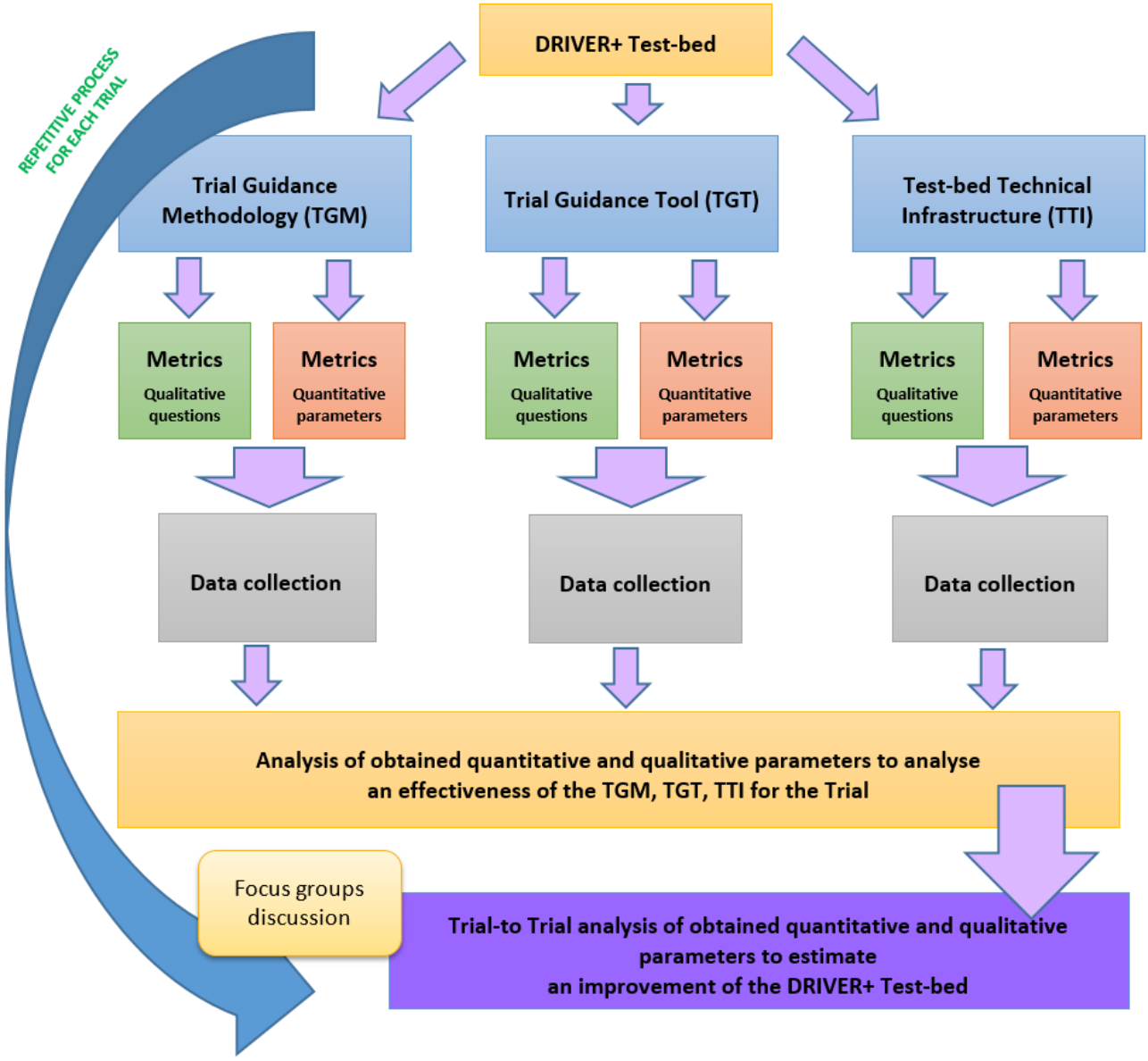

Figure 3.1: The general Test-bed evaluation approach

In Table 3.1 - Table 3.3 the scheme of the general survey for the evaluation of the Test-bed components is presented.

Table 3.1: Scheme of the general survey for evaluating the TGM component of the Test-bed

	Qualitative methods	Quantitative methods
Trial Guidance Methodology (TGM)	**Leading questions** • Does the Trial Guidance Methodology Handbook provide a systematic, easy to use and understandable step-by-step guidance to conduct Trials? • What is the improvement of the Trial Guidance Methodology Handbook from the last executed Trial (which stages/parts of methodology implementation process were influenced the most and how)? • What is the advantage of using the Trial Guidance Methodology Handbook for evaluating CM solutions within an appropriate environment?	
	Separate analysis among groups involved in preparation and execution of the Trial: • Trial Owner's crew. • End-users and practitioners. • Solution providers. • Guidance Tool designers[1]. • Test-bed Technical Infrastructure users (coordinator's crew). • Trial Guidance Methodology creators[1]. Research method used: • Semi-structured interviews (SI). [1] only collection of feedback from DRIVER+ consortium partners responsible for creation of each component of the methodology.	Definition and analysis of metrics (Key Performance Indicators - KPIs) appropriate for the design process (improving from Trial-to-Trial) of the Trial Guidance Methodology (TGM). Research methods used: • Comparative statistical analysis of metrics (responding to different Trials and different stages of Trials' preparation, execution and evaluation– see Figure 3.1). • comparative statistical analysis of results of the survey (selected questionnaire interviews' answers) Metrics have been measured by (or with) certain groups involved in preparation and execution of the Trial (Trial Owner's crew, Solution providers and End-users supported by Test-bed Technical Infrastructure coordinator's crew, Trial Guidance Tool creators), then collected and analysed.

Table 3.2: Scheme of the general survey for evaluating the TGT component of the Test-bed.

	Qualitative methods	Quantitative methods
Guidance Tool (TGT)	**Leading questions** • Does the Trial Guidance Tool support efficiently the TGM reflecting the step-by-step approach and making it easier to use? • What is an improvement of the Trial Guidance Tool from the last executed Trial (which elements of the tool were influenced the most and how)? • What is the advantage of using the Trial Guidance Tool for supporting the preparation process of the Trial?	
	Separate analysis among groups involved in preparation and execution of the Trial: • Trial Owner's crew. • End-users and practitioners. • Solution providers. • Trial Guidance Methodology Handbook	Definition and analysis of metrics (Key Performance Indicators - KPIs) appropriate for the design process (improving from Trial-to-Trial) of the Trial Guidance Tool. Research method used: • Comparative statistical analysis of metrics

	creators[1]. • Test-bed Technical Infrastructure users (coordinator's crew). Research method used: • Semi-structured interviews (SI). [1] only collection of feedback from DRIVER+ consortium partners responsible for creation of each component of the methodology.	(responding to different Trials and different stages of Trials' preparation, execution and evaluation – see Figure 3.1). Metrics have been measured by (or with) certain groups involved in preparation and execution of the Trial (Trial Owner's crew, Solution providers and End-users supported by Test-bed Technical Infrastructure coordinator's crew and Trial Guidance Methodology creators), then collected and analysed.

Table 3.3: Scheme of the general survey for evaluating the TTI component of the Test-bed.

	Qualitative methods	Quantitative methods
Test-bed Technical Infrastructure (TTI)	**Leading questions**	
	• Is the Test-bed Technical Infrastructure an appropriate environment for evaluating certain CM solutions? • What is an improvement of the Test-bed Technical Infrastructure from the last executed Trial (which elements of the environment were influenced the most a how)? • What is the advantage of using the specially prepared and created using Test-bed approach appropriate environment in perspective of evaluating CM solutions?	
	Separate analysis among groups involved in preparation and execution of the Trial: • Trial Owner's crew. • End-users and practitioners. • Solution providers. • Guidance Tool designers[1]. • Trial Guidance Methodology Handbook creators[1]. • Test-bed Technical Infrastructure users (coordinator's crew). Research method used: • Semi-structured interviews (SI). [1] only collection of feedback from DRIVER+ consortium partners responsible for creation of each component of the methodology.	Definition and analysis of metrics (Key Performance Indicators - KPIs) appropriate for the design process (improving from Trial-to-Trial) of the Test-bed Technical Infrastructure. Research method used: • Comparative statistical analysis of metrics (responding to different Trials and different stages of Trials' preparation, execution and evaluation – see Figure 3.1). Metrics have been measured by (or with) certain groups involved in preparation and execution of the Trial (Trial Owner's crew, Solution providers and End-users supported by Trial Guidance Tool creators and Trial Guidance Methodology creators), then collected and analysed.

3.3. Specific approach to the Test-bed evaluation within Trials

The general approach to the evaluation of the DRIVER+ Test-bed approach presented in Section 3.2 looks the most solid. However, the amount of to be collected data was too huge given the time restrictions. Besides, as explained before, the components of the Test-bed were not fully developed yet at the beginning of the evaluation process as their maturity were iteratively increased with each Trial. Therefore, a simplified procedure based on the general approach has been conducted. The basis of this procedure is presented in this section.

Table 3.4 shows the conditions of the specific survey for the DRIVER+ Test-bed evaluation approach. It contains information about:

- Which elements of the Test-bed were evaluated?
- Who was questioned to collect the data?
- When was the evaluation data collected?

The connections of these aspects mentioned above to the 3-dimension evaluation of the Solutions-in-Trial activities, as part of the TGM approach, are presented in Table 3.5.

Finding the set of initial KPIs measuring the performance of the TGM, TTI and TGT against existing methodologies was challenging due to the fact that there is no standardised (baseline) methodology for Crisis Management capability development based on systematically conducted trials and evaluation of solutions within an appropriate testing environment. In this area DRIVER+ presents an innovative and pragmatic approach. Additionally, differences existing among CM systems functioning in different EU countries together with dissimilarities among organisational systems of certain services (fire brigade, police, emergency service, etc.) made the comparison of KPIs' values very difficult and less reliable.

Therefore, it was proposed to focus on measuring subjective (from the perspective of the respondents, users of the TGM, TTI and TGT components) metrics (KPIs) which measurement lead to an objective analysis of its usage performance. The objective of this measurement is to answer the question "How much does the Test-bed approach (together TGM, TTI and TGT) improve:

- Resources (both human and physical) management,
- Time management,
- Cost management,

in comparison to the methodologies used in your country or organisation for conducting trials/exercises?".

Subjective metrics were measured using the semi-structured interviews (SI) technique. For most of the questions a five-point Likert scale (from -2.0 to 2.0) was used. Additionally, focus group discussions were conducted to collect experiences and lessons learned regarding the Test-bed components improvement after each Trial.

Table 3.4: Conditions of the specific (cross-Trial) survey for evaluating the Test-bed (TGM, TTI, TGT).

	Evaluation aspects
What can be evaluated?	DRIVER+ Test-bed consist of: • Trial Guidance Methodology (TGM) Handbook (and its preliminary versions), • Guidance Tool (TGT), • Test-bed Technical Infrastructure (TTI).
	Conclusions: • Each component of the Test-bed was evaluated varying templates corresponding to the features of the component.
How can be evaluated?	For evaluation of each component of the Test-bed a **Semi-structured interview (SI)** and a **Focus group (FG)** were used.
	Conclusions: Semi-structured interviews were conducted using the questionnaire technique, with individual questionnaires (focused on different aspects) prepared for each group of respondents. The Focus groups were used as a supportive method to continuously collect feedback (to check mutual understanding) from each group of respondents.
Who may be asked?	Group of respondents: • **Participants**: invited people actively taking part in Trials (end-users/practitioners, solution providers) who received training on the Test-bed approach (TGM, TTI, TGT).

	• **Validators**: DRIVER+ consortium members using the Test-bed (Trial Committees). • **Observers**: Outside CM and technical experts assisting the validators through the observation and report of interesting moments. Observers have learnt the approach proposed by the Test-bed as well as the description, role and functionality of each trialled solution.
	Conclusions: Semi-structured interviews (questionnaires) were tailored accordingly to the knowledge of each group of respondents to measure different aspects (features) of each component of the Test-bed. Questions asked have been focused on: • **Usability, validity, pragmatism, logic, affordability, difficulties in use** and **measurement of subjective KPIs** during surveys (SI) among **Validators**. • **Credibility, affordability and cost-effectiveness, reliability, EU added value, innovation, scalability** and **Trial-To-Trial improvement** as well as **measurement of subjective KPIs** during surveys (SI) among **Observers**. • **Intuitiveness, intelligibility, value, ease, innovation** during surveys (SI) among **Participants**.
When evaluation data can be collected?	Time (date) of surveys: • Preparation phase – **SI** during Dry Runs 2 of each Trial. • Execution phase – **SI** and **FG** during execution of each Trial. • Evaluation phase – **SI** after Trial evaluation process.
	Conclusions: • After certain steps of the survey (SI), results were discussed with FG (consisting of Observers and users of the Test-bed selected by the respective Trial Owner) and shared among DRIVER+ consortium members.

In Annex 2 – Evaluation survey results for Trials 1 - 4 questions asked within the Semi-structured interview (SI) are presented. These questions asked during the individual interviews, besides KPIs measurement, pointed to difficulties encountered by the:

- Trial Owners during the Preparation/Execution/Evaluation phase of the Trial.
- Solution providers during the Preparation and Execution phase of the Trial.
- Participants during the Execution phase of the Trial.

Table 3.5: Evaluation concept of Trial activities using the 3-dimensional TGM approach.

Respondents	**EVALUATION DIMENSIONS**		
	TRIAL (quality of organisational issues of the Trial and technical/Test-bed difficulties)	**CRISIS MANAGEMENT** (metrics refer to Research Questions)	**SOLUTION** (measurement of the quality and usability of each solution)
Validators (users of the TGM, Trial's Committees) **INTERNAL**	**Measures:** • TECHNICAL DIFFICULTIES of Trial conduction. • INTERNAL CONSTRAINTS that may influence Trial results.		
	Techniques: • Semi-structured questionnaires (SI)		

Participants (practitioners and end-users have learned solutions) **EXTERNAL**	**Measures:** • SATISFACTION. • EASE and UNDER-STANDING of organi-sational procedures. • TECHNICAL BARIER level. • Fulfilling of EXPECTATIONS and NEEDS. • ETHICAL aspects.	**Measures:** • RESEARCH QUESTIONS oriented survey (opinion, qualitative data) – after the Trial.	**Measures (of solution):** • • USABILITY. • INNOVATION. • EU ADDED VALUE. • INTUITIVENESS. • • USER FRIENDLINESS.
	Techniques: • Semi-structured questionnaires (SI).	**Techniques:** • Semi-structured questionnaires (SI).	**Techniques:** • Semi-structured questionnaires (SI).
Observers (CM experts have learned the TGM approach) **EXTERNAL and INTERNAL**	**Measures:** • ORGANISATIONAL DIFFICULTIES of Trial conduction • EXTERANAL CONSTRAINS and CONDITIONS may influence Trial results	**Measures:** • RESEARCH QUESTIONS oriented survey (opinion, qualitative data) – after the Trial • CM oriented KPIs MEASURMENT (during the Trial)	
	Techniques: • Semi-structured questionnaires (SI) • Prolong observation during Trial (Observer support tool)	**Techniques:** • Semi-structured questionnaires (SI) • KPIs measurement	
Observers (technical / technology experts have learnt solutions) **EXTERNAL and INTERNAL**	**Measures:** • TECHNICAL DIFFICULTIES of Trial conduction • EXTERANAL CONSTRAINS and CONDITIONS may influence Trial results		**Measures:** • SOLUTION oriented survey (opinion, qualitative data) – after the Trial • SOLUTION oriented KPIs MEASUREMENT (during the Trial)
	Techniques: • Semi-structured questionnaires (SI) • Prolong observation during Trial (Observer support tool)		**Techniques:** • Semi-structured questionnaires (SI) • KPIs measurement

For each Trial evaluation of the TGM, TTI and TGT by using qualitative and quantitative indicators, demonstrating the level of achievement reached was also essential. Key Performance Indicators (KPIs) were defined to find the added value of the DRIVER+ Test-bed methodology and its components concerning: *EU added value, usefulness, scalability, modularity, reliability, innovation, affordability, cost-effectiveness, usability* and *validity*. These KPIs values were extracted from answers collected within the Semi-structured interview (SI). KPIs have been mapped to certain questions and average values from the ratings for each KPI on the aforementioned 5-point Likert scale. In Annex 3 – Mapping of the Key Performance Indicators (KPIs) for evaluation survey's questions the mapping of KPIs to SI questions is presented. Some general questions from the survey were not ascribed to any KPI.

3.4. First Impression Evaluation of the Final Demo

The Final Demo was focusing on demonstrating the efficiency offered by DRIVER+ outcomes - the innovative solutions that were tested could improve the situation assessment of the involved practitioners. To assess the improvement of practitioners' response at the European level and Crisis Management capabilities resulting from the use of integrated DRIVER+ solutions according to the Description of Work (DoW), the First Impression Evaluation (FIE) was designed and implemented.

Methodologically the FIE was based on a modified version of cost-benefit analyses methods. Typically, in this method both, the cost and benefit, are owned by the same stakeholder. For the FIE purposes it was slightly changed. The cost is incurred by one stakeholder while the benefit is gained by another one. For example, in case of a communication flow process somebody produces information bearing the costs of the information production and transmission as a sender, and then a receiver is benefiting from having this information and using it for his/her purposes. So, in practical words, the modification boils down to the fact that the *sender/producer* of an information devotes some effort (cost e.g. time, energy, wisdom, etc.) to generate this particular product while the result *(benefit e.g. good quality report is easier to be analysed by the receiver)* is obtained by another actor, a *receiver*. The information products which were validated by the practitioners in the innovation line and baseline runs of the FD differ from one to another. The information products were as follows (5):

1. Info package of briefing materials (incl. support e.g. visualisations in innovative solutions) generated by the ERCC *(sender)* and provided to the EUCPT *(receiver)* before deployment to a CP mission.
2. Daily SitRep generated by the EUCPT *(sender)* and provided to the ERCC *(receiver)* after 1-st and 2-nd day of the Trial.
3. Briefing materials (incl. support e.g. visualisations in legacy solutions used in the baseline run and innovative solutions used in the innovation line run) generated by the EUCPT *(sender)* and provided to the Team Leaders of in-coming CP Modules *(receivers)* in the baseline run and innovation line run.
4. Status update materials (incl. support e.g. visualisations in legacy solutions used in the baseline run and innovative solutions used in the innovation line run) generated by the Team Leaders *(senders)* of CP Modules and provided to the EUCPT *(receiver).*

The measured quantities were as follows:

- The dedicated effort (cost) of the sender/s to create and transmit the information product.
- The result *(benefit)* gained by the *receiver/s* out of the information product.

These quantities were collected for seven different criteria (the same criteria for *effort* and *result*): *usability, editability, formatting, searchability, structure, visualisation and relevance*. For each criterion the reference data (relevant for the baseline) and innovative data (relevant for the innovation line) were collected using questionnaires filled by the practitioners in the Observer Support Tool (OST). Each criterion was coded in a form of question/s. The questions were tailored appropriately to the practitioner's role in the surveyed information management process, depending on if a practitioner was a *sender* or a *receiver* of a particular information product. The practitioners were requested to assess their answers in an interval quotient scale from 1 to 10 for each criterion (question/s). The collected data were transferred to the After-Action Review tool which generated relevant visualisation of the results in form of graphs.

Since there was no baseline run on the strategic level, the *reference data* for these cases were revealed prior the Trial on the base of the practitioners' experiences in real missions and civil protection exercises. The practitioners completed questionnaires assessing their mental representation of trialled information products on the base of their experiences with legacy tools in real civil protection missions and exercises. For strategic level the *innovative data* were collected after respective sessions conducted in the Trial. Answering the questionnaires for the innovation line run, the practitioners were equipped with prior collected individual *reference data* in order to provide them a reference point for each of the assessed criteria for the innovation line. Therefore, the strategic level cases were assessed in a form of so-called *dependent groups* (the same practitioners provide reference and innovative data).

A more detailed description of the FIE method can be found in **D947.12** (5).

3.5. The Observer Support Tool's collected data

The semi-structured questionnaires were used to collect data based on participations and observations during all DRIVER+ Trials. All participants (Practitioners and Observers) involved in the Trials were given the opportunity to complete such questionnaires. The results of the completed questionnaires were collated by using the Observer Support Tool (OST). The OST was developed within the DRIVER+ project by one of the project's partner (ITTI) and the OST software is available at https://github.com/DRIVER-EU/ost.

Within the questionnaire, respondents were first asked to fill in personal information, and to provide their expert opinion about the Trial. Participation in this questionnaire was voluntary. All responses remained confidential and data was always presented anonymously.

In each Trial, there were a couple of multiple groups of experts were participating. Apart from solutions providers, organisers and technical staff, there were practitioners who are actual users of the tested solutions and observers whose major task was to evaluate the solutions and their usability in the simulated situation and the potential application in CM organisations. They observed the requested actions on an ongoing basis, so as to provide the data for the Trial evaluation, provide feedback regarding observed organisational difficulties of the Trial execution, and external constrains that may influence the Trial results. In the Preparation phase, the Evaluation Coordinator prepares a list of questions and checklists to be implemented in the OST. All the answers were stored, including the information about the Trial name, stage, observers' roles and timestamps. After the Trial Execution phase, the collected data was analysed and disseminated.

The evaluation survey was made separately for each Trial and for each phase of the Trial. The important constraint of this activity was the fact, that the OST as well as the evaluation approach of the Test-bed were developed together during the DRIVER+. Especially for Trials 1 and 2 the OST was not yet functioning adequately. That was a reason for postponing parts of the data collection for the survey from the planned date (during the Dry Run 2, just after the Trial, etc.) to a later point in time. The dates of each survey for all Trials and their phases are presented in Table 3.6.

Table 3.6: Dates of each survey, for all Trials and phases, made with use of the OST.

	Trial 1		Trial 2		Trial 3		Trial 4	
	Start	end	start	end	start	end	start	end
Preparation	24/04/ 2019	10/04/ 2019	24/04/ 2019	10/04/ 2019	17/05/ 2019	17/06/ 2019	10/04/ 2019	17/04/ 2019
Execution	10/05/ 2019	17/05/ 2019	10/05/ 2019	17/05/ 2019	22/09/ 2019	22/10/ 2019	24/05/ 2019	24/06/ 2019
Evaluation	17/05/ 2019	24/05/ 2019	17/05/ 2019	24/05/ 2019	After delivery of **D945.12** (18)	2 weeks after delivery of **D945.12** (18)	After delivery of **D946.12** (17)	2 weeks after delivery of **D946.12** (17)

Results of the evaluation surveys are presented in Annex 2 – Evaluation survey results for Trials 1 - 4. The analysis of the answers given are broadly presented and discussed in Section **Error! Reference source not found.**.

3.6. Implementation of focus groups method and its results

This evaluation encompasses experiences on DRIVER+ Test-bed implementation gained during of Trials 1-4 in a form of a Focus Group Interview supported by Mentimeter[2].

Qualitative research methods concentrate on identifying and describing certain problems, without going deeper into the scope or frequency of their occurrence. The methods allow describing a studied problem in categories of "how" and "why". One of the frequently used research techniques in the field of social sciences is Focus Group Interview. This technique is also used successfully in marketing research as well as in consulting processes. This technique takes the form of a group discussion conducted by an experienced moderator based on an interview scenario. A moderated interview is usually conducted with the participation of 8-12 people, taking into account the variety of the group (25), (26), (27).

Focus group interview methodology consists of five steps (presented in more detail in Figure 3.4, own elaboration based on (25)).

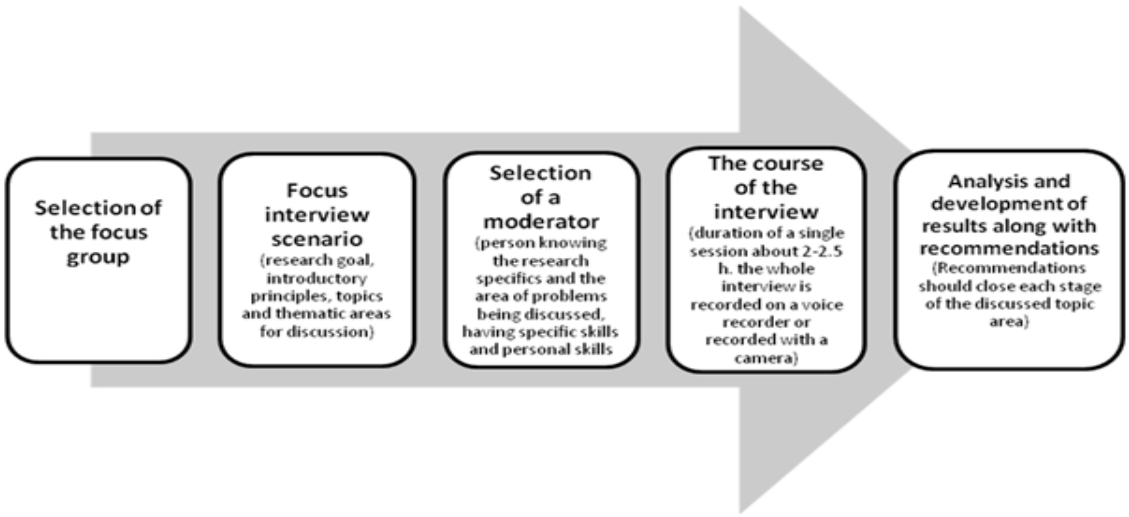

Figure 3.2: Chronology of focus group interview construction and implementation

The presented steps indicate the whole idea of the focus group methodology. From the perspective of organized focus group workshops, the activities carried out by the team responsible for preparing, conducting and analysing focus group consisted of two parts:

- Part one – presenting the organizational assumptions by the moderator (content regarding this part is available to all participants of the workshops).
- Second part – asking open questions and closed questions using the Mentimeter tool and running a discussion panel by the moderator based on the focus group scenario containing substantive assumptions (material is only available for the moderator). Each part of the discussion panel was completed with recommendations.

As a general rule after each Trial the Focus Group Workshop gathered key personnel of each Trial, representing at least the main stakeholders such as the Practitioners, the Solution providers and the Trial owner. All the workshops were led by the same moderator in order to ensure consistency and coherency of the evaluation approach all over the Trials. The moderator was supported by two persons (recording the findings of the discussions). The rest of the participants were contributing with their answers and

[2] Mentimeter is available for use by everyone on the website https://www.mentimeter.com/

discussions to the workshop. The group of contributors consisted of the Trials' Committee Members (Trial Owner, Test-bed Technical Infrastructure Coordinator, Solutions Coordinator) but also other people deeply involved in the Trial Preparation and Execution phases like solution providers, **SP94** leaders and last but not least Technical Project Leader.

For each Focus Group closed and open questions were formulated on the base of the most often raised concerns on the TGM and TTI implementation during recent Trial(s). The future topics for the next Trial Focus Group Workshops have been also identified on the base of the results from the questionnaire surveys on the implementation of Preparation, Execution and Evaluation phases of the most recent Trial.

The main results and conclusions coming from all Trials' focus groups and Final Demo discussion are:

- For most practitioners (~90%) participating in/preparing Trials the DRIVER+ Test-bed is a complex environment with potential for finding innovation in CM.
- The DRIVER+ Test-bed enables to collect sufficient data to answer Research Questions asked for closing the CM Gaps.
- The most advantages of the DRIVER+ Test-bed are its scalability, innovative approach, validity and modularity; however, the cost-effectiveness seems to be its disadvantage.
- The TGM Handbook is a handful document where Practitioners as a priority look for precise descriptions of procedures for each TGM phase as well as examples of the TGM practical implementation.
- The TTI is a tool which is highly helpful for Practitioners in the Trial preparation and conduction.
- Practitioners believe that for identified CM Gaps the best way is to test new solutions by organising the Trial by their own organisation.
- The TGM seems to be the most challenging in creation of an appropriate data collection plan for solution evaluation.

A full description of the focus groups' results can be found in Annex 7 – Results of focus group interviews for Trials 1 - 4 and the Final Demo discussion.

3.7. Comparison of evaluation survey results from Trial to Trial

The KPIs (EU added value, usefulness, scalability, modularity, reliability, innovation, affordability, cost-effectiveness, usability and validity) were calculated in the way described in Section 3.4. Figure 3.3 present the resulting values of these KPIs measured on the 5-point Likert scale (from -2.0 to 2.0) for all survey's corresponded questions (overall) for each Trial. Taking into account the average value for all four Trials and all Trial phases, the respondents assessed positively all KPIs. The best evaluated features were modularity and scalability, the least – cost-effectiveness and affordability.

The KPIs' evaluation results dedicated separately for consecutive Trials are presented in Annex 4 – DRIVER+ Test-bed's KPIs evaluation results of particular Trials. All these evaluation results correspond fully to those, which were presented in Annex 7 – Results of focus group interviews for Trials 1 - 4 and the Final Demo discussion. However, another reference point of view is used (related to Trials). A full description of the KPIs evaluation results measured from Trial to Trial together with their interpretation can be found in Annex 8 – Detailed result of comparison of evaluation survey results from Trial to Trial (KPIs measurement).

The average value of all KPIs related to all Trial phases for four consecutive Trials rose constantly with exception of Trial 2 (Figure 3.4).

This indicates the improvement of DRIVER+ outcomes from Trial to Trial. The exception of Trial 2 may be explained by the fact, that at the time of preparation and execution of Trial 1 the description of the TGM was not yet available, as well as the mature version of the TTI and TGT, hence the Trial 1 Committee and other respondents involved in the Trial assessed the idea of trialling rather than the real features of the methodology and its elements. These were evaluated for the first time during the Trial 2.

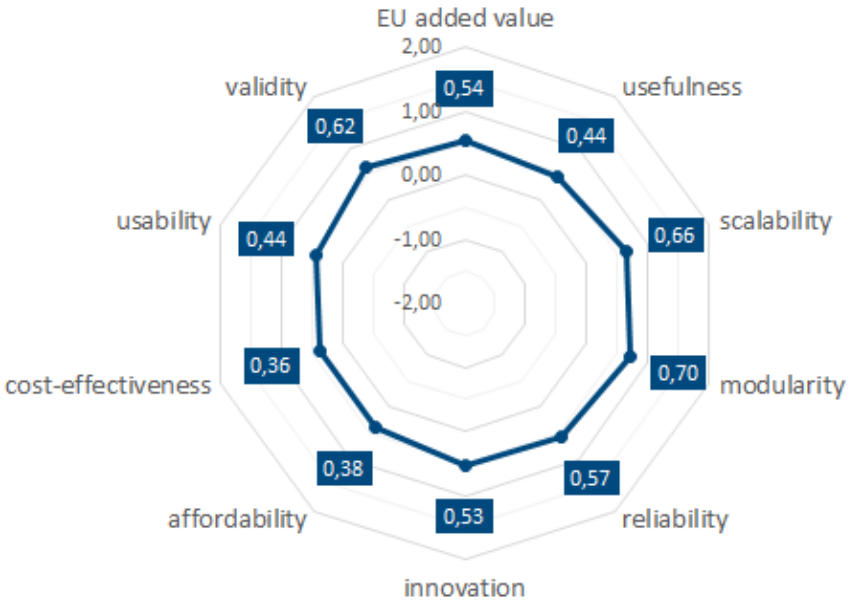

Figure 3.3: KPIs' average values of all Trials and Trial phases

Please note that in Figure 3.4 – Figure 3.7 the Trials are ordered chronologically instead of numerically to provide a better visualisation of changes/improvements over the duration of the project.

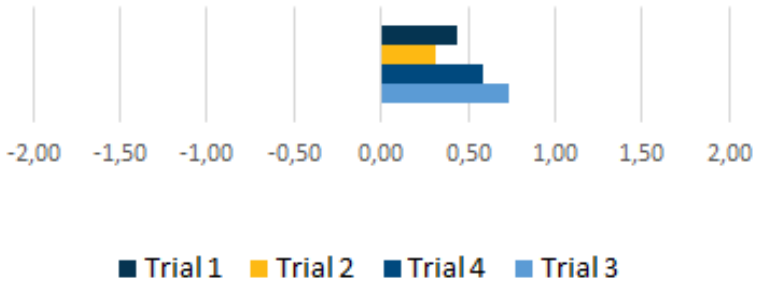

Figure 3.4: Average values of all Trial phases' KPIs for four consecutive Trials

3.7.1. Evaluation of TGM, TTI and TGT throughout Trial phases

All results presented in this section are based on evaluation surveys of all four Trials (see more in Annex 2 – Evaluation survey results for Trials 1 - 4).

Figure 3.5 presents values of the Test-bed evaluation indicators calculated for the Preparation phase for Trials 1 - 4 separately for the TGM, TTI and TGT. The TGT evaluation indicator was assessed as positive for Trial 1 (1.18) and neutral for Trial3 (-0.01), it has not been assessed for Trials 2 and 4. The TTI evaluation indicator was assessed as positive for Trials 1, 3 and 4 (0.32, 1.10 and 0.68 respectively) and negative for Trial 2 (-0.77). The TGM evaluation indicator was assessed as positive for Trials 1, 3 and 4 (0.45, 0.68 and 0.71 respectively) and negative for Trial 2 (-0.36).

The results prove high expectations put on the TGT in the context of Trial 1 preparation while the Trial was mainly realized based on the conceptual version of DRIVER+ tools. High challenges related to preparation of

Trial 1 determined by low maturity level of the DRIVER+ tools, intensified the need of a concrete tool facilitating planning and preparation of a Trial, which would meet the initial version of TGM. Therefore, the TGT is highly rated for Trial 1 Preparation phase. Furtherly, due to the relatively low maturity level of the TGT till the late stage of the project realization, it has not been used at all in Trials 2 and 4, while during the Preparation phase of Trial 3, only to a limited extent.

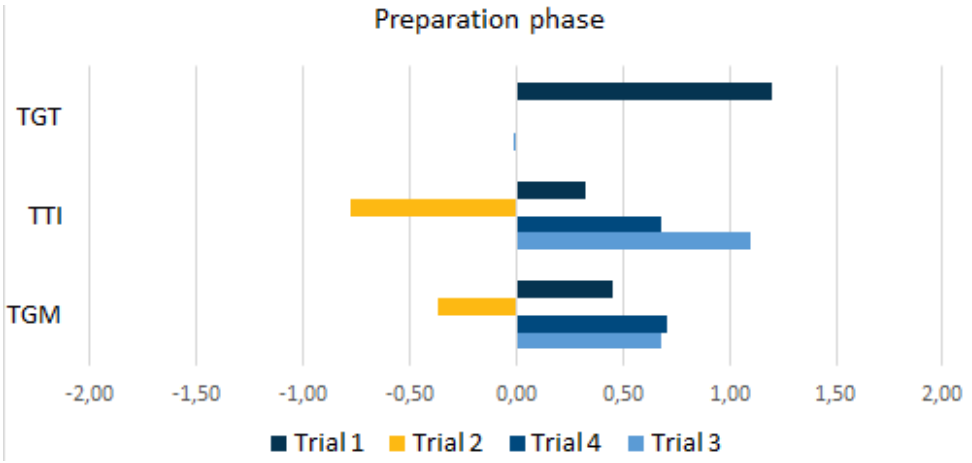

Figure 3.5: Test-bed evaluation indicators for Preparation phase for Trials 1 - 4

In general, all of the DRIVER+ tools present a tendency to increase in ratings for the Preparation phase from Trial to Trial, besides Trial 2. The reason for the lower ratings in case of Trial 2 could be psychological phenomena of disproportions between expectations and reality. It means that Trial 1 was prepared mainly on the basis of the promising concept of the DRIVER+ tools. Then for Trial 2 there were actually first practical, initial versions of the tools utilised which were perceived rather not so much helpful in the process of the Trial preparation. After that, as the DRIVER+ tools (TGM, TTI and TGT) were developed in the course of the project, based on the Trial to Trial iterative approach to their professionalization, the ratings went up providing arguments for their potential to support the preparation of Trials in a satisfactory manner. Figure 3.6 presents values of the Test-bed evaluation indicators calculated for Execution phase for Trials 1 - 4 separately for the TGM and TTI. The survey did not include questions corresponding to the TGT, as the scope of functionalities of this component covers mainly the preparatory activities. The TTI evaluation indicator was assessed as positive for Trials 2, 3 and 4 (0.38, 1.10 and 0.62 respectively) and neutral for Trial 1 (-0.15). The TGM evaluation indicator was assessed as positive for Trials 2, 3 and 4 (0.84, 0.91 and 0.58 respectively) and neutral for Trial 1 (0.09).

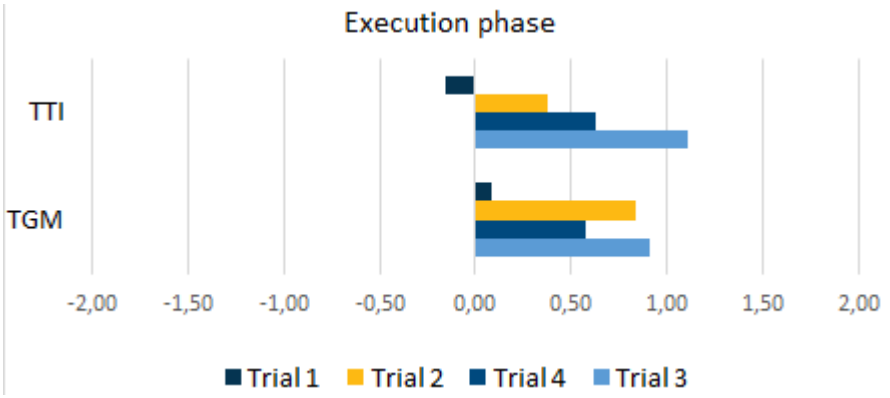

Figure 3.6: Test-bed evaluation indicators for Execution phase for Trials 1 – 4

During Trial 1 execution the TTI was at a very initial stage of development, hence this component was used only to a limited extent. Therefore, the score for Trial 1 is neutral in this respect - mainly based on assumptions of the respondents. This significantly changes when TTI founds its application in further Trials. Then the results turn into positive and grow from Trial to Trial, what is a good sign for the development

process of the tools benefiting from Lessons Learned from earlier Trials and confirms the iterative approach implemented in the project.

Figure 3.7 presents values of the Test-bed evaluation indicators calculated for the Evaluation phase for Trials 1 - 4 separately for the TTI and TGM. The TTI evaluation indicator was assessed as negative for Trials 1, 2 and 4 (-0.50, -0.67 and -1.00 respectively) and positive for Trial 3 (1.50). The TGM evaluation indicator was assessed as positive for all Trials 1 – 4 (0.39, 0.87, 0.95 and 1.04 respectively).

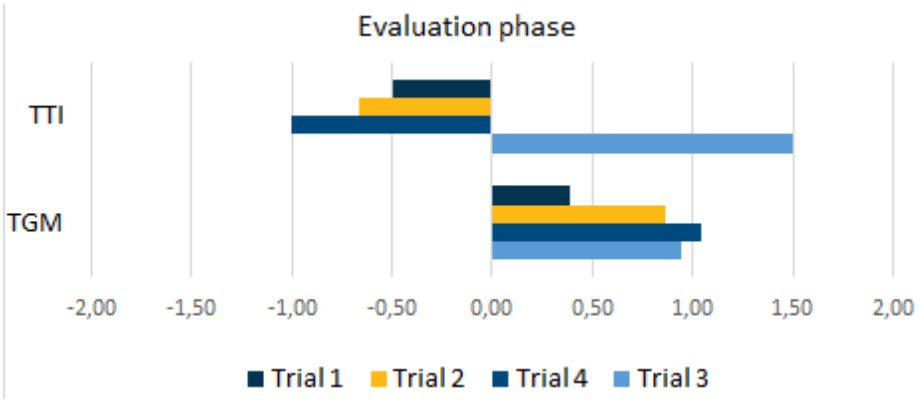

Figure 3.7: Test-bed evaluation indicators for Evaluation phase for Trials 1 – 4

The TGT is mainly used for Trial preparation; therefore, an assessment for the Evaluation phase is not reasonable. As it comes to TTI, the results suggest its highly supportive role for big scale Trials, in which tracing and recording data is up most demanding due to complex, and remote setups of the Trial venues. In such cases having data collected automatically by the TTI, or at least having transferred data collected by observers working in remote areas, constitutes a value. Therefore, Trial 3 was assessed the highest in this respect. The TGM presents constantly increasing tendency of the ratings what reflects the constant improvement of its status in respect to being helpful for evaluation purposes.

TGM is perceived as a more supportive tool for Evaluation phase than TTI. The reason for these scores could be that the TGM is a tool which guides the Trial team how to deal with evaluation while TTI is providing data for that process (e.g. by Observer Support Tool). The provision of the data from TTI is somehow “hidden” in the evaluation process while the most engaging part of this phase focusses on data analyses. In this respect the TGM is perceived as more valid tool.

KPI analysis results coming from DRIVER+ Test-bed Trial to Trial evaluation are:

- The overall value of the "**EU added value**" KPI of the DRIVER+ Test-bed was assessed for each Trial (1 to 4) as positive. The lowest rate (0.27) was measured for Trial 2; the highest rate (0.77) was measured for Trial 4 (in -2.0 to 2.0 scale).
- The overall value of the "**usefulness**" KPI of the DRIVER+ Test-bed was assessed as positive for Trials 1, 3 and 4 and as close to neutral for Trial 2. The lowest rate (0.12) was measured for Trial 2; the highest rate (0.64) was measured for Trial 3 (in -2.0 to 2.0 scale).
- The overall value of the "**scalability**" KPI of the DRIVER+ Test-bed was assessed for each Trial (1 to 4) as positive. The lowest rate (0.25) was measured for Trial 2; the highest rate (1.16) was measured for Trial 3 (in -2.0 to 2.0 scale).
- The overall value of the "**modularity**" KPI of the DRIVER+ Test-bed was assessed for each Trial (1 to 4) as positive. The lowest rate (0.49) was measured for Trial 1; the highest rate (1.02) was measured for Trial 3 (in -2.0 to 2.0 scale).
- The overall value of the "**reliability**" KPI of the DRIVER+ Test-bed was assessed for each Trial (1 to 4) as positive. The lowest rate (0.29) was measured for Trial 1; the highest rate (0.96) was measured for Trial 3 (in -2.0 to 2.0 scale).
- The overall value of the "**innovation**" KPI of the DRIVER+ Test-bed was assessed for each Trial (1 to 4) as positive. The lowest rate (0.13) was measured for Trial 2; the highest rate (0.84) was measured for Trial 1 (in -2.0 to 2.0 scale).
- For all Trials (1 to 4) the overall value of the "**affordability**" KPI of the DRIVER+ Test-bed was assessed as positive. Overall the lowest rate (0.23) was measured for Trial 1; the highest rate (0.64) was measured for Trial 3 (in -2.0 to 2.0 scale).
- The overall value of the "**cost-effectiveness**" KPI of the DRIVER+ Test-bed was assessed for each Trial (1 to 4) as positive. The lowest rate (0.07) was measured for Trial 4; the highest rate (0.71) was measured for Trial 2 (in -2.0 to 2.0 scale).
- For all Trials (1 to 4) the overall value of the "**usability**" KPI of the DRIVER+ Test-bed was as positive. The lowest rate (0.14) was measured for Trial 2; the highest rate (0.59) was measured for Trial 3 and Trial 4 (in -2.0 to 2.0 scale).
- The overall value of the "**validity**" KPI of the DRIVER+ Test-bed was assessed for each Trial (1 to 4) as positive. The lowest rate (0.41) was measured for Trial 2; the highest rate (0.97) was measured for Trial 3 (in -2.0 to 2.0 scale).

3.8. Final Demo - First Impression Evaluation

The Final Demo (FD) results in the area of the CM dimension contain the First Impression Evaluation (FIE) on the tasks deployed by the ERCC and the EUCPM, as well as, the baseline and innovation line executed in parallel on the level of the Modules. The results presented in **D947.12** (5) and elaborated on below mainly cover the FIE results as well as the innovation line results. Before each FIE session the Trial participants involved in either the ERCC or EUCPT were asked to assess their experience on the requested information products from their perspective (producers or recipients).

This assessment refers to the efforts needed to prepare information (from the producer's perspective) and the benefits gained through the information product (from the recipient perspective). The assessment covers eight criteria being *usability, editability, formatting, searchability, structure, visualisation*, and *relevance*. For each criterion and each perspective dedicated questions have been formulated, reviewed by the involved practitioners and rephrased accordingly. More precisely described results of the FIE of FD can be found Annex 9 – Final Demo – detailed results of the First Impression Evaluation as well as in **D947.12** (5).

The main results and conclusions coming from FIE of the Final Demo are:

- *Episode 1*: For the preparation and sharing of the initial briefing documents by the ERCC to the EUCPT the efforts appear to be higher compared to the use of legacy systems. At the same time, the EUCPT perceives the benefits as lower when using the innovative solutions. The main reasons seem to be the strength of the variety and flexibility of the legacy systems (technical, organisational, in combination), the need to further adjust the innovative solution to the needs of the ERCC and EUCPT as well as the lack of adequate training to get familiarised with the solutions.
- *Episode 2*: The main findings suggest that the SitRep needs of the ERCC are met both by the legacy systems and the innovative solutions at a very high level. The perceived efforts for the EUCPT to use the innovative solutions have increased significantly (probably due to lack of training), although the second round of using the innovative solutions suggests that a learning effect lowers that effort.
- *Episode 3:* The information exchange between the EUCPT and the Modules shows the biggest added value using the innovative solutions. While on average only a slight increase of the required efforts has been observed, a relatively higher increase of the perceived benefits has been acknowledged by the Modules. It can be concluded that the applied set of innovative solutions largely improves the perceived benefits by the Modules, while the small increase of the required efforts by the EUCPT can be easily addressed with a better training and familiarisation of the solutions.
- *Episode 4&5:* The exchange of the status updates using the innovative solutions by the Modules to the EUCPT seem to offer only limited added value. On the one hand, the efforts to generate the messages are perceived as lower. On the other hand, in most cases the perceived benefits have decreased on average as well.

In conclusion:

- In the exchange between the ERCC and the EUCPT there is some added value observed on the EUCPT side since the innovative solutions demonstrated they could bring extra potential in formatting criterion in case of reusing briefing materials received before deployment from the ERCC in the innovation line run. This improvement costs a bit more effort of the ERCC, however, this extra effort possibly could be reduced when the ERCC would have had a possibility to familiarize with the new solutions better.
- The innovative solutions show some extra potential in the communication flow from the EUCPT to the ERCC, being realized in a form of Situational Reports. This was identified for such criteria as usability and structure.
  - Using innovative solutions the ERCC benefits in usability criterion (finds it more usable then the currently used legacy tool, a simple Word file), however, at the same time the EUCPT has to dedicate more effort to use the solutions in order to produce the SitRep (the reason for that observation could be the solution usage novelty aspect).
  - The new solutions provide added value by reducing the EUCPT effort on structuring their SitRep, at the same time the SitRep is perceived by the ERCC as the document receiver as better structured comparing to the SitReps generated in the legacy system.
- The SitRep in a current status of its legacy tool is perceived by the ERCC as the one which meets its expectations. It is confirmed by very high indications of the ERCC for all criteria in respect to the current status of legacy tool used to communicate between EUCPT and ERCC in a form of SitRep. It means that solution providers face a real challenge to improve this aspect in Crisis Management. An option for solution providers could be to concentrate their development work on how to reduce the EUCPT effort with generating and sharing the SitRep.
- The information flow from the EUCPT to the CP Modules with support of the innovative solutions is perceived as very beneficial, especially in combination with lower efforts dedicated by the EUCPT to this process. It demonstrates a high potential of the innovative solutions to facilitate the communication between the EUCPT and the CP Modules, especially during briefings for the Modules which is not fully clear and structured these days. The bottom-up information flow, from the CP Modules to the EUCPT, was quantitatively evaluated as less beneficial. However, the qualitative feedback of the practitioners suggests that the innovative solutions have a high potential for status updates from the CP Modules to the EUCPT.

4. EU dimension in evaluation of the DRIVER+ Test-bed

One of the key objectives of the DRIVER+ Test-bed is to enable trialling beyond the responsibility of a single national civil protection authority, including international cooperation, involvement of EU mechanisms and issues relevant to different EU policies.

In order to facilitate the development and validation of this capability, specific indicators covering the EU dimension have been defined. These indicators are as follows:

- Cross-border situation assessment.
- Cross-border cooperation.
- Cross-border resource and logistics planning.
- Active participation (as players) of at least two international organisations.
- Active involvement of the ERCC.
- Information exchange between the ERCC and UCPM Participating State.
- Common operational picture at the ERCC and UCPM Participating State.
- Activation of the Union Civil Protection Mechanism.
- Explicit reference to relevant EU policies.

The four Trials and the Final Demo were designed with a clear goal of addressing as many of above-mentioned aspects as practical (and the minimum requirement was three). As a result, they addressed several issues of European importance and their findings are relevant to specific EU interests and policies. The overview of these findings is presented in Section 4.1.

Trial 1 was designed to specifically focus on cross-border communication, coordination and resource management. Its scenario covered two fictional neighbouring states where Crisis Management Centres were stimulated to cooperate in order to optimize their effectiveness in response management. In initial sessions the lack of specific civil protection resources on one side of the border required cooperation for efficient and urgent response to specific emergencies. Additional sessions were focused on cross border risk of the toxic flood impact and on the evaluating the usefulness of different common operational picture solutions in supporting preparation of the UCPM Request for Assistance.

In **Trial 2** one of key addressed issues was the integration of foreign organisations into the response operations, in particular the cooperation between French fire-fighters, and Italian fire-fighters and emergency management services. The focus of the cooperation was set on the dispatch and follow up of the foreign means (different types of forest fires vehicles, and ambulances from the Italian Red Cross) deployed on the operation site and on the evaluation of the COP solution to share operational data at the cross border level.

Trial 3 was organised in a table-top form closely coordinated with a field component based on the IRONORE EU civil protection exercise which have ensured close to real environment conditions. The Trial addressed challenges of a response to earthquake in mountains in Austria resulting in residential and industrial areas. One of the key aspects was incorporation of information from multiple and non-traditional sources and the ability to share aggregated information, including information exchange among international participants.

The scenario of **Trial 4** was focused on a breach of the coastal defences in Netherlands and the resulting flooding of large areas of The Hague. One of the key aspects analysed was the efficiency of sharing information at all levels (international, national and regional) and the resulting ability to solve a crisis in an effective and efficient manner involving coordination with external institutions. Furthermore, the international dimension seemed from the fact that The Hague is home to many international organisations. During the Trial these organisations were represented by a crisis team with representatives from EuroPol, EuroJust and the International Peace Palace.

The **Final Demo** was fully focused on activation and operations of UCPM during large forest fire with cascading effects. The trialling was aimed at assessing added value of demonstrated solutions for efficiency of operation of different UCPM elements: effective exchange of information between EUCPT and ERCC;

increased situation awareness thanks to the integrated information environment available for EUCPT; more structured information results for increased situation awareness and more efficient decision-making.

Implementation of the EU dimension in the Trials and FD was monitored as part of the evaluation process. Table 4.1 demonstrates that in most cases the majority of these indicators were addressed.

Table 4.1: The EU dimensions in Trials

EU dimension	Trial 1	Trial 2	Trial 3	Trial 4	Final Demo
1. Cross-border situation assessment.	X	X			X
2. Cross-border cooperation.	X	X			X
3. Cross-border resource and logistics planning.	X	X			X
4. Active participation (as players) of at least two international organisations.		X	X	X	X
5. Active involvement of the ERCC.					X
6. Information exchange between the ERCC and UCPM Participating State / EU Member State	X	X		X	X
7. Common operational picture at the ERCC and UCPM Participating State / EU Member State	X	X		X	X
8. Activation of the Union Civil Protection Mechanism.	X	X	X	X	X
9. Explicit reference to relevant EU policies.	X	X	X	X	X

4.1. Trial findings relevant to EU policies

The evaluation process of each Trial and Final Demo resulted in the formulation of findings and recommendations addressing several specific EU interests and policies. A summary is presented below (see also Table 4.2). The generated knowledge demonstrates that the DRIVER+ Test-bed concept may be applied effectively to address not only issues of importance to individual national authorities, but also to matters of European significance. Several recommendations refer to specific solutions tested during the DRIVER+ Trials and FD.

Table 4.2: EU policies in Trials and Final Demo

EU Policy	Trial 1	Trial 2	Trial 3	Trial 4	Final Demo
CIVIL PROTECTION	X	X	X	X	X
INTERNAL SECURITY	X				
ENVIRONMENTAL PROTECTION	X	X		X	
SOLIDARITY FUND			X	X	
INDUSTRY AND		X		X	

EU Policy	Trial 1	Trial 2	Trial 3	Trial 4	Final Demo
INFRASTRUCTURE					
INSURANCE				X	
HUMANITARIAN AID			X		X
FLOOD RISK MANAGEMENT AND MAJOR INDUSTRIAL ACCIDENT PREVENTION	X				
CRITICAL INFRASTRUCTURE PROTECTION	X				
CLIMATE CHANGE ADAPTATION	X				
RESEARCH AND INNOVATION	X		X		
FOREST FIRE		X			

Use of the DRIVER+ Test-bed concept during Trials and Final demo enabled formulation of findings addressing several specific EU interests and policies. These outcomes prove that the concept may be applied to examine issues of European significance.

Overview of key findings relevant for civil protection:

- Use of the integrated information systems providing a Common Operational Picture may improve pooling and sharing civil protection assets during cross border emergencies.
- Use of the integrated information systems providing a Common Operational Picture between authorities of different levels facilitates formulation of a UCPM Request for Assistance.
- Recording of interagency communication and relevant spatial data during crisis may facilitate after-action evaluation.
- Near real-time use of aerial imagery may improve situational awareness, including needs and damage assessments, and it may facilitate horizontal communication and coordination as well as vertical reporting.
- Aerial monitoring of roads availability and traffic congestion may facilitate management of civil protection modules during crisis.
- Capabilities enhancing use of drones, such as orthophotomap generation and 3D modelling, may support operations of the UCPM assets.
- Use of dynamic modelling for flood simulation may result in improved precision of emergency planning and better forecasting of possible impacts in response phase.
- Establishment of the Common Information Space for all UCPM elements may improve communication and situational awareness and its implementation may decrease the effort required for reporting.
- Innovative IT solutions may improve communication between EUCPT and CP Modules and they should be considered as an element of establishing the RescEU capacities.

4.1.1. Civil protection

Trial 1 was focused on matters relevant to EU policies in the field of civil protection and internal security. Its evaluation formulated the findings presented below.

Use of the integrated information systems providing a Common Operational Picture may improve pooling and sharing civil protection assets during cross border disaster by better communication (incl. cross-border reporting). This may positively influence host nation support activities of the country affected by a disaster as information about shared resources will be available earlier at different levels of command.

Use of dynamic modelling for flood simulation may result in improved precision of emergency planning (risk management related to floods and to critical infrastructure). It may also improve forecasting of possible impacts in response phase – during the development of actual disaster.

Use of the integrated information systems providing a Common Operational Picture between authorities of different levels (vertical configuration) may improve assessment of the operational needs and gaps and facilitate formulation of a more precise Request for Assistance under the Union Civil Protection Mechanism. Such an approach increases participation of local and regional level authorities in formulation of the needs.

Capabilities enhancing use of drones, such as orthophoto map generation and 3D modelling, may support operations of the European Emergency Response Capacity assets (modules/teams) which have "searching competence", e.g.:

- Medium/Heavy urban search and rescue (MUSAR/HUSAR) which declares the function: ability to search with dogs and technical equipment.
- Flood rescue using boats (FRB) which declares the functions: ability to search for people in urban and rural areas; ability to rescue people out of a flooded area; ability to work together with aerial search.
- Teams with unmanned aerial vehicles.

Aerial observation and mapping may improve realisation of post disaster needs assessment, especially in case of major, wide area disasters.

Trialling of the future rescEU assets in accordance with DRIVER+ methodology may enable early assessment of new solutions effectiveness in realization of operational tasks.

The finding presented above may also be relevant to other EU policies: Internal security; Flood risk management and major industrial accident prevention; Environmental protection; Critical infrastructure protection; Climate change adaptation; Research and innovation.

Trial 2 addressed a more general problem of evaluating interoperability and inter-organisation cooperation. As there is no specific European solution, the French fire service institutions have adapted the US Homeland Security Department tool *Interoperability Continuum* to assess the French organisation of civil protection in a whole spectrum of interoperability.

Findings of the Trial postulate adaptation of similar approach to evaluate interoperability at the European level. It could enable the diagnosis of the current situation and thus support evaluation of the benefit of the development of the European civil protection policy, and in particular the most recent RescEU program, which considers assets for fighting forest fires (especially Aerial forest fire fighting modules using planes) as the key resources to be in the RescEU pool managed by the ERCC.

Trial 3 demonstrated that the trialled solutions, mainly Airborne and Terrestrial Situational Awareness (airplane-based) as well as vieWTerra Evolution, could be broadly used for improving situational awareness, including needs and damage assessments, particularly in case of limited availability of Copernicus services. This type of support is required mainly in case of major disasters like earthquakes, wildfires or floods due to the wide territorial impact. There may be several reasons to launch the solutions in a disaster situation, in particular a need for ad hoc urgent assessment of a specific area or a general need for situation overview in poor weather conditions (which limit the potential use of satellite imagery). However, in this case it is

important to take into account that the plane flights have to be processed due to international and national legal commitments.

The aerial imagery could also improve communication and reporting in horizontal scheme, among the stakeholders involved in the operation, as well as vertical, from the field to HQs (e.g. from EUCPT to ERCC). Supplementing reports and maps with respective images of affected area may significantly improve clarity of communication.

Furthermore, availability of the two solutions may facilitate the work of European civil protection assets by providing information on preferable location for a Base of Operation, Reception and Departure Centres and other crucial information which may be obtained from aerial observation and clearly presented in the form of 2D and 3D maps and imagery.

The trialled solutions (ATSA, vieWTerra Evolution) could represent an additional asset in the European Emergency Response Capacity which is deployed by ERCC on commercial or other bases if needed. It could also be a part of a national capacity offered within the voluntary pool if agreed between the producers and a member state where the company is operating.

In **Trial 4** one of key analysed matters was information exchange among multiple institutions participating in the operations at different levels (from international to regional). Several advantages of net-centric information exchange were confirmed during the Trial:

- Information is shared instantaneously and continuously; all organisations use the same information.
- Faster information exchange between Safety Region (using solely the legacy system) and external organisations (using solution): Information is digitally available, including maps (in contrast to phone or mail communications, followed by importing this information into the systems).
- No errors are made in distribution of information and all information is up-to-date because all organisations use the same data.
- Unambiguous information, since the organisations share their information. There is no person in between that may distort the information.
- Higher efficiency for the external organisations, since their information was available for all AC/CT in contrast to every action centre to individually contact the organisation by mail/phone (or relaying information request via the information manager).

Evaluation of **Trial 4** led to formulation of the recommendations presented below.

The case with forest fires in Sweden (2018) revealed a need for continuous up-date on the roads patency in order to shorten time for reconnaissance activities and deployment of resources. The same problem concerns also other major disasters like flood which impacts broad geographical areas and transport infrastructure making them not operational any longer (e.g. roads or railways). Having software (ATSA–KeepOperational) which provides a close to real time up-date on the passable of roads could have an impact on civil protection modules management. Such solution could facilitate the work of national coordinating cells as well as Union Civil Protection Teams (UCPT) and civil protection team leaders.

Secondly, solutions 3Di and ATSA–ZKI could contribute to the European Flood Awareness System (EFAS) by providing new software which potentially provide added value (e.g. new algorithm for flood spread calculations) to the system utilized on the EU level.

Solution CrisisSuite adds to efficient information sharing among different stakeholders in response phase. Since UCPM missions by definition includes many stakeholders CrisisSuite has a potential to facilitate vertical and horizontal communication between the ERCC, UCPT and civil protection modules working under UCPM umbrella. The shared communication environment of CrisisSuite could also be extended on other partners from outside the UCPM (e.g. UN agencies). It would facilitate the work of all these actors in different phases of CP missions (pre-mission, on-mission and mission-end).

Since CrisisSuite has a potential to be technically connected to other COP legacy solutions (like in **Trial 4** to LCMS), it is worth to consider whether CrisisSuite could also be a module of Common Emergency Communication and Information System (CECIS).

Furthermore, since the set of the trialled solutions provides records on the interagency communication as well as the decisions taken during the disaster response, spatial data recorded in the solutions could be used for post-disaster analyses. These records could facilitate the process of lesson-identification from the past emergencies in order to share it among the EU Member States.

Results of the **Final Demo** evaluation clearly indicated high potential of the innovative IT solutions to improve communication between EUCPT and CP Modules. The improvement in quality of communicated information and efficiency of information exchange would be relevant to: provision of an initial set of information; normal briefings for Modules; and a rapid provision of situational updates.

Therefore, establishment of a dedicated IT system aimed at facilitating information exchange between EUCPT and UCPM Modules should be considered as an element of establishing the RescEU capacities in line with the relevant Commission Implementing Decisions. To ensure maximum efficiency of such system, the appropriate technical interoperability standards should be defined and operational procedures for its use should be developed.

The EUCPT–ERCC information exchange may also benefit from resulting establishment of the Common Information Space. The effectiveness of communication between these entities is already very high and the expected improvement would be mainly related to decreased effort on information processing and report preparation in EUCPT. The appropriate requirements should in particular emphasise optimisation of user interfaces and information processing methods.

Since information management is a key element of civil protection activities, especially in the response phase, increasing its efficiency would clearly benefit effectiveness of the UCPM.

These findings are also fully relevant for the EU humanitarian aid policy.

4.1.2. Environmental protection

Evaluation of **Trial 4** led to formulation of the recommendation related to the Directive 2007/60/EC on the assessment and management of flood risks. The Regulation is primarily in place to: increase public awareness; support the process of prioritising, justifying and targeting investments and developing sustainable policies and strategies; support flood risk management plans, spatial planning and emergency plans.

Solutions 3Di, SIM-CI, ATSA–ZKI are crucial for flood development prognoses and adequate information sharing on the flood risk, and as such, could positively influence the quality of flood risk planning processes. They could facilitate the work of water authorities from local up to national level.

4.1.3. Solidarity Fund

Trial 3 demonstrated that data collected and presented by Airborne and Terrestrial Situational Awareness (airplane-based) as well as vieWTerra Evolution could be used to document the ‘major’ disaster losses in case the stricken EU member state is applying for a support from the Solidarity Fund. In specific cases it could be considered as a sufficient evidence of the damage and enable assessment of its scale.

During **Trial 4** solution CrisisSuite demonstrated its potential to facilitate Integrated Political Crisis Response (IPCR) arrangements, especially before and during Informal roundtable meetings as well as in drafting an Integrated Situational Awareness and Analyses (ISAA) Reports. It is worth to consider type of added value the solution could bring in communication process among the Member States in case of IPCR activation.

4.1.4. Industry and infrastructure

In **Trial 2**, Crisis Suite was used between the critical infrastructure crisis operational centre and the Regional Environmental Agency. It was demonstrated that the use of this solution optimized the data and information exchanges between both levels, allowing to win time in this critical infrastructure protection against the forest fire, which was the natural hazard studied in the scenario.

Evaluation of **Trial 4** led to formulation of the recommendations presented below.

Cascading effects are one of the key phenomena which are recognized in the late 20th century. Increasing significance of networks forces deeper understanding of these phenomena in order to mitigate its negative consequences. SIM-CI should be considered as a valuable asset in this respect. Therefore, such solutions as SIM-CI should be used for simulation exercises to facilitate critical infrastructure contingency planning.

Planning localization of critical infrastructure as well as trans-European energy and transport objects requires simulation exercises on potential flood impact on investment areas. This could be supported by 3Di and ATSA–ZKI solutions in order to minimalize a risk of building the objects in current flood prone areas as well as the areas which could be flood prone in longer time perspective (taking into consideration the climate change effect).

4.1.5. Insurance

Evaluation of **Trial 4** led to formulation of the following recommendation.

Since flood is the highest risk natural disaster in Europe, involvement of the insurance sector is critical in order to decrease its impact. 3Di and ATSA–ZKI solutions could be valuable in facilitating the consultations among stakeholders on the flood risk calculations. The solutions could support identification and prediction of the potential flood impact, also cross border, for different scenarios. These measures could support the consultation processes between the stakeholders such as policy makers, insurance companies and potential clients of these companies. Such types of discussions, supported by the results of the simulations, could also broadly promote insurance as a way to decrease flood risks to acceptable levels.

4.1.6. Humanitarian aid

Trial 3 results demonstrated that Psychological First Aid (PFA) solution could be implemented in the training programmes which are dedicated to the members of the EU Aid Volunteers Corp. PFA could be introduced as a solution improving quality of their trainings and resulting in better quality of psychological aid offered on site of a humanitarian crisis.

Humanitarian aid is built upon the key principle of partnership, which can be supported by CrowdTasker solution that can improve communication, collaboration and early warning in humanitarian crisis. This is particularly important during initial part of response phase, when a high number of NGOs respond and communication and collaboration structures between the stakeholders are not fully clear for all of the responding actors. In such cases proper and on-time communication supports avoiding mistakes and mis-understanding and through that it limits gaps and duplications in the initial phase of response. CrowdTasker could be a solution recommended to be used by NGOs and spontaneous volunteers who are or feel associated with certain NGOs.

Airborne and Terrestrial Situational Awareness (airplane-based) as well as vieWTerra Evolution could improve provision of humanitarian aid by providing information about accessibility of the suitable areas for humanitarian aid transports, geographical and other conditions for IDP and refugee camps settlements, amongst others. However, it should be noted that humanitarian aid is normally provided in third countries and the flights to collect data would require a commitment of the affected country.

4.2. Potential benefits for the European Research Area and the European Security Policy

This section elaborates on the potential impact of the DRIVER+ in the specific areas of the EU responsibilities and challenges: the European Research Area (ERA) and the European Security Policy.

4.2.1. European Research Area

The EU Member States are already cooperating closely in research and innovation to ensure Europe's long-term competitiveness and economic growth and to address the grand societal challenges. Europe is in a good position with its 7 percent of the world population contributing almost 30 percent to global knowledge generation. But the global race for knowledge and innovation is picking up speed. In this context, it is important to pool Europe's strengths and forge stronger links between national research and innovation activities. The EU Member States are therefore working with the European Commission to firmly establish a common research area in Europe. The aim is to create a genuine single research and innovation area. The **European Research Area (ERA)** is intended to guarantee freedom of movement for researchers and to enable the free exchange of scientific knowledge and technologies.

The ERA aims to improve and harmonize the conditions for research and innovation in Europe. A European research environment is being designed along the general principles listed below, which could be supported by the DRIVER+ results in the following way:

- More effective national research systems

  Introducing, validating and disseminating of the DRIVER+ concept for testing new solutions in Crisis Management (e.g. by the Centres of Expertise) can strengthen the national research systems by providing clear methodology, valid infrastructure and facilities (CoEs) wherein the new solutions could be verified before their implementations in the critical national systems which are Crisis Management systems. It facilitates introducing innovative ideas and concepts as well as building new knowledge in order to make the systems more effective in facing current and emerging threats, contributing to the EU priority formulated as “A Europe that protects”.

- Optimal transnational cooperation and competition

  Including, as in DRIVER+, a broad spectrum of partners in respect to nationalities and sectoral approach (Crisis Management practitioners, solution providers, research institutes) all working together in line with transparent and commonly accepted methodology as well as in one validated environment guarantees transnational cooperation and fair competition in seeking innovation in Crisis Management.

- Open labour market for researchers

  DRIVER+ provides a strongly inclusive approach for researchers with no exceptions for nationalities or scientific disciplines. Security domain, including Crisis Management, is naturally a multidisciplinary field which highly requires expertise from many different perspectives e.g. exact sciences, technology, sociology, psychology, etc. Broad involvement of researchers from many pools is a necessary requirement for complete and objective development of Crisis Management systems being challenged with more and more complex environments and negative impacts of current and emerging threats.

- Gender equality and gender mainstreaming in research

  There are no exceptions and limitations in gender equality and mainstreaming in conduction of research within DRIVER+ environment. Moreover, this diversification is strongly required since the findings are related to different scientific disciplines as well as address protection of every person and entire society, including sensitive groups.

- Optimal exchange and transfer of and access to scientific findings

  The international approach to the research within DRIVER+ guarantees exchange, transfer and access to the research findings. Several tools have been developed and introduced (e.g. TGM, TTI, PoS) and are ready to be applied by each and every person and organization believing it useful for their purposes. The findings are broadly and openly disseminated e.g. through the DRIVER+ Portfolio of Solutions (PoS) or Lesson Learned Framework tools.

- Internationalization of the European Research Area

  Participation of the stakeholders from different countries as well as international organizations is an aspect which strengthens the DRIVER+ research process and its results by expanding the impact of the findings on common Crisis Management and civil protection structures. Through that it facilitates the common understanding of the complex field of international Crisis Management e.g. by introducing so much required standardisation processes in this area. Therefore, internationalization of the DRIVER+ Trials is a highly desired element at each stage of its realization. This argument encourages Trials owners to make their Trials respecting and including international contexts what automatically influences internationalization of the European Research Area.

4.2.2. European Security Policy

EU security research is one of the building blocks of the Security Union. It enables innovation in technologies and knowledge that is crucial for **developing capabilities to address today's security challenges**, to **anticipate tomorrow's threats** and contribute to a **more competitive European security industry**. **EU internal security and Crisis Management** are to benefit from the findings of DRIVER+ Trials. Since the process, as validated in the project, is able to provide new knowledge in challenging and complex realities of Crisis Management, the results for facilitating the introduction of innovative solutions in respective systems are highly promising. The objectives of the European Security Policy are addressed as follows:

- Support achievement of the Security Union through funding Security Research

  Building and validating the DRIVER+ environment with support of the EU funding led to the provision of a complete platform for testing new solutions for Crisis Management. The created system, as well as results of the new knowledge generated in Trials, is broadly available for all the practitioners including innovation managers, solution providers, decision makers and politicians. It guarantees multi-stakeholders' contribution and benefits tailored for seeking improvements in security area.

- Reduce the gap between research and market

  DRIVER+ created an effective platform for validating new solutions by practitioners before they implement them into their routine duty lines. It facilitates the process of introducing only these solutions which really meet the practitioners' needs and requirements, before the practitioners' organizations invest their budget into it. This "check before invest" concept revealed potential for more adequate management of the practitioners' budgets by targeting only the relevant solutions, and through that, making a real and expected improvements of the systems they work within.

  DRIVER+ has a potential to support introduction of new solutions into Crisis Management at all stages of the process from research (e.g. testing with TGM and TTI in Trials) to the market (e.g. promoting the solutions in PoS, CMINE, CoEs).

- Raise awareness

  CMINE and PoS are well developed, broadly used and accepted tools for raising awareness on affordable and innovative technologies among Crisis Management practitioners and other stakeholders in the security area. DRIVER+ provides transparent access to test-based knowledge on new solutions. Furthermore, there was a set of standards revealed which were discussed and implemented (some of them still in the process of implementation) on the EU level. These results raise awareness on terminology and newest methods used in the respective area.

- Contribute to the international reflection on developing affordable and innovative technologies for security practitioners and first responders

  CMINE, PoS, TGM and Trials are the tools which especially contribute to the international reflection on developing new technologies for security practitioners and first responders. All of them provide

knowledge on affordable and innovative functionalities being “off the shelf” or tested in Trials while still in development process. The results are broadly disseminated through CMINE and PoS.

- Overcome the fragmentation of the EU security markets for security technologies

  The PoS is a “one stop market place” for practitioners and solution providers for promoting and sharing the objective, open access knowledge and experiences on usage of new solutions. CMINE is supporting the process by exchanging and communicating information about the practitioners’ needs and all other aspects having a positive impact on Crisis Management including promoting the DRIVER+ environment. These elements strongly support the solution providers present on the EU security markets, also counteracting fragmentation of these markets.

- Promote the societal acceptance of security technologies

  DRIVER+ throughout the entire project put a lot of attention to the societal acceptance of security technologies. One of the strong results is an EU standard being developed on Societal Impact Assessment (SIA) Framework for Crisis Management (CM). Furthermore, the TGM underlines the significance of the societal acceptance monitoring for the trialled solutions in order to ensure they do not negatively influence the society e.g. in side areas which are not the key trialled CM functionalities.

DRIVER+ with the above elaborated influences addresses the key aims of the European Security Policy by facilitating and promoting interaction between practitioners, academia, policy-makers and industry through:

- Ensuring, e.g. by the TGM and TTI, that the Trials take into account the needs of practitioners.
- Identifying the most promising solutions derived from previous analyses supported by PoS that could be adopted by practitioners.
- Facilitating policy development and implementation on national and international level, supporting the competitiveness of EU industry by introducing solutions previously or newly recognized by broad Crisis Management and civil protection forum (CMINE, PoS), ensuring at the end that the expertise of practitioners is made available to policy makers (CMINE, CoEs).
- Developing new initiatives with synergies across the EU and beyond e.g. by CoEs and their transparent and inclusive approach to the process of testing new solutions.

5. Overall conclusions and way forward

This section presents results of evaluation of the DRIVER+ Test-bed accumulated throughout the four Trials and Final Demo. The initial subsection presents key findings, which are further expanded in following subsections addressing specific Test-bed elements. The final subsection focuses on future plans resulting from these findings.

Additional information about lessons learnt from DRIVER+ activities is presented in Annex 6 – Lessons Learned summary based on results from Trials and Final Demo.

5.1. Key findings

Evaluation of DRIVER+ Trials and Final Demo confirmed that the Test-bed may offer considerable added value for the Crisis Management community. In particular:

- The Test-bed (together with the PoS and CMINE) can provide considerable support in a process of finding solutions addressing specific practitioners' needs.
- It combines all the components needed by Crisis Management organizations to find innovations.
- It can have a positive impact on the assessment and modification of existing standards and procedures by adapting them to new tools and solutions, leading to increased operational effectiveness.

The following key advantages of the Test-bed were identified:

- The Test-bed can facilitate the process of a systematic assessment of solutions that is potentially more objective, and in addition to a traditional qualitative approach (through individual perception) it also enables a quantitative assessment.
- It can be relatively easily adjusted to requirements of users enabling testing and finding innovations corresponding to their specific gaps. Its flexibility and scalability represent substantial advantages.
- In the perception of practitioners the use of the Test-bed is particularly justified when looking for highly specialized solutions – a process which is costly and requires a significant level of complexity.

Evaluation of DRIVER+ activities also confirmed that:

- The Test-bed can be used for trialling both specific technical and non-technical solutions or procedures. It can be applied to asses one or multiple solutions at the same time, depending on the needs of users.
- Utilisation of the Test-bed can help to better understand information exchange flow/process among stakeholders.
- The Test-bed provides a universal, pan-European tool for supporting research and comparing the achieved results – it allows defining suitable Key Performance Indicators in the Crisis Management Dimension to obtain answers for formulated Research Questions and gather all related data during a Trial.

At the same time, it was observed that utilisation of the Test-bed can be challenging, particularly in technical- and evaluation-related aspects. Efficient practical implementation of Trials may require an external support by specialised experts. This conclusion provided the foundation for establishing the network of dedicated Centres of Expertise.

The Trials and the Final Demo took a central place in the project. These were the main milestones during which prototypes of the Test-bed could be co-created and tested together with practitioners. The specific gaps and research questions for each of the Trials were elaborated on with the Trial hosts and Trial owners strongly in the lead. Based on this, the Call for Applications (CfA) and solution selections were implemented, involving additional practitioners both from within and external to the consortium. During the further preparations of the Trials, the practitioners strongly remained in the driver seat, supported by the other project members, creating realistic Trials addressing their identified gaps. During this co-creation

process, the main DRIVER+ products like the TGM and the TTI were developed taking as much as possible into account the practitioners' language and way of working and thinking: these practitioner experiences were used to further update the next prototype versions of these products. Nevertheless, in line with the observations made in **D911.91** ***Lessons learned on project level*** (28), it was experienced during the Trials that it was difficult to really adapt the work processes and operational procedures when introducing the innovative solutions.

To a large extent this was caused by a lack of sufficient training time to learn about all relevant functionalities of the solutions and to familiarize with these. This was further hampered by the fact that during the DR1, DR2 and the actual Trial it was practically impossible to have the same group of practitioners involved. Trying to use the innovative solutions is already challenging, and in addition changing standard procedures only complicates this. Besides, in some cases the legacy solutions were still available on the Trial scene. In some cases, this resulted in practitioners falling back to these legacy systems or in a limited use of the innovative solutions. A good solution for this problem was to have the practitioners supported by staff of the solution providers: they did not really take over, but gave assistance and guidance to the practitioners in applying the solutions. Finally, during the Trials some practitioners had a strong tendency to be more focused on solving the crisis, rather than on trying out the innovative solutions. Several practitioners still regarded the Trial as some kind of exercise or training, despite the briefings before and during the Trial. Shifting their mind-set in this respect turned out to be more complicated than expected.

In the end, the project did not fully succeed in demonstrating that the Trials enabled practitioner organisations to actually close the identified gap and to support them to advance their capability development (28). Obviously, the DRIVER+ project had a clearly defined scope and mandate, and the Trials mainly served as a way to test and improve the various components of the DRIVER+ Test-bed. In addition, many solutions improved considerably during the whole Trial process, because the feedback of practitioners was used to improve the solutions. Nevertheless, it would have been worthwhile to organise closer follow-up and support activities in the post-Trial phases, for example by proactively facilitating the continuous engagement processes between practitioner organisations and solution providers towards a potential procurement. In the end, a Trial is just one (yet new and important) element in the whole process of capability development and innovation management. Applying the Test-bed should therefore always be embedded in this larger context, and the DRIVER+ CoE network has been established with the intention to support this process.

5.2. Specific observations related to Test-bed elements

Trial Guidance Methodology and its tools and methods, including the Trial Guidance Tool

1. The TGM stimulates a comprehensive, holistic approach to a given problem: it encourages Trial Owners to focus not only on solving a particular crisis (which is quite often the case for practitioners during a Trial), but to think more about risk reduction, operation, finding new solutions for their problems.
2. The TGM helps to determine a clear gap and/or a problem, which is a necessary requirement for starting the search for possible improvements.
3. The TGM can encourage the practitioners to reflect upon their already-established way of thinking, protocols and procedures which may sometimes hinder or even block introducing innovative solutions in organisation.
4. The TGM allows Trial Owners to reflect not only on the cross-border and cross-level Gaps, needs and issues, but also to take into account cross-sectoral dimension of Crisis Management (in two critical aspects – as differences between practitioners and solution providers and between practitioners themselves) and properly address the challenges they may present.

5. The TGM Handbook with its tools and methods in a precise, comprehensive and easy to understand way describes procedures for each Trial phase, gives numerous examples of the practical implementation and provides a good overall description of the TGM logic and its added value for practitioners.
6. The TGT provides an interactive work environment to support the practical implementation of the TGM, enabling active involvement of people from different parties, companies or departments in the process of designing, organising and planning a conduction of a Trial.
7. The Trial Action Plan proved its usefulness in facilitating the Trial management. The tool was successfully utilised for collaborative planning, circulation of decisions and to support combined execution.
8. Since the TGM is a rather comprehensive approach with many steps and tools, it might sometimes present an additional challenge for practitioners to implement it to use the Test-bed method effectively. Therefore, some support from organisations with academic or applied scientific background is extremely beneficial.
9. Conducting of the Trials demonstrated that a systematic and research-focused trialling process, following the methodology created in the DRIVER+ project, has a substantial potential to generate new knowledge.
10. Use of the TGM and Test-bed Technical Infrastructure enables to explore and reveal new data, even in cases when the solutions trialled did not represent a significant breakthrough in the Crisis Management Dimension compared to the existing baselines.

Test-bed Technical Infrastructure

1. The TTI provides interoperability features for different solutions. It allows to connect different solutions and to share information among them, thus enabling finding solutions for more complicated problems, for which just one single solution may not be sufficient.
2. The TTI allows sharing information in an easy way between organizations whenever cross- cooperation between sectors is needed and expected during a crisis. The TTI enables to test such cooperation during Trials and to find the best ways and procedures for that, on the condition that specific restrictions and/or internal procedures of different stakeholders are taken into account from the beginning.
3. The TTI is a useful tool for research, improving both the process itself as well as the assessment of results – by using precisely pointed research questions it facilitates the data collection and evaluation process and enables to clearly indicate where the progress is made.
4. Despite generally positive feedback from the users who have the opinion that the TTI is a good and valuable product, it may have some difficulties in practical implementation on a wider scale, since some countries/practitioners have been working on standards (evaluation of solutions) fixing their problems for 10-15 years and it may be hard to change their way of thinking now.
5. A somehow „lighter" version of the TTI with easier solution connection/integration method would be appreciated, as well as technical support by the people experienced in this matter from outside of the practitioner community, since sometimes technical aspects of the TTI may be perceived as difficult and too complex.
6. The TTI is a tool not only highly helpful in a Trial organisation, but also deemed a good environment for training purposes.
7. The TTI offers new possibilities to collect, store and make basic analyses of data gathered during a Trial, which is later helpful for ad deeper analysis to find the solution best suited to the practitioner needs.
8. The TTI is an already well-developed environment; however one needs to bear in mind that extra effort for the creation of the connection with additional legacy solutions or new possible innovative solutions is still required.

5.3. Way forward with the DRIVER+ Test-bed

In the previous section an exhaustive list of proven and potential benefits of the DRIVER+ Test-bed is presented. Since numerous advantages of this concept were demonstrated in practice during the DRIVER+ project, as well as many initial problems solved and lessons learnt, it is important now to elaborate a possible way forward to maintain and promote them in the Crisis Management sector across Europe. In order to address this challenge and to ensure that the DRIVER+ results are implemented in practice to the widest possible extent and not placed on the shelf, the project consortium has decided to pursue three complementary lines of activities, focused on technical, promotional and organisational aspects. Proposed activities stem from results of the Trials and updated versions of Trial Guidance Methodology and are focused on maximizing the benefits that were achieved during the course of the project, as well as solving the recurring issue indicated by the practitioners involved in the Trials – mainly the need for constant expert support and academic advice to fully exploit all the advantages offered by the project results.

The first, most obvious but necessary issue is to guarantee technical availability of the products elaborated under DRIVER+. All of them are easily accessible and can be downloaded from the project website. They are made available on an "open source" basis under MIT or Creative Commons license. Moreover, in order to ensure the widest possible uptake by potential users, the key outputs, like Trial Guidance Methodology, are translated into several languages: French, German, Spanish, Italian, Dutch, Polish, Swedish and Estonian. A dedicated, in-depth training module, combining both theoretical assumptions of DRIVER+ and practical lessons learned during their practical tests in four Trials and the Final Demonstration, has been elaborated and is also freely available. This is a very important support tool for potential users who are interested in learning more about the results achieved under the project, but did not have a chance to participate in any of the Trials directly.

The second component for ensuring the "continued survival" of the DRIVER+ Test-bed consists of promotional and informational activities, to be continued after the end of the project itself. In the Crisis Management sector quite often innovative solutions and procedures are shared by a kind of peer-review process and exchange of knowledge and experiences among practitioners and academia. In order to benefit from that approach, the Crisis Management Innovation Network Europe (CMINE) has been created and will be maintained at least three years after the end of DRIVER+ (29). It is an umbrella network of stakeholders active in Crisis Management, aiming at linking existing projects, networks and initiatives. By doing so, CMINE is supposed to reduce fragmentation, generate ideas and help identifying innovative solutions to improve European resilience. CMINE is designed to evolve continuously through collaboration with the aim of becoming a pan-European platform, focused on the exchanges between various Crisis Management professionals (including policymakers, practitioners, members of the private sector, NGOs/CSOs, science & research, training & education, media and standardisation representatives). CMINE comprises an online community platform and face-to-face meetings and workshops with the aim of tackling current and future challenges and facilitating the uptake of research and innovation by practitioner organisations. Specific task groups have been set up to develop approaches aimed at resolving current issues in different thematic areas in Crisis Management. This flexible and user-driven approach enables CMINE members on the one hand to have an overall, up-to-date picture of Crisis Management activities happening across Europe and on the other hand to focus on a particular area of interest (for instance floods or wildfires) and share their experiences in that domain.

Finally, in order to go even further beyond a "simple" maintenance of DRIVER+ outcome and to support their permanent sustainability and continued evolution on a more "institutionalized" basis it was decided to establish a network of so-called Centres of Expertise. The founding members of the CoE network come from the initial partners of the DRIVER+ project consortium, as well as some practitioner-centred organisations from outside the consortium. This approach offers obvious practical benefits – the institutions which were involved in the whole process of developing and testing DRIVER+ products from the very beginning are naturally the best suited for promoting them and sharing useful, hands-on experience. This does not mean, however, that the Centres of Expertise network is a closed, exclusive club. On the contrary, it is open for all interested practitioner-oriented entities operating in the Crisis Management

domain. A lot of effort has been made to encourage them to become a CoE. In particular, a dedicated CoE Toolkit has been prepared to support potential CoEs in identifying products, activities and services they could take up and match their organisational objectives and profiles, outline what is the added value of adopting each output and help them to conduct a preliminary self-assessment on whether they would meet the criteria to provide these services. This CoE toolkit is available on the DRIVER+ website for download (28). It is based on the Strategy Realisation Model – a structured and integral approach for organisational transition and performance improvement, as well as the building blocks from the Business Model Canvas, duly adapted to the Crisis Management domain (including some changes in terminology).

The basic rules for cooperation among current and future Centres of Expertise (CoEs), including light but necessary verification of potential candidates, is currently under definition in dedicated Terms of Reference, which will be approved by the current members of this CoE network, before the end of the project (30). By signing these Terms of Reference, CoEs declare that they will fulfil the overall objectives of the network:

- Maintain and update the initial DRIVER+ products and support their further use.
- Act as a practitioner-centred organization and – whenever relevant and possible – intermediary between (applied) research organizations, solution providers, public administration at all levels and policy-makers in the Crisis Management domain.
- Become a contact point for all practitioner-driven organisations operating in the field of Crisis Management and disaster risk reduction (or a specific domain under the latter) interested in using one or more of the DRIVER+ outputs, advising them in their capability development and innovation management, commensurate with their needs and available resources.
- Seek to improve the way capability development and innovation management are tackled, whenever possible by testing and validating (in realistic environments) solutions that are addressing the operational needs of practitioners dealing with Crisis Management.
- Endeavour to share lessons learned and improve knowledge transfer between Crisis Management practitioners, research organizations and solution providers.
- Exchange information and experiences and to promote collaboration in the Crisis Management domain.

It is worth underlining that the CoE network will be operating on a basis of flexibility – all members may choose to use either the whole suite of DRIVER+ outputs or only some of its components, and while applying these products, they are free to tailor and adapt them to local or national needs, circumstances and capacities. They will determine the role they wish to play themselves, depending on the specific domain of expertise that they have and type of support they can offer – they may for instance cover a wide range of Crisis Management aspects or focus on a specific topic, such as the usage of drones or training of firefighters. An important role of the Centres of Expertise is to ensure that interested local organisations have easy access to DRIVER+ outputs and to provide guidance and support on how to use them. These advisory capabilities offered by CoEs will help to mitigate one of the main risks mentioned in Section 5.1: that despite their proven usefulness and practical benefits DRIVER+ outcomes may seem too complex and difficult to apply by entities without any previous experience in that. Centres of Expertise will share lessons learned and contribute to the improvement of knowledge transfer between practitioners and research organisations. This can also help with the development of new training programs and improving curricula, as well as producing clear recommendations for policy-makers about research programming and specific funding needs. In that way the outputs of DRIVER+ can be promoted among the European Crisis Management community and implemented in their everyday practice.

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Annexes

Annex 1 – DRIVER+ Terminology

In order to have a common understanding within the DRIVER+ project and beyond and to ensure the use of a common language in all project deliverables and communications, a terminology is developed by making reference to main sources, such as ISO standards and UNISDR. This terminology is presented online as part of the Portfolio of Solutions and it will be continuously reviewed and updated[3]. The terminology is applied throughout the documents produced by DRIVER+. Each deliverable includes an annex as provided here-under, which holds an extract from the comprehensive terminology containing the relevant DRIVER+ terms for this respective document.

Table A1: DRIVER+ Terminology

Terminology	Definition	Source
End-user	Individual person who ultimately benefits from the outcomes of the system. The End-user can be a regular operator of the software product or a casual user such as a member of the public. In the context of DRIVER+ End-user encompasses practitioners, solution providers and other stakeholders.	ISO/IEC 25010:2011(en) Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — System and software quality models.
Gap	Difference between the existing capabilities of responders and what was actually needed for effective and timely response.	Adapted from Project Responder 5, Homeland Security, Science and Technology, August 2017.
Innovation	Implementation of a new or significantly improved product (good or service), or process, new marketing method, or new organizational method in business practices, workplace organization or external relations. Alternative definition: new or changed object realizing or redistributing value.	ISO 9000:2015(en) Quality management systems — Fundamentals and vocabulary, 3.6.15 ISO 37500:2014(en) Guidance on outsourcing, section 3.6).
Lessons Learned, Lesson Learning process	Lessons Learning: process of distributing the problem information to the whole project and organization as well as other related projects and organizations, warning if similar failure modes or mechanism issues exist and taking preventive actions. Lessons Learned: Result of the lessons learning process.	ISO 18238:2015(en) Space systems — Closed loop problem solving management, 3.3

[3] Until the Portfolio of Solutions is operational, the terminology is presented in the DRIVER+ Project Handbook and access can be requested by third parties by contacting coordination@projectdriver.eu.

Terminology	Definition	Source
Portfolio of Solutions	A database driven web site that documents the available Crisis Management solutions. The PoS includes information on the experiences with a solution (i.e. results and outcomes of Trials), the needs it addresses, the type of practitioner organisations that have used it, the regulatory conditions that apply, societal impact consideration, a glossary, and the design of the Trials.	*Initial DRIVER+ definition*
Scenario	Pre-planned storyline that drives an exercise, as well as the stimuli used to achieve exercise project performance objectives. In the context of DRIVER+ scenarios are defined for Trials not for exercises.	ISO 22300:2018(en), Security and resilience — Vocabulary, 3.127.
Trial Guidance Methodology (TGM)	A structured approach from designing a Trial to evaluating the outcomes and identifying lessons learnt.	*Initial DRIVER+ definition*
Trial Guidance Tool (TGT)	A software tool that guides Trial design, execution and evaluation using a step-by-step approach, including as much of the necessary information as possible in terms of data or references to the Portfolio of Solutions.	*Initial DRIVER+ definition*
Test-bed Technical Infrastructure (TTI)	The software tools and middleware to systematically create an appropriate (life and/or virtual) environment in which the trialling of solutions is carried out. The Test-bed infrastructure can enable existing facilities to connect and exchange data.	*Initial DRIVER+ definition*
Trial	An event for systematically assessing solutions for current and emerging needs in such a way that practitioners can do this following a pragmatic and systematic approach.	*Initial DRIVER+ definition*

Annex 2 – Evaluation survey results for Trials 1 - 4

Answers to all questions asked within the Semi-structured interview (SI) are presented, divided into each phase of the DRIVER+ Test-bed (Preparation - Table A2, Execution – Table A3 and Evaluation – Table A4). They were measured using 5-point Likert scale (from -2.0 to 2.0). For each statement a response was given using values according to the scale where -2 means "Strongly disagree", -1 means "Disagree", 0 means "Neutral", 1 means "Agree" and 2 means "Strongly agree". Additional optional response "Not applicable" (if respondent wasn't comfortable or not competent to relate to a statement) was possible to choose in each question – when it was chosen by the respondent the answer wasn't taken into account. Results of the survey presented in Table A2, Table A3 and Table A4 were calculated as average of all answers which have been given be respondents to certain question.

Annex 2.1 Preparation phase

Table A2: Results of evaluation survey for Trial 1 – Trial 4 (Preparation phase, OST data).

Question	Trial 1	Trial 2	Trial 3	Trial 4
1.1. Explanation of the Trial Guidance Methodology (TGM) is sufficient to understand what it is.	0.40	1.00	1.50	1.00
1.2. The role of TGM in the Trial design is sufficiently explained.	0.60	0.33	1.25	1.00
1.3. Explanation of Trial Guidance Tool (TGT) is sufficient to understand what it is.	0.50	-1.00	1.00	1.00
1.4. The role of the TGT in the Trial design is sufficiently explained.	1.00	-1.50	1.00	1.00
1.5. The Test-bed infrastructure (TB) is sufficiently defined to understand what it is.	-0.40	1.00	1.33	1.00
1.6. The role of TB in the Trial design is sufficiently explained.	0.00	1.00	1.00	1.00
2.1. TGM sufficiently explains the step 'Crisis Management Gaps selection' to design the Trial.	1.11	0.00	1.67	1.00
2.10. TGM sufficiently explains 'Trial Dimension' in order to prepare Data Collection Plan properly.	0.67	1.00	1.33	1.00
2.11. TGM sufficiently explains 'Solution Dimension' in order to prepare Data Collection Plan properly.	0.89	1.00	1.33	1.00
2.12. TGM sufficiently explains what is understood by 'Baseline'.	0.00	-1.00	1.00	1.00
2.13. TGM sufficiently explains possible methods to imitate 'Baseline' to design the Trial.	-0.67	-1.00	1.50	1.00
2.14. TGM sufficiently explains what is understood by 'Innovation Line'.	0.22	0.00	0.33	1.00

Question	Trial 1	Trial 2	Trial 3	Trial 4
2.15. TGM sufficiently explains possible methods to imitate 'Innovation Line' to design the Trial.	0.00	-1.00	1.50	1.00
2.16. TGM sufficiently explains what profiles of Practitioners should be involved in the Trial in order to ensure credibility of collected data.	0.67	-2.00	0.00	1.00
2.17. TGM sufficiently explains what profiles of Observers should be involved in collecting data for Crisis Management Dimension in order to ensure credibility of collected data.	0.44	-2.00	-0.67	1.00
2.18. TGM sufficiently explains what profiles of Observers should be involved in collecting data in Trial Dimension in order to ensure credibility of collected data.	0.67	-2.00	-0.67	1.00
2.19. TGM sufficiently explains what profiles of Observers should be involved in collecting data in Solution Dimension in order to ensure credibility of collected data.	0.89	-2.00	-0.67	1.00
2.2. TGM sufficiently explains possible choices of Practitioners involvement into 'Crisis Management Gaps selection' in order to ensure Practitioners driven Trial.	0.89	0.00	1.50	1.00
2.2. TGM sufficiently explains the step 'Final scenario with simulations' as a part of the Dry Run 2 to execute the Trial.	-0.40	1.00	1.13	0.50
2.20. TGM sufficiently explains how many Observers are required in Crisis Management Dimension in order to ensure feasibility of the Data Collection Plan.	0.22	-2.00	-0.67	0.00
2.21. TGM sufficiently explains how many Observers are required in the Trial Dimension in order to ensure feasibility of the Data Collection Plan.	-0.22	-2.00	-0.67	0.00
2.21. TGM sufficiently explains the step 'Feedback from external stakeholders' as a part of the Trial execution.	-0.20	2.00	0.57	1.00
2.22. TGM sufficiently explains how many Observers are required in Solution Dimension in order to ensure feasibility of the Data Collection Plan.	0.22	-2.00	-0.67	0.00
2.23. TGM sufficiently explains legal aspects of data collection.	-0.11	-2.00	1.33	0.00
2.24. TGM sufficiently explains ethical aspects of data collection.	0.44	-2.00	1.33	0.00
2.25. TGM sufficiently explains the 'Formulate evaluation approaches and metrics' step to design the Trial.	-0.22	-1.00	0.67	0.00
2.26. TGM sufficiently explains how to formulate Key Performance Indicators in Crisis Management Dimension to obtain answers for formulated Research Questions.	-0.44	-1.00	0.67	0.00
2.27. TGM sufficiently explains how to formulate Key Performance Indicators for Trial Dimension.	-0.22	-1.00	0.00	0.00

Question	Trial 1	Trial 2	Trial 3	Trial 4
2.28. TGM sufficiently explains how to formulate Key Performance Indicators for Solution Dimension.	0.44	0.00	0.00	0.00
2.29. TGM sufficiently explains what is understood by 'Reference data'.	0.22	-1.00	0.33	1.00
2.3. TGM sufficiently explains matching Crisis Management Function with Crisis Management Gap.	0.44	-1.00	0.33	1.00
2.30. TGM sufficiently explains possible methods/techniques of collecting 'Reference data'.	0.22	-1.00	0.33	0.00
2.31. TGM sufficiently explains possible methods/techniques of collecting searched data while trialling 'Innovation Line'.	0.00	-1.00	1.00	0.00
2.32. TGM sufficiently explains what does it mean collecting representative/ credible data.	-0.89	-1.00	0.00	0.00
2.33. TGM sufficiently explains the relation between collected data and Key Performance Indicators for Crisis Management Dimension, incl. analyses techniques which could be applied to interpret the KPIs, enabling answer to formulated Research Questions.	-0.89	-1.00	0.00	0.00
2.34. TGM sufficiently explains the relation between collected data and Key Performance Indicators for Trial Dimension incl. analyses techniques which could be applied to interpret the KPIs.	-0.67	-1.00	0.00	0.00
2.35. TGM sufficiently explains the relation between collected data and Key Performance Indicators for Solution Dimension incl. analyses techniques which could be applied to interpret the KPIs.	-0.22	-1.00	0.00	0.00
2.36. TGM sufficiently explains the 'Formulate scenarios' step to design the Trial.	1.11	-1.00	1.33	1.00
2.37. TGM sufficiently explains possible methods to formulate scenarios which reveal in its course defined/selected Crisis Management Gaps for the Trial.	0.89	-1.00	0.67	1.00
2.38. TGM sufficiently explains possible methods to formulate scenarios in order to keep them close to the reality.	1.11	-1.00	0.67	1.00
2.39. TGM sufficiently explains how to define the roles of Practitioners in order to ensure upmost reality of the Trial setup.	1.11	-1.00	0.00	1.00
2.4. TGM sufficiently explains the 'Identify the Trial objectives' step to design the Trial.	0.44	1.00	1.33	1.00
2.40. TGM sufficiently explains the 'Select solutions' step to design the Trial.	1.11	0.00	1.67	1.00
2.41. TGM sufficiently explains how to ensure selection of most promising solutions for Trial design tailored to highest potential for Crisis Management Gaps coverage.	0.44	0.00	1.00	1.00
2.42. TGM sufficiently explains how to ensure fair competition between solutions in the frame of the 'Select solutions'	1.11	1.00	0.67	1.00

Question	Trial 1	Trial 2	Trial 3	Trial 4
step.				
2.43. TGM sufficiently explains possible choices of matching functionality of a Selected Solution with a formulated Research Question.	0.44	0.00	0.00	1.00
2.44. TGM sufficiently explains how to match Selected Solutions with Data Collection Plan in order to ensure Crisis Management Dimension KPIs measurement.	0.22	-1.00	0.00	0.00
2.45. TGM sufficiently explains how to match Selected Solutions with Data Collection Plan in order to ensure Trial Dimension KPIs measurement.	0.22	-1.00	0.00	0.00
2.46. TGM sufficiently explains how to match Selected Solutions with Data Collection Plan in order to ensure Solution Dimension KPIs measurement.	0.44	-1.00	0.00	0.00
2.47. TGM sufficiently explains the 'Technical integration meeting (TIM)' step to design the Trial.	1.60	-2.00	1.00	1.00
2.48. TGM sufficiently explains legal aspects which need to be taken into account while designing the Trial.	0.22	-1.00	1.33	0.00
2.49. TGM sufficiently explains ethical aspects which need to be taken into account while designing the Trial.	0.00	-1.00	1.33	0.00
2.5. TGM sufficiently explains possible choices of Practitioners involvement into the 'Identify the Trial objectives' step to ensure Practitioners driven Trial.	0.22	0.00	1.33	1.00
2.6. TGM sufficiently explains the 'Formulate research questions' step to design the Trial.	0.00	2.00	1.33	1.00
2.7. TGM sufficiently explains how to formulate a research question in order to ensure appropriate matching it with defined/selected Gaps.	-0.67	2.00	1.00	1.00
2.8. TGM sufficiently explains how to verify/test technical applicability of Data Collection Plan in the Dry Run 1.	-0.20	0.00	0.44	-0.50
2.9. TGM sufficiently explains 'Crisis Management Dimension' in order to prepare Data Collection Plan properly.	0.67	-1.00	1.00	1.00
3.1. The Trial Guidance Tool (TGT) was sufficiently helpful to complete the 'Crisis Management Gaps selection' step.	1.50	0.00	1.00	
3.10. TGT was sufficiently helpful in defining what profiles of Practitioners are required to ensure credibility of collected data in Crisis Management Dimension.	1.00	0.00	-1.00	
3.11. TGT was sufficiently helpful in defining how many Practitioners are required to ensure credibility of collected data in Crisis Management Dimension.	1.00	0.00	-1.00	
3.12. TGT was sufficiently helpful in ensuring a process of data collection which takes into account legal aspects (e.g.	1.00	0.00	0.50	

Question	Trial 1	Trial 2	Trial 3	Trial 4
data collecting, processing, storing, etc.).				
3.13. TGT was sufficiently helpful in ensuring designing an ethical process for data collection.	1.50	0.00	0.50	
3.14. TGT was sufficiently helpful to complete the 'Formulate evaluation approaches and metrics' step.	0.33	0.00	-0.50	
3.15. TGT was sufficiently helpful in defining 'Reference data' from a 'Baseline' for Crisis Management Dimension.	1.50	0.00	-0.50	
3.16. TGT was sufficiently helpful in defining searched data from an 'Innovation Line' for Crisis Management Dimension.	0.67	0.00	-0.50	
3.17. TGT was sufficiently helpful in defining Key Performance Indicators in Crisis Management Dimension.	1.00	0.00	-0.50	
3.18. TGT was sufficiently helpful in defining techniques of collecting searched data for Crisis Management Dimension.	0.00	0.00	-0.50	
3.19. TGT was sufficiently helpful in defining techniques of searched data measurement for Crisis Management Dimension.	1.00	0.00	-0.50	
3.2. TGT was sufficiently helpful in defining/selection of Crisis Management Gaps.	1.00	0.00	1.00	
3.20. TGT was sufficiently helpful in matching collected data with Key Performance Indicators for Crisis Management Dimension.	1.50	0.00	-1.00	
3.21. TGT was sufficiently helpful in linking Key Performance Indicators for Crisis Management Dimension with Research Questions.	1.00	0.00	-1.00	
3.22. TGT was sufficiently helpful in defining Key Performance Indicators for Trial Dimension.	1.50	0.00	0.00	
3.23. TGT was sufficiently helpful in defining techniques for collecting data in Trial Dimension.	1.50	0.00	-0.50	
3.24. TGT was sufficiently helpful in defining techniques of data measurement for Trial Dimension.	1.50	0.00	-0.50	
3.25. TGT was sufficiently helpful in defining Key Performance Indicators for Solution Dimension.	1.50	0.00	0.00	
3.26. TGT was sufficiently helpful in defining techniques for collecting data for Solution Dimension.	0.33	0.00	-0.50	
3.27. TGT was sufficiently helpful in defining techniques of data measurement for Solution Dimension.	1.50	0.00	-0.50	
3.28. TGT was sufficiently helpful to complete the 'Formulate scenarios' step.	1.50	0.00	0.50	
3.29. TGT was sufficiently helpful in formulating scenarios which reveals defined/selected Crisis Management Gaps in	1.50	0.00	0.50	

Question	Trial 1	Trial 2	Trial 3	Trial 4
the course of their realization.				
3.3. TGT was sufficiently helpful in matching a Crisis Management Gap with a Crisis Management function.	1.50	0.00	0.50	
3.30. TGT was sufficiently helpful in defining roles of Practitioners in the scenario in order to ensure upmost reality of the Trial setup.	1.50	0.00	-0.50	
3.31. TGT was sufficiently helpful to complete the 'Select solutions' step.	1.50	0.00	1.00	
3.32. TGT was sufficiently helpful in matching Selected solutions with Research Questions.	1.50	0.00	-0.50	
3.33. TGT was sufficiently helpful in matching Data Collection Plan with Selected Solutions enabling Key Performance Indicators measurement for Crisis Management Dimension.	1.50	0.00	-0.50	
3.34. TGT was sufficiently helpful in matching Data Collection Plan with Selected Solutions enabling KPIs measurement for Trial Dimension.	1.50	0.00	-0.50	
3.35. TGT was sufficiently helpful in matching Data Collection Plan with Selected Solutions enabling KPIs measurement for Solution Dimension.	1.50	0.00	-0.50	
3.36. TGT was sufficiently consulted for legal aspects of the Trial design.	1.50	0.00	-0.50	
3.37. TGT was sufficiently consulted for ethical aspects of the Trial design.	1.50	0.00	-0.50	
3.4. TGT was sufficiently helpful to complete the 'Identify the Trial objectives' step.	1.50	0.00	1.00	
3.5. TGT was sufficiently helpful in matching defined/selected Crisis Management Gaps with the Trial objectives.	1.00	0.00	1.00	
3.6. TGT was sufficiently helpful to complete the 'Formulate research questions' step.	0.67	0.00	0.50	
3.7. TGT was sufficiently helpful in matching Research Questions with defined/selected Crisis Management Gaps.	1.00	0.00	-1.00	
3.8. TGT was sufficiently helpful to complete the 'Formulate data collection plan' step.	1.00	0.00	0.00	
3.9. TGT was sufficiently helpful in designing 'Baseline'.	1.00	0.00	-0.50	
4.1. The role of the Test-bed infrastructure (TB) is sufficiently explained to design a Trial.	0.40	-1.00	1.67	1.00
4.10. TB's Message Injector is sufficiently explained to design a Trial.	0.00	-1.00	1.00	0.00
4.11. TB's Admin Tool and security is sufficiently explained to design a Trial.	0.00	-1.00	1.00	1.00

Question	Trial 1	Trial 2	Trial 3	Trial 4
4.12. TB's Docker Environment is sufficiently explained to design a Trial.	0.50	-1.00	0.67	1.00
4.13. TB's Data Server is sufficiently explained to design a Trial.	0.00	-1.00	0.67	0.00
4.14. TB's Platform is sufficiently explained to design a Trial.	0.60	-1.00	1.00	1.00
4.15. Defining selection of TB's Platform in order to ensure upmost reality of the Trial setup (e.g. if there is a need for in-door, out-door facilities) is sufficiently explained.	0.60	-1.00	0.67	1.00
4.16. TB's Observer Support Tool is sufficiently explained to design a Trial.	1.00	0.00	1.00	1.00
4.17. TB's After-Action Review Module is sufficiently explained to design a Trial.	0.00	-1.00	0.67	1.00
4.18. The type of data which could be recorded by TB is sufficiently explained.	0.80	-1.00	1.00	1.00
4.19. The formats of data collected by TB which could be downloaded for evaluation is sufficiently explained.	0.00	-1.00	0.67	1.00
4.2. TB's simulation space is sufficiently explained to design a Trial.	0.20	-1.00	1.50	0.00
4.20. Technical Integration Meeting (TIM) ensures sufficient level of solutions integration to TB in order to conduct a Dry Run 1.	0.67	-1.00	1.00	2.00
4.3. The integration of solutions with the TB's simulation space (incl. adaptors) is sufficiently explained to conduct a Dry Run 1.	0.40	-1.00	1.50	-2.00
4.4. The integration of simulators (incl. simulations realized in the frame of TB's Platform e.g. role-plays) with TB simulation space (incl. adaptors) is sufficiently explained to conduct a Dry Run 1.	0.20	-1.00	1.50	1.00
4.5. TB's information space is sufficiently explained to design a Trial.	0.00	-1.00	1.67	1.00
4.6. The integration of solutions with TB's information space (incl. adaptors) is sufficiently explained to conduct a Dry Run 1.	0.60	-1.00	1.33	1.00
4.7. TB's Play Service is sufficiently explained to design a Trial.	0.25	-1.00	1.33	0.00
4.8. TB's Trial Scenario Management Tool is sufficiently explained to design a Trial.	0.75	-1.00	1.00	1.00
4.9. TB's Time Service is sufficiently explained to design a Trial.	0.50	-1.00	1.00	0.00
5.1. How many times do you follow 6-steps cycle in interactive way to design elements of the Trial? Please indicate a proper number (1-6)?				

Question	Trial 1	Trial 2	Trial 3	Trial 4
5.10. How much do you agree with the statement that TGM Training Module has met your expectations as it comes to its content?	1.00	0.00	2.00	
5.11. How much do you agree with the statement that the didactic content of TGM Training Module has sufficiently explained all the aspects you need to know to implement TGM in Preparation phase?	1.00	0.00	2.00	
5.12. How much do you agree with the statement that TGM Training Module utilizes didactic methods which sufficiently prepared you to implement TGM in Preparation phase?	1.50	0.00	1.50	
5.13. How much do you agree with the statement that you have designed your Trial in line with TGM?	1.00	1.50	1.00	1.00
5.14. How much do you agree with the statement that you have managed to design the Trial which is ready for the Execution phase?	1.00	0.50	1.00	2.00
5.15. How much do you agree with the statement that you have designed the Trial which gives high probability to create new knowledge on the basis of the Trial results?	1.00	-0.50	1.00	1.00
5.16. How much do you agree with the statement that you have designed your Trial which gives high probability to find innovations in Crisis Management at the end of its Evaluation phase?	1.00	0.00	0.67	1.00
5.17. How much do you agree with the statement that the Trial Guidance Methodology (TGM) is usable to design the Trial?	1.25	0.50	0.67	1.00
5.18. How much do you agree with the statement that You have assessed the validity of the Trial Guidance Methodology in order to design the Trial?	1.25	0.00	0.50	1.00
5.19. How much do you agree with the statement that TGM is pragmatic enough (able to implement successfully) for practical Trial design?	0.75	-0.50	0.67	1.00
5.2. How much do you agree with the statement that You have sufficiently understood the Trial Guidance Methodology (TGM) in order to design the Trial?	0.75	1.00	1.33	1.00
5.20. How much do you agree with the statement that You were able to find logical references to your doubts in TGM during Trial Preparation phase in order to design the Trial?	0.33	-1.00	0.67	1.00
5.21. How much do you agree with the statement that TGM is affordable for the process of Trial design?	0.50	0.00	-0.50	
5.22. How much do you agree with the statement that you were able to ask TGM support team for support in each case You faced difficulties in using and performing measurements of subjective KPIs in the Preparation phase?	0.50	2.00	0.00	1.00

Question	Trial 1	Trial 2	Trial 3	Trial 4
5.23. How much do you agree with the statement that each time you have asked TGM support team for support you have received content-wise and sufficient support to overcome doubts connected with credibility You faced in the Preparation phase?	0.50	0.00	1.00	1.00
5.24. How much do you agree with the statement that clearness of leads (tips) you have received from TGM support team helped you in implementing them into Trial design in time?	0.25	1.00	1.00	1.00
5.25. How much do you agree with the statement that TGM Training Module was valuable and met your expectations as it comes to its content?	1.00	0.00	1.50	
5.26. How much do you agree with the statement that the didactic content of TGM Training Module has sufficiently explained all the aspects You need to know to implement TGM innovation in the Preparation phase?	0.33	0.00	1.50	
5.27. How much do you agree with the statement that TGM Training Module's didactic methods were reliable enough for preparing You to implement TGM in the Preparation phase?	1.00	0.00	1.50	
5.28. How much do you agree with the statement that you have designed your Trial credibly and in line with TGM?	0.50	1.00	1.00	1.00
5.29. How much do you agree with the statement that you have designed the Trial which status enables to step into Execution phase?	0.80	0.50	1.67	1.00
5.3. How much do you agree with the statement that You know how to use the TGM in order to design the Trial?	0.50	0.00	1.00	1.00
5.30. How much do you agree with the statement that added value in your Trial gives high probability to create new knowledge on the basis of the Trial results?	1.20	0.00	0.67	1.00
5.31. How much do you agree with the statement that you have designed the cost-effective Trial which gives high probability to find innovations in Crisis Management with the lowest possible cost after its Evaluation phase?	0.60	0.00	0.00	
5.32. How much do you agree with the statement that simplicity of didactic methods used in TGM Training Module gives high probability of understanding the idea of TGM?	1.50	0.00	1.50	
5.4. How much do you agree with the statement that You are able to implement TGM into practical Trial design successfully?	0.75	0.50	0.00	1.00
5.5. How much do you agree with the statement that You are able to find sufficient references in TGM to your doubts in the Trial Preparation phase in order to design the Trial?	0.50	1.00	0.33	1.00
5.6. How much do you agree with the statement that TGM sufficiently facilitates the process of the Trial design?	1.00	0.50	0.33	1.00

Question	Trial 1	Trial 2	Trial 3	Trial 4
5.7. How much do you agree with the statement that you have asked TGM support team for support in each case you faced problems with implementation of TGM in Preparation phase?	1.25	2.00	0.50	1.00
5.8. How much do you agree with the statement that each time you asked TGM support team for support you have received content-wise and sufficient support to overcome problems you faced in Preparation phase?2	0.75	0.00	1.00	1.00
5.9. How much do you agree with the statement that each time you asked TGM support team for support you have received it in time to be able to implement it into Trial design according to preparation time-line?	0.75	0.50	1.50	2.00

Annex 2.2 Execution phase

Table A3: Results of evaluation survey for Trial 1 – Trial 4 (Execution phase, OST data).

Question	Trial 1	Trial 2	Trial 3	Trial 4
1.1. The Trial Guidance Methodology (TGM) is sufficiently defined to understand what it is.2	-0.25	2.00	1.18	1.00
1.2. The role of TGM in the Trial execution is sufficiently explained.2	0.20	2.00	0.78	0.60
1.3. The Test-bed infrastructure (TB) is sufficiently defined to understand what it is.	0.00	1.00	0.70	0.91
1.4. The role of TB in the Trial design is sufficiently explained.2	0.00	1.00	0.64	1.00
2.1. TGM sufficiently explains the step 'Review of scenario with simulations' as a part of the Dry Run 1 to execute the Trial.	-0.60	1.00	1.13	-0.33
2.10. TGM sufficiently explains how to verify/test applicability of the Data Collection Plan with participation of the selected Participants and Observers in the Dry Run 2.	-0.60	0.00	1.14	0.00
2.11. TGM sufficiently explains training for the Observers to ensure feasibility of the Data Collection Plan realization for Crisis Management Dimension.	-0.20	1.00	0.00	0.00
2.12. TGM sufficiently explains training for the Observers to ensure feasibility of the Data Collection Plan realization for Trial Dimension.	-0.20	1.00	-0.14	0.00
2.13. TGM sufficiently explains training for the Observers to ensure feasibility of the Data Collection Plan realization for Solution Dimension.	0.00	1.00	-0.13	0.00

Question	Trial 1	Trial 2	Trial 3	Trial 4
2.14. TGM sufficiently explains the step 'Finalization of TAP'.	-0.20	0.00	1.00	0.67
2.15. TGM sufficiently explains the step 'Execution and data collection' as a part of the Trial execution.	-0.20	1.00	0.88	0.75
2.16. The same Practitioners should attend both the Dry Run 2 and the Trial.	1.33	1.00	0.10	0.29
2.17. The same Observers should attend both the Dry Run 2 and the Trial.	1.83	0.00	0.60	1.14
2.18. TAP is a useful document in TGM implementation for the execution of the Trial.	0.50	0.00	0.78	1.14
2.19. TGM implementation enables complete realization of the Data Collection Plan.	0.40	1.00	0.63	-0.25
2.20. TGM implementation enables recording the data in orderly manner.	0.20	1.00	0.63	0.33
2.22. TGM sufficiently explains who is understood as 'External stakeholder'.	0.60	2.00	0.57	1.00
2.23. TGM sufficiently explains possible choices of collecting feedback from External stakeholders.	-0.60	1.00	0.43	1.00
2.24. The final feedback from External stakeholders is helpful to collect additional opinions and/or observations to answer Research Questions.	1.00	2.00	0.44	1.25
2.3. TGM sufficiently explains how to conduct the training on Solution for the Participants.	-0.20	2.00	0.25	0.50
2.4. TGM sufficiently explains how to conduct the training on Solution for the Observers.	0.20	2.00	-0.13	0.00
2.5. TGM sufficiently supports the process of Practitioners selection in order to ensure representative data collection during the Trial.	0.20	0.00	0.50	0.00
2.6. The pilot trial executed during the Dry Run 2 sufficiently prepared the Trial setup to be appropriately applied in the final Trial execution.	-0.17	0.00	1.70	1.33
2.7. TGM sufficiently explains the step 'Review of trial/solution evaluation plan' to execute the Trial.	-0.20	1.00	0.50	0.25
2.8. TGM sufficiently explains the 'Formulate data collection plan' step to design the Trial.	-0.44	-2.00	1.00	1.00
2.9. TGM sufficiently explains the step 'Final Trial/solution evaluation plan' to execute the Trial.	-0.80	0.00	0.63	0.00
3.1. The Test-bed infrastructure (TB) is explained sufficiently to execute the Trial achieving necessary data collection as a final result.	-0.33	1.00	1.22	0.80
3.10. TB's Information space enables realization of the Data Collection Plan in order to measure KPIs for the Trial Dimension.	-0.17	0.00	0.71	0.00

Question	Trial 1	Trial 2	Trial 3	Trial 4
3.11. TB's Information space enables realization of the Data Collection Plan in order to measure KPIs for the Solution Dimension.	0.00	0.00	0.71	0.75
3.12. TB enables sufficient integration of simulators (incl. simulations realized in the frame of TB's Platform e.g. role-plays) with the Simulation space to conduct the Dry Run 1.	-0.17	-1.00	1.00	1.00
3.13. TB enables execution of simulations adequate to the Trial scenario during the Dry Run 1.	0.33	1.00	1.00	1.00
3.14. The step 'Final review of local Test-bed adaptation' as a part of the Dry Run 2 is sufficiently explained to execute the Trial.	-0.40	1.00	1.60	0.75
3.15. TB's Play Service sufficiently supports Trial execution.	-0.20		1.60	0.00
3.16. TB's Trial Scenario Management Tool sufficiently supports Trial execution.	-1.00	0.00	1.33	0.50
3.17. TB's Trial Scenario Management Tool is easy to use in execution of the Trial.	-1.20		1.13	1.00
3.18. TB's Time Service is easy to use in Execution phase of the Trial.	-1.00		1.14	1.00
3.19. TB's Message Injector sufficiently supports Trial execution.	-0.50	0.00	1.20	
3.2. The step 'Review of local Test-bed adaptation' as a part of the Dry Run 1 is sufficiently explained to execute the Trial.	0.00	0.00	1.00	1.00
3.20. TB's Message Injector is easy to use in Execution phase of the Trial.	-0.33	0.00	0.83	
3.21. TB's Admin Tool and security sufficiently supports Trial execution.	-0.33	0.00	0.83	1.00
3.22. TB's Admin Tool and security is easy to use in Execution phase of the Trial.	-0.50	0.00	1.00	0.50
3.23. TB's Docker Environment sufficiently supports Trial execution.	0.20	0.00	1.14	0.00
3.24. TB's Docker Environment is easy to use in Execution phase of the Trial.	-0.60	0.00	1.00	-0.50
3.25. TB's Data Server sufficiently supports Trial execution.	0.00	-1.00	0.60	
3.26. TB's Data Server is easy to use in Execution phase of the Trial.	-0.25	-1.00	0.75	
3.27. TB's Platform sufficiently supports Trial execution.	0.60	0.00	1.63	1.00
3.28. TB runs in accordance to the Trial scenario assumptions.	0.40	1.00	1.63	1.00

Question	Trial 1	Trial 2	Trial 3	Trial 4
3.29. TB simulates the Trial context on the appropriate level of realism.	0.80	1.00	1.29	0.67
3.3. TB provides sufficient technical opportunities to integrate Solutions to achieve the Dry Run 1 goals.	0.33	1.00	1.43	0.80
3.30. Observer Support Tool sufficiently supports realization of the Data Collection Plan during Trial execution.	0.00	0.00	1.38	1.00
3.31. Observer Support Tool is easy to use in Execution phase of the Data Collection Plan.	-0.20	0.00	0.88	-1.67
3.32. TB's After-Action Review Module sufficiently supports realization of the Data Collection Plan in Trial execution.	-0.75		0.83	0.00
3.33. TB's After-Action Review Module is easy to use in execution of the Data Collection Plan.	-0.75		1.00	-0.50
3.4. TB enables sufficient integration of Solutions to the Simulation space to conduct the Dry Run 1.	-0.40	1.00	1.20	0.50
3.5. TB allows to collect the necessary data from the Simulation space.	-0.17	0.00	1.57	0.60
3.6. TB enables sufficient integration of Solutions to the Information space to conduct the Dry Run 1.	0.17	1.00	1.38	0.75
3.7. TB sufficiently supports trialling 'Baseline' in order to collect reference data.	-1.00	1.00	-0.20	0.75
3.8. TB sufficiently supported trialling 'Innovation Line' in order to collect searched data.	-0.17	1.00	1.56	0.80
3.9. TB's Information space enables realization of the Data Collection Plan in order to measure KPIs for the Crisis Management Dimension.	-0.67	0.00	0.71	0.25
4.1. How much do you agree with the statement that You sufficiently understand the Trial Guidance Methodology (TGM) in order to execute the Trial collecting all required data?	0.00	0.00	1.71	0.75
4.10. How much do you agree with the statement that the didactic content of TGM Training Module has sufficiently explained all the aspects you need to know to implement TGM in Trial Execution phase?	-0.40		1.00	0.17
4.11. How much do you agree with the statement that TGM Training Module has utilized didactic methods which sufficiently prepared you to implement TGM in Trial Execution phase?	-0.40		0.80	0.00
4.12. How much do you agree with the statement that you have executed your Trial in line with TGM?	0.14	1.00	1.71	0.75
4.13. How much do you agree with the statement that data collected during Execution phase are accurate enough to reliably analyse KPIs for the Crisis Management dimension?	0.43	0.00	0.67	1.00
4.14. How much do you agree with the statement that data collected during Execution phase are accurate enough to reliably analyse KPIs for the Trial dimension?	0.29	1.00	1.17	1.50

Question	Trial 1	Trial 2	Trial 3	Trial 4
4.15. How much do you agree with the statement that data collected during Execution phase are accurate enough to reliably analyse KPIs for the Solution dimension?	0.29	1.00	1.50	1.00
4.16. How much do you agree with the statement that data collected during Execution phase are consistent enough to reliably analyse KPIs for the Crisis Management dimension?	0.29	0.00	1.17	1.00
4.17. How much do you agree with the statement that data collected during Execution phase are consistent enough to reliably analyse KPIs for the Trial dimension?	0.29	1.00	1.17	1.00
4.18. How much do you agree with the statement that data collected during Execution phase are consistent enough to reliably analyse KPIs for the Solution dimension?	0.14	1.00	1.40	1.00
4.19. How much do you agree with the statement that data collected during Execution phase are complete enough to reliably analyse KPIs for the Crisis Management dimension?	0.29	0.00	1.17	1.00
4.2. How much do you agree with the statement that You know how to use the TGM in order to execute the Trial collecting all required data?	0.00	1.00	1.43	0.50
4.20. How much do you agree with the statement that data collected during Execution phase are complete enough to reliably analyse KPIs for the Trial dimension?	0.14	1.00	1.17	0.75
4.21. How much do you agree with the statement that data collected during Execution phase are complete enough to reliably analyse KPIs for the Solution dimension?	0.29	0.00	1.00	0.80
4.22. How much do you agree with the statement that data collected during Execution phase could be reproduced in order to analyse KPIs for the Crisis Management dimension?	0.14	-1.00	0.60	1.00
4.23. How much do you agree with the statement that data collected during Execution phase could be reproduced in order to analyse KPIs for the Trial dimension?	0.14	0.00	0.60	1.33
4.24. How much do you agree with the statement that data collected during Execution phase could be reproduced in order to analyse KPIs for the Solution dimension?	0.29	0.00	0.80	1.00
4.25. How much do you agree with the statement that data collected during Execution phase have formats which enable reliable analyses of KPIs for the Crisis Management dimension?	0.14	0.00	1.00	1.00
4.26. How much do you agree with the statement that data collected during Execution phase have formats which enable reliable analyses of KPIs for the Trial dimension?	0.14	1.00	1.20	0.75

Question	Trial 1	Trial 2	Trial 3	Trial 4
4.27. How much do you agree with the statement that data collected during Execution phase have formats which enable reliable analyses of KPIs for the Solution dimension?	0.14	1.00	1.20	0.75
4.28. How much do you agree with the statement that data collected during Execution phase cover the scope planned in data collection plan and through that enable reliable analyses of KPIs for the Crisis Management dimension?	0.57	0.00	1.17	1.25
4.29. How much do you agree with the statement that data collected during Execution phase cover the scope planned in data collection plan and through that enable reliable analyses of KPIs for the Trial dimension?	0.43	1.00	1.17	1.33
4.3. How much do you agree with the statement that You were able to successfully implement TGM into practical Trial execution?	0.00	1.00	1.43	0.63
4.30. How much do you agree with the statement that data collected during Execution phase cover the scope planned in data collection plan and through that enable reliable analyses of KPIs for the Solution dimension?	0.43	1.00	1.33	1.33
4.31. How much do you agree with the statement that you have executed your Trial in a way which gives high probability to create new knowledge on the basis of the Trial results?	0.71	0.00	1.29	0.86
4.32. How much do you agree with the statement that you have executed your Trial in a way which gives high probability to find innovations in Crisis Management at the end of its Evaluation phase?	1.00	0.00	1.17	0.71
4.33. How much do you agree with the statement that TGM is easy to follow in order to execute the Trial and be able to collect required data?	0.00	1.00	1.29	0.67
4.34. How much do you agree with the statement that You assessed the validity of TGM in order to collect required data while executing the Trial?	0.20	1.00	0.86	0.75
4.35. How much do you agree with the statement that TGM is pragmatic enough (able to implement successfully) for practical Trial execution?	0.20	1.00	1.14	0.43
4.36. How much do you agree with the statement that You were able to find logical references to your doubts in TGM during the Trial Execution phase?	0.40	1.00	0.33	0.00
4.37. How much do you agree with the statement that TGM is affordable for the process of the Trial execution?	0.20	0.00	1.00	0.00
4.38. How much do you agree with the statement that you were able to ask TGM support team for support in each case you faced difficulties in using and performing measurements of subjective KPIs in the Execution phase?	0.40	2.00	1.40	0.60

Question	Trial 1	Trial 2	Trial 3	Trial 4
4.39. How much do you agree with the statement that each time you asked TGM support team for support you have received content-wise and sufficient support to overcome doubts connected with credibility You faced in the Execution phase?	0.40	2.00	1.40	0.40
4.4. How much do you agree with the statement that You were able to find sufficient references to your doubts in TGM during Trial Execution phase?	-0.29	1.00	0.20	0.60
4.40. How much do you agree with the statement that clearness of leads (tips) you have received from TGM support team helped you in implementing them into Trial design in time according to execution time-line?	0.60	2.00	1.40	0.20
4.41. How much do you agree with the statement that TGM Training Module was valuable and met your expectations as it comes to its content concerning the Execution phase?	-0.40		1.00	0.33
4.42. How much do you agree with the statement that the didactic content of TGM Training Module has sufficiently explained all the aspects You need to know to implement TGM innovation in the Execution phase?	-0.20		1.00	0.17
4.43. How much do you agree with the statement that TGM Training Module's didactic methods were reliable enough for preparing You to implement TGM in the Execution phase?	-0.20		1.00	0.00
4.44. How much do you agree with the statement that you have executed your Trial credibly in line with TGM?	0.00	1.00	1.71	0.71
4.45. How much do you agree with the statement that data collected during the Execution phase are usable to reliably analyse KPIs for the Crisis Management dimension?	0.57	0.00	1.17	0.50
4.46. How much do you agree with the statement that data collected during the Execution phase are usable to reliably analyse KPIs for the Trial dimension?	0.43	1.00	1.17	0.75
4.47. How much do you agree with the statement that data collected during the Execution phase are usable to reliably analyse KPIs for the Solution dimension?	0.29	1.00	0.83	1.00
4.48. How much do you agree with the statement that data collected during the Execution phase are credible enough to reliably analyse KPIs for the Crisis Management dimension?	0.57	0.00	1.33	0.75
4.49. How much do you agree with the statement that data collected during the Execution phase are credible enough to reliably analyse KPIs for the Trial dimension?	0.43	1.00	1.33	0.75
4.5. How much do you agree with the statement that TGM sufficiently facilitates the process of Trial execution?	0.00	1.00	1.43	0.57
4.50. How much do you agree with the statement that data collected during the Execution phase are credible enough	0.43	1.00	1.33	0.75

Question	Trial 1	Trial 2	Trial 3	Trial 4
to reliably analyse KPIs for the Solution dimension?				
4.51. How much do you agree with the statement that data collected during the Execution phase to reliably analyse KPIs for the Crisis Management dimension are cost-effective?	0.14	0.00	0.00	-0.33
4.52. How much do you agree with the statement that data collected during the Execution phase to reliably analyse KPIs for the Trial dimension are cost-effective?	0.14	1.00	0.00	-0.33
4.53. How much do you agree with the statement that data collected during the Execution phase to reliably analyse KPIs for the Solution dimension are cost-effective?	0.00	1.00	0.00	-0.33
4.54. How much do you agree with the statement that data collected during the Execution phase have added value and could be reproduced in order to analyse KPIs for the Crisis Management dimension?	0.71	0.00	0.60	0.33
4.55. How much do you agree with the statement that data collected during the Execution phase have added value and could be reproduced in order to analyse KPIs for the Trial dimension?	0.43	0.00	0.60	0.50
4.56. How much do you agree with the statement that data collected during the Execution phase have added value and could be reproduced in order analyse KPIs for the Solution dimension?	0.71	0.00	0.80	0.50
4.57. How much do you agree with the statement that affordability of data collected during the Execution phase enable reliable analyses of KPIs for the Crisis Management dimension?	0.67		0.83	0.50
4.58. How much do you agree with the statement that affordability of data collected during the Execution phase enable reliable analyses of KPIs for the Trial dimension?	0.50		0.83	0.50
4.59. How much do you agree with the statement that affordability of data collected during the Execution phase enable reliable analyses of KPIs for the Solution dimension?	0.50		1.00	0.50
4.6. How much do you agree with the statement that you have asked TGM support team for support in each case you faced problems with implementation of TGM in Execution phase?	0.86	2.00	1.00	0.67
4.60. How much do you agree with the statement that data collected during the Execution phase cover the scalability planned in the Data Collection Plan and through that enable reliable analyses of KPIs for the Crisis Management dimension and create possibility for improvement of the Trial?	0.33	1.00	1.40	0.67
4.61. How much do you agree with the statement that data collected during the Execution phase cover the scalability planned in the Data Collection Plan and through that enable reliable analyses of KPIs for the Trial dimension and create possibility for improvement of the Trial?	0.33		1.40	0.67

Question	Trial 1	Trial 2	Trial 3	Trial 4
4.62. How much do you agree with the statement that data collected during the Execution phase cover the scalability planned in the Data Collection Plan and through that enable reliable analyses of KPIs for the Solution dimension and create possibility for improvement of the Trial?	0.50		1.17	0.67
4.63. How much do you agree with the statement that you have executed your Trial so it gives high probability to create innovation knowledge on the basis of the Trial results?	0.57	0.00	1.29	0.75
4.64. How much do you agree with the statement that you have executed your Trial so it gives high probability to find innovations in Crisis Management at the end of its Evaluation phase described as EU added value?	0.86	0.00	1.33	0.57
4.7. How much do you agree with the statement that each time you asked TGM support team for support you received content-wise and sufficient support to overcome problems you faced in Execution phase?	0.43	2.00	1.00	0.60
4.8. How much do you agree with the statement that each time you asked TGM support team for support you received it in time to be able to implement it into the Trial according to execution time-line?	0.29	1.00	1.40	0.50
4.9. How much do you agree with the statement that TGM Training Module has met your expectations as it comes to its content concerning Execution phase?	-0.40		0.60	0.00

Annex 2.3 Evaluation phase

Table A4: Results of evaluation survey for Trial 1 – Trial 4 (Evaluation phase, OST data).

Question	Trial 1	Trial 2	Trial 3	Trial 4
1.1. The proposed infrastructure of the Test-bed is an appropriate environment for the assessment of some Crisis Management solutions.	0.60	1.67	2.00	1.00
1.10. TB sufficiently enables downloading collected data in a format easy to be processed in for evaluation purposes.	-0.50	-0.67	1.50	-1.00
1.11. TGM implementation enables realization Data Collection Plan resulting with enough data collected to answer Research Questions.	0.00	0.33	0.75	-1.00
1.12. TGM contributes to Crisis Management performance improvement.	0.30	1.33	1.25	1.00
1.13. TGM contributes to the organization of roles and tasks in the Crisis Management process.	0.50	0.33	1.00	2.00

Question	Trial 1	Trial 2	Trial 3	Trial 4
1.14. All TGM elements have been understood in the implementation of TGM.	0.20	0.50	1.00	
1.15. All TGM elements have been useful in the implementation of TGM.	-0.44	1.00	1.50	
1.16. The international dimension of TGM contributes to the development and gathering of good practices.	0.22	1.00	1.00	0.00
1.17. TGM contributes to increasing the effectiveness of tool suppliers' cooperation with Crisis Management practices.	0.78	1.00	1.25	1.00
1.18. Data collected during the Trial was sufficiently complete to get answers to research questions.	0.30	0.33	1.33	1.00
1.19. The innovativeness of the solutions has helped to overcome the identified Gaps in Crisis Management.	0.40	0.00	1.33	1.00
1.2. TGM contributes to improvement of the efficiency of human resources management as part of Crisis Management activities.	0.20	0.67	1.25	2.00
1.20. Those responsible for collecting the data (observers) have been adequately prepared.	0.10	0.00	1.50	2.00
1.21. Those responsible for collecting the data (observers) done it reliably.	0.50	1.00		2.00
1.22. TGM's assumptions met the expectations of practitioners (end-users).	0.20	-0.33	0.75	1.00
1.23. TGM step 'Data quality check' is necessary to prepare the Trial.	1.50	1.33	0.50	2.00
1.24. TGM step 'Data analysis' is necessary to prepare the Trial.	1.40	1.33	0.50	1.00
1.25. TGM step 'Synthesis' is necessary to prepare the Trial.	1.30	1.00	0.50	1.00
1.26. TGM step 'Internal Documentation' is necessary to prepare the Trial.	0.80	1.33	0.25	0.00
1.27. TGM step 'Dissemination' is necessary to prepare the Trial.	0.90	1.33	0.75	2.00
1.28. TGM step 'Internal Documentation' is necessary to prepare the Trial.	0.80	2.00	0.75	2.00
1.29. TGM step 'Dissemination' is necessary to prepare the Trial.	0.80	1.50	0.75	2.00
1.3. TGM contributes to improvement of the efficiency of time management as part of Crisis Management activities.	-0.10	0.67	0.75	0.00
1.30. TGM sufficiently explains step 'Data quality check' to execute the Trial.	0.40	1.33	1.25	0.00
1.31. TGM sufficiently explains step 'Data analysis' to execute the Trial.	0.30	0.50	1.25	

Question	Trial 1	Trial 2	Trial 3	Trial 4
1.32. TGM sufficiently explains step 'Synthesis' to execute the Trial.	0.20	0.50	1.25	
1.33. TGM sufficiently explains step 'Internal Documentation' to execute the Trial.	0.30	1.00	0.75	1.00
1.34. TGM sufficiently explains step 'Dissemination' to execute the Trial.	0.20	1.00	0.75	2.00
1.4. TGM contributes to the improvement of the financial management efficiency as part of Crisis Management activities.	-0.30	0.67	0.75	-1.00
1.5. TGM helps to improvement the efficiency of coordination and logistics of the team's activities.	0.60	1.33	1.25	2.00
1.6. TGM sufficiently explains the influence of Trial Dimension results on the Crisis Management Dimension results in respect to the credibility of the answers for Research Questions.	0.20	1.00	1.00	1.00
1.7. TGM sufficiently explains the influence of Solution Dimension results on the Crisis Management Dimension results in respect to the credibility of the answers for Research Questions.	0.20	0.67	1.00	1.00
1.8. TGM sufficiently explains the influence of Trial Dimension results on the Crisis Management Dimension results.	0.40	1.00	1.00	1.00
1.9. TGM sufficiently explains possible methods of Key Performance Indicators interpretations based on the data collected.	-0.90	-0.33	1.25	0.00

Annex 3 – Mapping of the Key Performance Indicators (KPIs) for evaluation survey's questions

Key Performance Indicators (KPIs) were defined to find the added value of the DRIVER+ Test-bed methodology and its solutions concerning: EU added value, usefulness, scalability, modularity, reliability, innovation, affordability, cost-effectiveness, usability and validity. These KPIs values were extracted from answers to questions asked within the Semi-structured interview (SI) by mapping KPIs to certain questions as it is presented in Table A5.

Table A5: Mapping of the Key Performance Indicators (KPIs) for evaluation survey's questions.

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
1.1. Explanation of the Trial Guidance Methodology (TGM) is sufficient to understand what it is.										
1.2. The role of TGM in the Trial design is sufficiently explained.										
1.3. Explanation of the Trial Guidance Tool (TGT) is sufficient to understand what it is.										
1.4. The role of TGT in the Trial design is sufficiently explained.										
1.5. The Test-bed infrastructure (TB) is sufficiently defined to understand what it is.										
1.6. The role of TB in the Trial design is sufficiently explained.										
2.1. TGM sufficiently explains the step 'Crisis Management Gaps selection' to design the Trial.										
2.10. TGM sufficiently explains 'Trial Dimension' in order to prepare Data Collection Plan properly.										
2.11 TGM sufficiently explains 'Solution Dimension' in order to prepare Data Collection Plan properly.										
2.12. TGM sufficiently explains what is understood by 'Baseline'.										
2.13. TGM sufficiently explains possible methods to imitate 'Baseline' to design the Trial.										
2.14. TGM sufficiently explains what is understood by 'Innovation Line'.										
2.15. TGM sufficiently explains possible methods										

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
to imitate 'Innovation Line' to design the Trial.										
2.16. TGM sufficiently explains what profiles of Practitioners should be involved in the Trial in order to ensure credibility of collected data.		X								
2.17. TGM sufficiently explains what profiles of Observers should be involved in collecting data for Crisis Management Dimension in order to ensure credibility of collected data.		X								
2.18. TGM sufficiently explains what profiles of Observers should be involved in collecting data in Trial Dimension in order to ensure credibility of collected data.		X								
2.19. TGM sufficiently explains what profiles of Observers should be involved in collecting data in Solution Dimension in order to ensure credibility of collected data.										
2.2. TGM sufficiently explains possible choices of Practitioners involvement into 'Crisis Management Gaps selection' in order to ensure Practitioners driven trial.										
2.20. TGM sufficiently explains how many Observers are required in Crisis Management Dimension in order to ensure feasibility of the Data Collection Plan.										
2.21. TGM sufficiently explains how many Observers are required in the Trial Dimension in order to ensure feasibility of the Data Collection Plan.										
2.22. TGM sufficiently explains how many Observers are required in Solution Dimension in order to ensure feasibility of the Data Collection Plan.										
2.23. TGM sufficiently explains legal aspects of data collection.		X								
2.24. TGM sufficiently explains ethical aspects of data collection.		X								
2.25. TGM sufficiently explains the 'Formulate evaluation approaches and metrics' step to design the Trial.										

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
2.26. TGM sufficiently explains how to formulate Key Performance Indicators in Crisis Management Dimension to obtain answers for formulated Research Questions.	X	X							X	
2.27. TGM sufficiently explains how to formulate Key Performance Indicators for Trial Dimension.	X	X							X	
2.28. TGM sufficiently explains how to formulate Key Performance Indicators for Solution Dimension.	X	X							X	
2.29. TGM sufficiently explains what is understood by 'Reference data'.										
2.3. TGM sufficiently explains matching Crisis Management Function with Crisis Management Gap.	X	X				X			X	
2.30. TGM sufficiently explains possible methods/techniques of collecting 'Reference data'.										
2.31. TGM sufficiently explains possible methods/techniques of collecting searched data while trialling 'Innovation Line'.		X							X	
2.32. TGM sufficiently explains what does it mean collecting representative/ credible data.										
2.33. TGM sufficiently explains the relation between collected data and Key Performance Indicators for Crisis Management Dimension, incl. analyses techniques which could be applied to interpret the KPIs, enabling answer to formulated Research Questions.		X							X	
2.34. TGM sufficiently explains the relation between collected data and Key Performance Indicators for Trial Dimension incl. analyses techniques which could be applied to interpret the KPIs.		X							X	
2.35. TGM sufficiently explains the relation between collected data and Key Performance Indicators for Solution Dimension incl. analyses techniques which could be applied to interpret the KPIs.		X							X	
2.36. TGM sufficiently explains the 'Formulate										

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
scenarios' step to design the Trial.										
2.37. TGM sufficiently explains possible methods to formulate scenarios which reveal in its course defined/selected Crisis Management Gaps for the Trial.		X							X	
2.38. TGM sufficiently explains possible methods to formulate scenarios in order to keep them close to the reality.		X			X				X	
2.39. TGM sufficiently explains how to define the roles of Practitioners in order to ensure upmost reality of the Trial setup.		X			X				X	
2.4. TGM sufficiently explains the 'Identify the Trial objectives' step to design the Trial.										
2.40. TGM sufficiently explains the 'Select solutions' step to design the Trial.										
2.41. TGM sufficiently explains how to ensure selection of most promising solutions for Trial design tailored to highest potential for Crisis Management Gaps coverage.		X				X			X	
2.42. TGM sufficiently explains how to ensure fair competition between solutions in the frame of the 'Select solutions' step.		X				X			X	
2.43. TGM sufficiently explains possible choices of matching functionality of a Selected Solution with a formulated Research Question.		X							X	
2.44. TGM sufficiently explains how to match Selected Solutions with Data Collection Plan in order to ensure Crisis Management Dimension KPIs measurement.		X			X				X	
2.45. TGM sufficiently explains how to match Selected Solutions with Data Collection Plan in order to ensure Trial Dimension KPIs measurement.		X			X				X	
2.46. TGM sufficiently explains how to match Selected Solutions with Data Collection Plan in order to ensure Solution Dimension KPIs measurement.		X			X				X	
2.47. TGM sufficiently explains the 'Technical integration meeting (TIM)' step to design the										

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
Trial.										
2.48. TGM sufficiently explains legal aspects which need to be taken into account while designing the Trial.		X			X				X	
2.49. TGM sufficiently explains ethical aspects which need to be taken into account while designing the Trial.		X			X				X	
2.5. TGM sufficiently explains possible choices of Practitioners involvement into the 'Identify the Trial objectives' step to ensure Practitioners driven trial.										
2.6. TGM sufficiently explains the 'Formulate research questions' step to design the Trial.										
2.7. TGM sufficiently explains how to formulate a research question in order to ensure appropriate matching it with defined/selected Gaps.	X	X			X				X	
2.8. TGM sufficiently explains how to verify/test technical applicability of Data Collection Plan in the Dry Run 1.		X			X				X	
2.9. TGM sufficiently explains 'Crisis Management Dimension' in order to prepare Data Collection Plan properly.										
3.1. Trial Guidance Tool (TGT) was sufficiently helpful to complete the 'Crisis Management Gaps selection' step.		X							X	
3.10. TGT was sufficiently helpful in defining what profiles of Practitioners are required to ensure credibility of collected data in Crisis Management Dimension.	X	X							X	
3.11. TGT was sufficiently helpful in defining how many Practitioners are required to ensure credibility of collected data in Crisis Management Dimension.	X	X							X	
3.12. TGT was sufficiently helpful in ensuring a process of data collection which takes into account legal aspects (e.g. data collecting, processing, storing, etc.).		X							X	
3.13. TGT was sufficiently helpful in ensuring designing an ethical process for data collection.		X							X	

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
3.14. TGT was sufficiently helpful to complete the 'Formulate evaluation approaches and metrics' step.		X				X			X	
3.15. TGT was sufficiently helpful in defining 'Reference data' from a 'Baseline' for Crisis Management Dimension.	X	X				X			X	
3.16. TGT was sufficiently helpful in defining searched data from an 'Innovation Line' for Crisis Management Dimension.	X	X				X			X	
3.17. TGT was sufficiently helpful in defining Key Performance Indicators in Crisis Management Dimension.	X	X							X	
3.18. TGT was sufficiently helpful in defining techniques of collecting searched data for Crisis Management Dimension.	X	X							X	
3.19. TGT was sufficiently helpful in defining techniques of searched data measurement for Crisis Management Dimension.	X	X							X	
3.2. TGT was sufficiently helpful in defining/ selection of Crisis Management Gaps.		X								
3.20. TGT was sufficiently helpful in matching collected data with Key Performance Indicators for Crisis Management Dimension.	X	X				X			X	
3.21. TGT was sufficiently helpful in linking Key Performance Indicators for Crisis Management Dimension with Research Questions.	X	X				X			X	
3.22. TGT was sufficiently helpful in defining Key Performance Indicators for Trial Dimension.	X	X				X			X	
3.23. TGT was sufficiently helpful in defining techniques for collecting data in Trial Dimension.		X							X	
3.24. TGT was sufficiently helpful in defining techniques of data measurement for Trial Dimension.		X							X	
3.25. TGT was sufficiently helpful in defining Key Performance Indicators for Solution Dimension.		X				X			X	
3.26. TGT was sufficiently helpful in defining techniques for collecting data for Solution Dimension.		X							X	

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
3.27. TGT was sufficiently helpful in defining techniques of data measurement for Solution Dimension.		X							X	
3.28. TGT was sufficiently helpful to complete the 'Formulate scenarios' step.		X								
3.29. TGT was sufficiently helpful in formulating scenarios which reveals defined/selected Crisis Management Gaps in the course of their realization.	X	X				X			X	
3.3. TGT was sufficiently helpful in matching a Crisis Management Gap with a Crisis Management function.	X	X							X	
3.30. TGT was sufficiently helpful in defining roles of Practitioners in the scenario in order to ensure upmost reality of the Trial setup.		X							X	
3.31. TGT was sufficiently helpful to complete the 'Select solutions' step.		X								
3.32. TGT was sufficiently helpful in matching Selected solutions with Research Questions.										
3.33. TGT was sufficiently helpful in matching Data Collection Plan with Selected Solutions enabling Key Performance Indicators measurement for Crisis Management Dimension.	X	X				X			X	
3.34. TGT was sufficiently helpful in matching Data Collection Plan with Selected Solutions enabling KPIs measurement for Trial Dimension.	X	X				X			X	
3.35. TGT was sufficiently helpful in matching Data Collection Plan with Selected Solutions enabling KPIs measurement for Solution Dimension.	X	X				X			X	
3.36. TGT was sufficiently consulted for legal aspects of the Trial design.										
3.37. TGT was sufficiently consulted for ethical aspects of the Trial design.										
3.4. TGT was sufficiently helpful to complete the 'Identify the Trial objectives' step.										
3.5. TGT was sufficiently helpful in matching defined/selected Crisis Management Gaps with	X	X				X			X	

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
the Trial objectives.										
3.6. TGT was sufficiently helpful to complete the 'Formulate research questions' step.										
3.7. TGT was sufficiently helpful in matching Research Questions with defined/selected Crisis Management Gaps.	X	X				X			X	
3.8. TGT was sufficiently helpful to complete the 'Formulate data collection plan' step.										
3.9. TGT was sufficiently helpful in designing 'Baseline'.										
4.1. The role of the Test-bed infrastructure (TB) is sufficiently explained to design a Trial.										
4.10. TB's Message Injector is sufficiently explained to design a Trial.										
4.11. TB's Admin Tool and security is sufficiently explained to design a Trial.										
4.12. TB's Docker Environment is sufficiently explained to design a Trial.										
4.13. TB's Data Server is sufficiently explained to design a Trial.										
4.14. TB's Platform is sufficiently explained to design a Trial.										
4.15. Defining selection of TB's Platform in order to ensure upmost reality of the Trial setup (e.g. if there is a need for in-door, out-door facilities) is sufficiently explained.		X			X				X	
4.16. TB's Observer Support Tool is sufficiently explained to design a Trial.										
4.17. TB's After-Action Review Module is sufficiently explained to design a Trial.				X						
4.18. The type of data which could be recorded by TB is sufficiently explained.										
4.19. The formats of data collected by TB which could be downloaded for evaluation is sufficiently explained.										
4.2. TB's simulation space is sufficiently explained										

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
to design a Trial.										
4.20. Technical Integration Meeting (TIM) ensures sufficient level of solutions integration to TB in order to conduct a Dry Run 1.										
4.3. The integration of solutions with the TB's simulation space (incl. adaptors) is sufficiently explained to conduct a Dry Run 1.										
4.4. The integration of simulators (incl. simulations realized in the frame of TB's Platform e.g. role-plays) with TB simulation space (incl. adaptors) is sufficiently explained to conduct a Dry Run 1.										
4.5. TB's information space is sufficiently explained to design a Trial.										
4.6. The integration of solutions with TB's information space (incl. adaptors) is sufficiently explained to conduct a Dry Run 1.										
4.7. TB's Play Service is sufficiently explained to design a Trial.										
4.8. TB's Trial Scenario Management Tool is sufficiently explained to design a Trial.										
4.9. TB's Time Service is sufficiently explained to design a Trial.										
5.1. How many times do you follow 6-steps cycle in interactive way to design elements of the Trial? Please indicate a proper number (1-6)?										
5.10. How much do you agree with the statement that TGM Training Module has met your expectations as it comes to its content?				X						X
5.11. How much do you agree with the statement that the didactic content of TGM Training Module has sufficiently explained all the aspects you need to know to implement TGM in Preparation phase?				X						
5.12. How much do you agree with the statement that TGM Training Module utilizes didactic methods which sufficiently prepared you to implement TGM in Preparation phase?				X						

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
5.13. How much do you agree with the statement that you have designed your Trial in line with TGM?										
5.14. How much do you agree with the statement that you have managed to design the Trial which is ready for the Execution phase?										
5.15. How much do you agree with the statement that you have designed the Trial which gives high probability to create new knowledge on the basis of the Trial results?	X					X				
5.16. How much do you agree with the statement that you have designed your Trial which gives high probability to find innovations in Crisis Management at the end of its Evaluation phase?	X					X				
5.17. How much do you agree with the statement that the Trial Guidance Methodology (TGM) is usable to design the Trial?									X	
5.18. How much do you agree with the statement that You have assessed the validity of the Trial Guidance Methodology in order to design the Trial?										X
5.19. How much do you agree with the statement that TGM is pragmatic enough (able to implement successfully) for practical Trial design?			X							
5.2. How much do you agree with the statement that You have sufficiently understood the Trial Guidance Methodology (TGM) in order to design the Trial?										
5.20. How much do you agree with the statement that You were able to find logical references to your doubts in TGM during Trial Preparation phase in order to design the Trial?										X
5.21. How much do you agree with the statement that TGM is affordable for the process of Trial design?							X			
5.22. How much do you agree with the statement that you were able to ask TGM support team for support in each case You faced difficulties in using and performing measurements of subjective KPIs in the Preparation phase?										

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
5.23. How much do you agree with the statement that each time you have asked TGM support team for support you have received content-wise and sufficient support to overcome doubts connected with credibility You faced in the Preparation phase?										
5.24. How much do you agree with the statement that clearness of leads (tips) you have received from TGM support team helped you in implementing them into Trial design in time?										
5.25. How much do you agree with the statement that TGM Training Module was valuable and met your expectations as it comes to its content?				X						X
5.26. How much do you agree with the statement that the didactic content of TGM Training Module has sufficiently explained all the aspects You need to know to implement TGM innovation in the Preparation phase?				X						
5.27. How much do you agree with the statement that TGM Training Module's didactic methods were reliable enough for preparing You to implement TGM in the Preparation phase?				X	X					
5.28. How much do you agree with the statement that you have designed your Trial credibly and in line with TGM?										
5.29. How much do you agree with the statement that you have designed the Trial which status enables to step into Execution phase?										
5.3. How much do you agree with the statement that You know how to use the TGM in order to design the Trial?										
5.30. How much do you agree with the statement that added value in your Trial gives high probability to create new knowledge on the basis of the Trial results?	X					X				
5.31. How much do you agree with the statement that you have designed the cost-effective Trial which gives high probability to find innovations in Crisis Management with the lowest possible cost after its Evaluation phase?								X		

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
5.32. How much do you agree with the statement that simplicity of didactic methods used in TGM Training Module gives high probability of understanding the idea of TGM?		X		X						
5.4. How much do you agree with the statement that You are able to implement TGM into practical Trial design successfully?		X							X	
5.5. How much do you agree with the statement that You are able to find sufficient references in TGM to your doubts in the Trial Preparation phase in order to design the Trial?										X
5.6. How much do you agree with the statement that TGM sufficiently facilitates the process of the Trial design?										
5.7. How much do you agree with the statement that you have asked TGM support team for support in each case you faced problems with implementation of TGM in Preparation phase?										
5.8. How much do you agree with the statement that each time you asked TGM support team for support you have received content-wise and sufficient support to overcome problems you faced in Preparation phase?										
5.9. How much do you agree with the statement that each time you asked TGM support team for support you have received it in time to be able to implement it into trial design according to preparation time-line?										
1.1. The Trial Guidance Methodology (TGM) is sufficiently defined to understand what it is.										
1.2. The role of TGM in the Trial execution is sufficiently explained.										
1.3. The Test-bed infrastructure (TB) is sufficiently defined to understand what it is.										
1.4. The role of TB in the Trial design is sufficiently explained.										
2.1. TGM sufficiently explains the step 'Review of scenario with simulations' as a part of the Dry Run 1 to execute the Trial.										

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
2.10. TGM sufficiently explains how to verify/test applicability of the Data Collection Plan with participation of the selected Participants and Observers in the Dry Run 2.										
2.11. TGM sufficiently explains training for the Observers to ensure feasibility of the Data Collection Plan realization for Crisis Management Dimension.										
2.12. TGM sufficiently explains training for the Observers to ensure feasibility of the Data Collection Plan realization for Trial Dimension.										
2.13. TGM sufficiently explains training for the Observers to ensure feasibility of the Data Collection Plan realization for Solution Dimension.										
2.14. TGM sufficiently explains the step 'Finalization of TAP'.										
2.15. TGM sufficiently explains the step 'Execution and data collection' as a part of the Trial execution.										
2.16. The same Practitioners should attend both the Dry Run 2 and the Trial.										
2.17. The same Observers should attend both the Dry Run 2 and the Trial.										
2.18. TAP is a useful document in TGM implementation for the execution of the Trial.										
2.19. TGM implementation enables complete realization of the Data Collection Plan.		X								
2.2. TGM sufficiently explains the step 'Final scenario with simulations' as a part of the Dry Run 2 to execute the Trial.										
2.20. TGM implementation enables recording the data in orderly manner.		X								
2.21. TGM sufficiently explains the step 'Feedback from external stakeholders' as a part of the Trial execution.										
2.22. TGM sufficiently explains who is understood as 'External stakeholder'.										

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
2.23. TGM sufficiently explains possible choices of collecting feedback from External stakeholders.		X								
2.24. The final feedback from External stakeholders is helpful to collect additional opinions and/or observations to answer Research Questions.		X								
2.3. TGM sufficiently explains how to conduct the training on Solution for the Participants.		X								
2.4. TGM sufficiently explains how to conduct the training on Solution for the Observers.		X							X	
2.5. TGM sufficiently supports the process of Practitioners selection in order to ensure representative data collection during the Trial.		X			X				X	
2.6. The pilot trial executed during the Dry Run 2 sufficiently prepared the Trial setup to be appropriately applied in the final Trial execution.										
2.7. TGM sufficiently explains the step 'Review of Trial/solution evaluation plan' to execute the Trial.										
2.8. TGM sufficiently explains the 'Formulate data collection plan' step to design the Trial.										
2.9. TGM sufficiently explains the step 'Final Trial/solution evaluation plan' to execute the Trial.										
3.1. The Test-bed infrastructure (TB) is explained sufficiently to execute the Trial achieving necessary data collection as a final result.		X							X	
3.10. TB's Information space enables realization of the Data Collection Plan in order to measure KPIs for the Trial Dimension.		X							X	
3.11. TB's Information space enables realization of the Data Collection Plan in order to measure KPIs for the Solution Dimension.		X							X	
3.12. TB enables sufficient integration of simulators (incl. simulations realized in the frame of TB's Platform e.g. role-plays) with the Simulation space to conduct the Dry Run 1.		X							X	
3.13. TB enables execution of simulations		X							X	

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
adequate to the Trial scenario during the Dry Run 1.										
3.14. The step 'Final review of local Test-bed adaptation' as a part of the Dry Run 2 is sufficiently explained to execute the Trial.										
3.15. TB's Play Service sufficiently supports Trial execution.		X							X	
3.16. TB's Trial Scenario Management Tool sufficiently supports Trial execution.		X							X	
3.17. TB's Trial Scenario Management Tool is easy to use in execution of the Trial.		X								
3.18. TB's Time Service is easy to use in Execution phase of the Trial.		X								
3.19. TB's Message Injector sufficiently supports Trial execution.		X								
3.2. The step 'Review of local Test-bed adaptation' as a part of the Dry Run 1 is sufficiently explained to execute the Trial.										
3.20. TB's Message Injector is easy to use in Execution phase of the Trial.		X								
3.21. TB's Admin Tool and security sufficiently supports Trial execution.		X								
3.22. TB's Admin Tool and security is easy to use in Execution phase of the Trial.		X								
3.23. TB's Docker Environment sufficiently supports Trial execution.		X								
3.24. TB's Docker Environment is easy to use in Execution phase of the Trial.		X								
3.25. TB's Data Server sufficiently supports Trial execution.		X								
3.26. TB's Data Server is easy to use in Execution phase of the Trial.		X								
3.27. TB's Platform sufficiently supports Trial execution.		X								
3.28. TB runs in accordance to the Trial scenario assumptions.		X								

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
3.29. TB simulates the Trial context on the appropriate level of realism.		X				X			X	X
3.3. TB provides sufficient technical opportunities to integrate Solutions to achieve the Dry Run 1 goals.		X				X			X	
3.30. Observer Support Tool sufficiently supports realization of the Data Collection Plan during Trial execution.		X								
3.31. Observer Support Tool is easy to use in Execution phase of the Data Collection Plan.		X								
3.32. TB's After-Action Review Module sufficiently supports realization of the Data Collection Plan in Trial execution.		X		X					X	
3.33. TB's After-Action Review Module is easy to use in execution of the Data Collection Plan.				X						
3.4. TB enables sufficient integration of Solutions to the Simulation space to conduct the Dry Run 1.										
3.5. TB allows to collect the necessary data from the Simulation space.		X							X	
3.6. TB enables sufficient integration of Solutions to the Information space to conduct the Dry Run 1.										
3.7. TB sufficiently supports trialling 'Baseline' in order to collect reference data.		X				X			X	
3.8. TB sufficiently supported trialling 'Innovation Line' in order to collect searched data.										
3.9. TB's Information space enables realization of the Data Collection Plan in order to measure KPIs for the Crisis Management Dimension.	X	X				X			X	
4.1. How much do you agree with the statement that You sufficiently understand the Trial Guidance Methodology (TGM) in order to execute the Trial collecting all required data?		X			X				X	X
4.10. How much do you agree with the statement that the didactic content of TGM Training Module has sufficiently explained all the aspects you need to know to implement TGM in Trial Execution phase?				X						

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
4.11. How much do you agree with the statement that TGM Training Module has utilized didactic methods which sufficiently prepared you to implement TGM in Trial Execution phase?		X		X						
4.12. How much do you agree with the statement that you have executed your Trial in line with TGM?										
4.13. How much do you agree with the statement that data collected during Execution phase are accurate enough to reliably analyse KPIs for the Crisis Management dimension?		X			X				X	
4.14. How much do you agree with the statement that data collected during Execution phase are accurate enough to reliably analyse KPIs for the Trial dimension?		X			X				X	
4.15. How much do you agree with the statement that data collected during Execution phase are accurate enough to reliably analyse KPIs for the Solution dimension?		X			X				X	
4.16. How much do you agree with the statement that data collected during Execution phase are consistent enough to reliably analyse KPIs for the Crisis Management dimension?	X	X			X				X	
4.17. How much do you agree with the statement that data collected during Execution phase are consistent enough to reliably analyse KPIs for the Trial dimension?		X			X				X	
4.18. How much do you agree with the statement that data collected during Execution phase are consistent enough to reliably analyse KPIs for the Solution dimension?		X			X				X	
4.19. How much do you agree with the statement that data collected during Execution phase are complete enough to reliably analyse KPIs for the Crisis Management dimension?	X	X			X				X	
4.2. How much do you agree with the statement that You know how to use the TGM in order to execute the Trial collecting all required data?		X								
4.20. How much do you agree with the statement that data collected during Execution phase are		X			X				X	

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
complete enough to reliably analyse KPIs for the Trial dimension?										
4.21. How much do you agree with the statement that data collected during Execution phase are complete enough to reliably analyse KPIs for the Solution dimension?		X			X				X	
4.22. How much do you agree with the statement that data collected during Execution phase could be reproduced in order to analyse KPIs for the Crisis Management dimension?	X	X							X	
4.23. How much do you agree with the statement that data collected during Execution phase could be reproduced in order to analyse KPIs for the Trial dimension?	X	X							X	
4.24. How much do you agree with the statement that data collected during Execution phase could be reproduced in order to analyse KPIs for the Solution dimension?	X	X							X	
4.25. How much do you agree with the statement that data collected during Execution phase have formats which enable reliable analyses of KPIs for the Crisis Management dimension?	X	X			X				X	
4.26. How much do you agree with the statement that data collected during Execution phase have formats which enable reliable analyses of KPIs for the Trial dimension?	X	X			X				X	
4.27. How much do you agree with the statement that data collected during Execution phase have formats which enable reliable analyses of KPIs for the Solution dimension?	X	X			X				X	
4.28. How much do you agree with the statement that data collected during Execution phase cover the scope planned in data collection plan and through that enable reliable analyses of KPIs for the Crisis Management dimension?	X	X			X				X	
4.29. How much do you agree with the statement that data collected during Execution phase cover the scope planned in data collection plan and through that enable reliable analyses of KPIs for the Trial dimension?	X	X			X				X	

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
4.3. How much do you agree with the statement that You were able to successfully implement TGM into practical Trial execution?		X					X		X	
4.30. How much do you agree with the statement that data collected during Execution phase cover the scope planned in data collection plan and through that enable reliable analyses of KPIs for the Solution dimension?	X	X			X				X	
4.31. How much do you agree with the statement that you have executed your Trial in a way which gives high probability to create new knowledge on the basis of the Trial results?	X	X				X			X	X
4.32. How much do you agree with the statement that you have executed your Trial in a way which gives high probability to find innovations in Crisis Management at the end of its Evaluation phase?	X	X				X			X	X
4.33. How much do you agree with the statement that TGM is easy to follow in order to execute the Trial and be able to collect required data?		X							X	
4.34. How much do you agree with the statement that You assessed the validity of TGM in order to collect required data while executing the Trial?										X
4.35. How much do you agree with the statement that TGM is pragmatic enough (able to implement successfully) for practical Trial execution?		X						X	X	
4.36. How much do you agree with the statement that You were able to find logical references to your doubts in TGM during the Trial Execution phase?	X	X							X	X
4.37. How much do you agree with the statement that TGM is affordable for the process of the Trial execution?							X			
4.38. How much do you agree with the statement that you were able to ask TGM support team for support in each case you faced difficulties in using and performing measurements of subjective KPIs in the Execution phase?										
4.39. How much do you agree with the statement that each time you asked TGM support team for										

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
support you have received content-wise and sufficient support to overcome doubts connected with credibility You faced in the Execution phase?										
4.4. How much do you agree with the statement that You were able to find sufficient references to your doubts in TGM during Trial Execution phase?	X	X							X	X
4.40. How much do you agree with the statement that clearness of leads (tips) you have received from TGM support team helped you in implementing them into Trial design in time according to execution time-line?										
4.41. How much do you agree with the statement that TGM Training Module was valuable and met your expectations as it comes to its content concerning the Execution phase?		X		X					X	X
4.42. How much do you agree with the statement that the didactic content of TGM Training Module has sufficiently explained all the aspects You need to know to implement TGM innovation in the Execution phase?	X			X		X				X
4.43. How much do you agree with the statement that TGM Training Module's didactic methods were reliable enough for preparing You to implement TGM in the Execution phase?		X		X	X				X	
4.44. How much do you agree with the statement that you have executed your Trial credibly in line with TGM?										
4.45. How much do you agree with the statement that data collected during the Execution phase are usable to reliably analyse KPIs for the Crisis Management dimension?	X	X			X				X	
4.46. How much do you agree with the statement that data collected during the Execution phase are usable to reliably analyse KPIs for the Trial dimension?	X	X			X				X	
4.47. How much do you agree with the statement that data collected during the Execution phase are usable to reliably analyse KPIs for the Solution dimension?	X	X			X				X	
4.48. How much do you agree with the statement	X	X			X				X	

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
that data collected during the Execution phase are credible enough to reliably analyse KPIs for the Crisis Management dimension?										
4.49. How much do you agree with the statement that data collected during the Execution phase are credible enough to reliably analyse KPIs for the Trial dimension?	X	X			X				X	
4.5. How much do you agree with the statement that TGM sufficiently facilitates the process of Trial execution?		X							X	
4.50. How much do you agree with the statement that data collected during the Execution phase are credible enough to reliably analyse KPIs for the Solution dimension?	X	X			X				X	
4.51. How much do you agree with the statement that data collected during the Execution phase to reliably analyse KPIs for the Crisis Management dimension are cost-effective?					X			X		
4.52. How much do you agree with the statement that data collected during the Execution phase to reliably analyse KPIs for the Trial dimension are cost-effective?					X			X		
4.53. How much do you agree with the statement that data collected during the Execution phase to reliably analyse KPIs for the Solution dimension are cost-effective?					X			X		
4.54. How much do you agree with the statement that data collected during the Execution phase have added value and could be reproduced in order to analyse KPIs for the Crisis Management dimension?	X	X							X	
4.55. How much do you agree with the statement that data collected during the Execution phase have added value and could be reproduced in order to analyse KPIs for the Trial dimension?	X	X							X	
4.56. How much do you agree with the statement that data collected during the Execution phase have added value and could be reproduced in order analyse KPIs for the Solution dimension?	X	X							X	
4.57. How much do you agree with the statement		X			X				X	X

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
that affordability of data collected during the Execution phase enable reliable analyses of KPIs for the Crisis Management dimension?										
4.58. How much do you agree with the statement that affordability of data collected during the Execution phase enable reliable analyses of KPIs for the Trial dimension?		X			X				X	X
4.59. How much do you agree with the statement that affordability of data collected during the Execution phase enable reliable analyses of KPIs for the Solution dimension?		X			X				X	X
4.6. How much do you agree with the statement that you have asked TGM support team for support in each case you faced problems with implementation of TGM in Execution phase?										
4.60. How much do you agree with the statement that data collected during the Execution phase cover the scalability planned in the Data Collection Plan and through that enable reliable analyses of KPIs for the Crisis Management dimension and create possibility for improvement of the Trial?			X		X					
4.61. How much do you agree with the statement that data collected during the Execution phase cover the scalability planned in the Data Collection Plan and through that enable reliable analyses of KPIs for the Trial dimension and create possibility for improvement of the Trial?			X		X					
4.62. How much do you agree with the statement that data collected during the Execution phase cover the scalability planned in the Data Collection Plan and through that enable reliable analyses of KPIs for the Solution dimension and create possibility for improvement of the Trial?						X				
4.64. How much do you agree with the statement that you have executed your Trial so it gives high probability to find innovations in Crisis Management at the end of its Evaluation phase described as EU added value?	X					X				
4.7. How much do you agree with the statement that each time you asked TGM support team for										

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
support you received content-wise and sufficient support to overcome problems you faced in Execution phase?										
4.8. How much do you agree with the statement that each time you asked TGM support team for support you received it in time to be able to implement it into the Trial according to execution time-line?										
4.9. How much do you agree with the statement that TGM Training Module has met your expectations as it comes to its content concerning Execution phase?				X						X
1.1. The proposed infrastructure of the Test-bed is an appropriate environment for the assessment of some Crisis Management solutions.	X									
1.10. TB sufficiently enables downloading collected data in a format easy to be processed in for evaluation purposes.									X	
1.11. TGM implementation enables realization Data Collection Plan resulting with enough data collected to answer Research Questions.									X	
1.12. TGM contributes to Crisis Management performance improvement.	X	X								
1.13. TGM contributes to the organization of roles and tasks in the Crisis Management process.	X	X								
1.14. All TGM elements have been understood in the implementation of TGM.										
1.15. All TGM elements have been useful in the implementation of TGM.										
1.16. The international dimension of TGM contributes to the development and gathering of good practices.	X								X	
1.17. TGM contributes to increasing the effectiveness of tool suppliers' cooperation with Crisis Management practices.	X	X				X			X	
1.18. Data collected during the Trial was sufficiently complete to get answers to research questions.										

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
1.19. The innovativeness of the solutions has helped to overcome the identified Gaps in Crisis Management.	X								X	
1.2. TGM contributes to improvement of the efficiency of human resources management as part of Crisis Management activities.	X								X	
1.20. Those responsible for collecting the data (observers) have been adequately prepared.										
1.21. Those responsible for collecting the data (observers) done it reliably.										
1.22. TGM's assumptions met the expectations of practitioners (end-users).										
1.23. TGM step 'Data quality check' is necessary to prepare the Trial.				X						
1.24. TGM step 'Data analysis' is necessary to prepare the Trial.				X						
1.25. TGM step 'Synthesis' is necessary to prepare the Trial.				X						
1.26. TGM step 'Internal Documentation' is necessary to prepare the Trial.				X						
1.27. TGM step 'Dissemination' is necessary to prepare the Trial.				X						
1.28. TGM step 'Internal Documentation' is necessary to prepare the Trial.				X						
1.29. TGM step 'Dissemination' is necessary to prepare the Trial.				X						
1.3. TGM contributes to improvement of the efficiency of time management as part of Crisis Management activities.	X								X	
1.30. TGM sufficiently explains step 'Data quality check' to execute the Trial.		X			X					
1.31. TGM sufficiently explains step 'Data analysis' to execute the Trial.		X			X					
1.32. TGM sufficiently explains step 'Synthesis' to execute the Trial.		X			X					
1.33. TGM sufficiently explains step 'Internal Documentation' to execute the Trial.		X			X					

Question	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
1.34. TGM sufficiently explains step 'Dissemination' to execute the Trial.		X			X					
1.4. TGM contributes to the improvement of the financial management efficiency as part of Crisis Management activities.	X							X		
1.5. TGM helps to improvement the efficiency of coordination and logistics of the team's activities.	X							X		X
1.6. TGM sufficiently explains the influence of Trial Dimension results on the Crisis Management Dimension results in respect to the credibility of the answers for Research Questions.					X					
1.7. TGM sufficiently explains the influence of Solution Dimension results on the Crisis Management Dimension results in respect to the credibility of the answers for Research Questions.					X					
1.8. TGM sufficiently explains the influence of Trial Dimension results on the Crisis Management Dimension results.					X					
1.9. TGM sufficiently explains possible methods of Key Performance Indicators interpretations based on the data collected.					X					

Annex 4 – DRIVER+ Test-bed's KPIs evaluation results of particular Trials

Table A6, Table A8, Table A10 and Table A10 present Test-bed evaluation indicators of particular Trials divided in Preparation, Execution and Evaluation phases, calculated separately for the TGM, TTI and TGT. The TGT is not assessed for Execution and Evaluation phases, since this Test-bed component is not dedicated to these phases.

Table A7, Table A9, Table A13 and

Table A11 present values of the DRIVER+ Test-bed evaluation KPIs (EU added value, usefulness, scalability, modularity, reliability, innovation, affordability, cost-effectiveness, usability and validity) for particular Trials, divided by Preparation, Execution and Evaluation phases.

All these results correspond to those presented in Section 3.7, where the figures referring to particular KPIs and indicators allow their comparison within consecutive Trials.

Annex 4.1 Trial 1 - Poland

Table A6: Test-bed components' evaluation indicators calculated for Trial 1 (overall values and as a function of Trial phases).

Phase	TGM	TTI	TGT
Overall	0.31	0.00	1.20
Preparation	0.45	0.32	1.20
Execution	0.09	-0.15	n/a
Evaluation	0.39	-0.50	n/a

Table A7: Calculated Key Performance Indicators (KPIs) based on evaluation survey for Trial 1

Phase	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
Overall	0.56	0.38	0.48	0.49	0.32	0.84	0.23	0.20	0.43	0.43
Preparation	0.90	0.76	0.75	0.92	0.37	1.12	0.50	0.60	0.75	0.82
Execution	0.35	0.09	0.39	-0.44	0.31	0.27	0.10	0.12	0.18	0.27
Evaluation	0.32	0.37	n/a	1.07	0.14	0.78	n/a	0.15	0.14	0.60

Annex 4.2 Trial 2 - France

Table A8: Test-bed components' evaluation indicators calculated for Trial 2 (overall values and as a function of Trial phases)

Phase	TGM	TTI	TGT
Overall	0.28	-0.06	n/a
Preparation	-0.36	-0.77	n/a
Execution	0.84	0.38	n/a
Evaluation	0.87	-0.67	n/a

Table A9: Calculated Key Performance Indicators (KPIs) based on evaluation survey for Trial 2

Phase	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
Overall	0.27	0.09	0.25	0.59	0.26	0.13	0.33	0.71	0.14	0.41
Preparation	-0.06	-0.38	-0.50	-0.13	-0.55	-0.03	0.00	0.00	-0.24	0.00
Execution	0.35	0.46	1.00	n/a	0.59	0.38	0.50	0.75	0.49	0.57

Annex 4.3 Trial 3 - Austria

Table A10: Test-bed components' evaluation indicators calculated for Trial 3 (overall values and as a function of Trial phases)

Phase	TGM	TTI	TGT
Overall	0.81	1.11	-0.01
Preparation	0.68	1.10	-0.01
Execution	0.91	1.10	n/a
Evaluation	0.95	1.50	n/a

Table A11: Calculated Key Performance Indicators (KPIs) based on evaluation survey for Trial 3

Phase	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
Overall	0.58	0.63	1.16	1.02	0.94	0.36	0.64	0.45	0.59	0.97
Preparation	-0.11	0.12	0.67	1.52	0.63	-0.01	-0.50	0.00	0.05	1.00
Execution	0.99	0.99	1.32	0.90	1.04	1.03	1.21	0.29	1.02	0.93
Evaluation	1.18	1.09	n/a	0.57	1.06	1.25	n/a	1.00	1.12	1.25
Evaluation	0.87	0.8	n/a	1.40	0.74	1.00	n/a	1.00	0.43	1.33

Annex 4.4 Trial 4 – The Netherlands

Table A12: Test-bed components' evaluation indicators calculated for Trial 4 (overall values and as a function of Trial phases)

Phase	TGM	TTI	TGT
Overall	0.71	0.62	n/a
Preparation	0.71	0.68	n/a
Execution	0.58	0.62	n/a
Evaluation	1.04	-1.00	n/a

Table A13: Calculated Key Performance Indicators (KPIs) based on evaluation survey for Trial 4

Phase	EU added value	usefulness	scalability	modularity	reliability	innovation	affordability	cost-effectiveness	usability	validity
Overall	0.77	0.61	0.75	0.70	0.62	0.78	0.31	0.07	0.59	0.67
Preparation	0.63	0.45	1.00	1.00	0.35	1.00	n/a	n/a	0.44	1.00
Execution	0.77	0.64	0.67	0.02	0.70	0.61	0.31	-0.14	0.69	0.49
Evaluation	0.90	1.17	n/a	1.43	0.86	1.00	n/a	0.50	0.29	2.00

Annex 5 – Results of fulfilment of DRIVER+ Gaps and answers for trialled Research Questions

Annex 5.1 Trial 1 - Poland

Table A14: Results of fulfilment of DRIVER+ Gaps and answers for trialled Research Questions - Trial 1

Gaps	Research questions	Sub-Research questions	Results
Limitations in the ability to model real-time (response phase) or pre-event (preparedness phase) dynamics of the chemical and radiological threat and visualization of obtained results in a form that can be used directly by the Head of the Rescue Operations.	How can cross-border communication, coordination and resource management be supported through socio-technical solutions?	How can the visualization of the chemical threat dynamics support communication and information exchange?	On the basis of these results, it is justified to state that cross-border communication, coordination and resource management could be effectively supported by the trialled socio-technical solutions. It was illustrated that the trialled Common Operational Picture solution (Socrates OC) has the potential to improve communication through an increase of the quality of situational reports and as well the Request for Assistance. Although the increase of quality of these documents is neither significant nor related to all established criteria, however the Trial showed which document quality criteria were positively affected by the solution (e.g. "reproducibility"). Increasing this kind of feature in the operational documents leads to more effective horizontal (cross-border, cross-sector) and vertical (between hierarchical levels) communication during Crisis Management. The quality of communication during decision-making can be improved by a dynamic modelling solution (3Di) and a visualisation solution (Drone Rapid Mapping/DRM). 3Di showed to be a potential "game changer" in decision-making processes by limiting the amount of information taken into account and prioritizing the information related to the time available for implementing response measures. It leads to shortening the decision time and through this supports the coordination and resource management. DRM showed it can
Lack of a Common Operational Picture (COP) environment to integrate data sources and calculation results from different models crucial for decision-making process from the perspective of the Head of Rescue Operations.		How can an integrated COP support decision-making processes at the tactical and operational level?	
Limitations in the cross-vulnerabilities (people, property, environment) assessment to optimize task prioritisation and decision-making.		How can models of chemical (or other) threat dynamics support making decisions sooner, faster and better?	
Insufficiencies in terms of resource management		How can models of cascading effects support taking decisions that minimise the impact on people, infrastructure and environment?	
		How can cross-border resource management be	

Gaps	Research questions	Sub-Research questions	Results
(human resources, hardware, etc.) during multi-stakeholder long-term rescue operations.		supported through socio-technical solutions during multi-stakeholder long-term rescue operations?	potentially shorten the time for damage and needs aerial assessment and thanks to that accelerating coordination and resource management processes. In conclusion, it is justified to state that the trialled innovative solutions bring an added value in cross-border communication, coordination and resource management processes.
		How can information on needed and available resources of multiple stakeholders be shared to increase the operational performance?	

Annex 5.2 Trial 2 - France

Table A15: Results of fulfilment of DRIVER+ Gaps and answers for trialled Research Questions – Trial 2

Gaps	Research questions	Sub-Research questions	Results
Shortcomings in the ability to exchange crisis-related information among agencies and organisations (also related to as interoperability).	How to improve and maintain, in real time, a shared situational awareness by supporting the exchange of crisis-related information among agencies and organisations?	How to support sharing relevant information to **relevant/appropriate crisis managers** while **preventing information overload**?	It was demonstrated that time delays, sharing and quality (accuracy) of information could be effectively improved by some of the trialled socio-technical solutions. Sharing of relevant information can be improved by the access to a common logbook and exchange of SitReps (CrisisSuite), while visualisation of information (in particular other's organizations means) is improved by the use of a COP. However, it is expected that socio-technical solutions could be more efficient in this regard by a better structuring and categorisation of information in the logbook (and the automatic generation of SitReps from the logbooks) and if the static and dynamic layers of the COP where not mixed. The trialled solutions, nonetheless, contribute to develop the quality (in terms of accuracy) of information (especially with regard
		How can socio-technical solutions improve the **quality** of the information exchanged?	
Limits in the ability to ensure a common understanding of the information exchanged (terminology, symbology) by all crisis managers involved in the response operations.		How can socio-technical solutions improve the **understandability** of the information exchanged among the different actors involved in a large and complex crisis despite different backgrounds (discipline, culture, language, etc.)?	

Gaps	Research questions	Sub-Research questions	Results
Shortcomings in the ability to exchange crisis-related information among agencies and organisations (also related to as interoperability).			to the exact localisation of means or events). Time-saving effects have been observed in most of the CM processes of a Trial.
Limits in the ability to ensure a common understanding of the information exchanged (terminology, symbology) by all crisis managers involved in the response operations.		How can socio-technical solutions **save time** in exchanging information between different agencies?	
Lack of common doctrines and procedures supporting international cooperation in aerial firefighting.			
Shortcomings in the ability to exchange crisis-related information among agencies and organisations (also related to as interoperability).	How to improve the coordination of fire fighters' response operations and EMS's rescue operations during a large forest fire with casualties?	How can socio-technical solution support EMS services in **understanding the crisis dynamics to ensure their safety** at a large forest fire scene?	Sharing a COP between the fire-fighters and the EMS supported a better situation assessment both concerning the crisis dynamics (fire contour visible for the EMS) and the dispatch of means (ambulances visible for the fire-fighters chain of command).
Barriers in capability to provide medical assistance to casualties by either transporting them to a safe place or bringing emergency medical service to the scene (when medical care is not provided by firefighters).		How can socio-technical solutions support EMS services in **obtaining an overview of the response operations in order to organise casualties' rescue**, without disturbing forest fire suppression operations?	

Gaps	Research questions	Sub-Research questions	Results
Insufficiency in the ability to incorporate accurate and verified information from multiple and non-traditional sources (e.g. crowdsourcing and social media) into response operations.	How to transform raw data from social networks into actionable information directly useful to the incident commander?	How can socio-technical solutions facilitate the **retrieval of relevant information** from social media for response operation?	SMAP facilitates the retrieval of information from Twitter for response operations. The solution looks promising, but it has to be trialled properly before drawing firm conclusions.
Shortcomings in the ability to exchange crisis-related information among agencies and organisations (also related to as interoperability).		How can socio-technical solutions support in **incorporating the retrieved information from social media into the COP** (including map visualisation)?	
Insufficiency in the ability to incorporate accurate and verified information from multiple and non-traditional sources (e.g. crowdsourcing and social media) into response operations.			

Annex 5.3 Trial 3 – Austria

Table A16: Results of fulfilment of DRIVER+ Gaps and answers for trialled Research Questions – Trial Austria

Gaps	Research questions	Sub-Research questions	Results
Volunteer Management Insufficiencies in the management of spontaneous and affiliated volunteers at the crisis scene in terms of location, tasking, capabilities, and shift duration.	How can non-traditional information sources be used to be of added value to volunteer management with respect to managing an earthquake and heavy rain situation?	How much is CrowdTasker of added value to volunteer management with respect to managing an earthquake and heavy rain situation?	CrowdTasker(CT) generates the additional value related to the volunteer management with respect to managing an earthquake and heavy rain situation mostly through the ability to task volunteers as well as to receive reports with results of their actions and it is technologically operational to be used by volunteers. However, CrowdTasker doesn't allow assigning tasks to specific individuals, nor having an automatic overview of the task's status. CrowdTasker demonstrates its potential in case of an urgent need for collecting information from population, including spontaneous volunteers. In this way CrowdTasker facilitates and extends an operational overview of the situation necessary for better decisions-making, however, with the mentioned above exception for individual tasking. Moreover, it should be noted that collaborating and communicating with emergent groups using the social media component (Telegram) has to be adopted by the tactical units (command language of tactical units is totally different to the language used in social media communication).
	Do socio-technical solutions improve the process of managing spontaneous volunteers in relation to accurate management procedure in terms of tasking, monitoring and locating volunteers working at the scene?	Does CrowdTasker solution improve the process of managing spontaneous volunteers in relation to accurate management procedure in terms of tasking, monitoring and locating volunteers working at the scene?	
	*Combining answers, it may be concluded that results 3 in the context of the Gap (Volunteer management) shows that usage of CrowdTasker in the situation described in the Trial's set-up allows to **partly** close the Gap.*		
Interaction with the population Improving the process of communication with the population, including e.g.: Micro-learning	How can communication channels related to the earthquake event and actual crises situation be used to inform the public, and	How much can CrowdTasker properly use its communication channels related to the earthquake event and actual crisis situation to inform	CrowdTasker demonstrates the potential to be used as a channel for early warning purposes. CT has the ability to send out related alarms/warnings as well as getting back alarms/warnings from the population. However, due to the fact that CT is a dedicated application

Gaps	Research questions	Sub-Research questions	Results
capabilities to communicate to the population safety information and recommendations what can they do during a crisis. Registration of affected people. Delivering information from the public to the emergency management authorities.	therefore positively influence/impact the Crisis Management process?	the public, and therefore positively influence/impact the Crisis Management process?	which doesn't belong to any official or governmental organisation possessing information from monitoring systems, its usage for warning purposes is limited. The advantage of the CT is its full operability.
	What type of information has to be communicated (e.g. safety info, etc.) and what type of information has to be accepted (e.g. allow public to send emergency information, Registration of affected persons)?	What type of information has to be communicated (e.g. safety info, etc.) and what type of information has to be accepted (e.g. allow public to send emergency information, Registration of affected persons)?	CT enables bottom-up communication (such as from the spontaneous volunteers to the coordination unit/stakeholder). According to practitioners' opinion the acceptance of information is an issue for the CT at the moment (functionality to send clear alerts to staff at the entrance of a danger zone). CT lacks functionality for a proper verification of users which creates a risk of launching fake communication streams intentionally or unintentionally. Therefore, it seems to disturb the system easily. These restrictions result in limited usability of CT as a mean of communication.
	*Combining answers, it may be concluded that results in the context of the Gap Communicating with the public during a large crisis shows that usage of CrowdTasker in the situation described in the Trial's set-up allows to **partly** close the Gap.*		
Psycho-social support Lack of having the capability to measure stress and/or improve the communication and the awareness of psychological stress of those affected; especially spontaneous and affiliated volunteers.	Is psycho-social support improving the awareness on psychological stress by crisis managers dealing with volunteers?		Psychological First Aid training to team leaders increases their awareness about the stress faced by volunteers in emergencies. PFA demonstrates its potential to increase the key knowledge and skills of its participants. However, measuring exactly the added value is hard to define since some other factors need to be taken into consideration.
	Does the training with socio-technical solutions influence/affect the performance of tasks given to	Does Virtual Reality Psychosocial Support (VR PSS) training influence/affect the performance of tasks given to volunteers and related	Comparison of the performance of tasks given to volunteers trained by VR PSS and those trained with the baseline does not show significant differences. However, participants expressed they were able to identify some signs of distress of the people

Gaps	Research questions	Sub-Research questions	Results
	volunteers and related commanders?	commanders? How much does it impact on the wellbeing after a response operation?	who were performing the role playing (victims), but dispersion of the answers doesn't let to reliably conclude the result.
	*Combining answers, it may be concluded that results in the context of the Gap Psycho-Social support shows that usage of Psychological First Aid training in the situation described in the Trial's set-up allows to **partly** close the Gap.*		
Real-time data and information fusion to support incident commander decision-making Limits in the ability to merge and synthesise disparate data sources and models in real-time (e.g. visualisation of resources, spreading models, tactical situation, critical assets map, etc.) to support incident commander decision-making.	Does ad-hoc generated data provide an adequate live update of the situation on the ground and enhance decision-making?	Does the Airborne and Terrestrial Situational Awareness solution provide an adequate live update of the situation on the ground and enhance decision-making?	Information provided by the Airborne and Terrestrial Situational Awareness (ATSA) solution (e.g. high-quality photos) enhanced a proper understanding of an ongoing crisis situation. In this way ATSA supports the decision-making process, however, complete usability of ATSA for commanders in charge requires a special training on how to interpret the photos in order to recognise all various damages (for example: automatic photo/video analysing system for different types of damages).
	Does the fusion of multi-modal live data enhance the decision-making process during a crisis operation?	Does the 3D aerial data provided by the Airborne and Terrestrial Situational Awareness system shown by the 3D view from vieWTerra Evolution enhance the decision-making process compared to the traditional 2D view provided by ASIGN?	3D aerial data provided by the Airborne and Terrestrial Situational Awareness system shown by the 3D view from vieWTerra Evolution doesn't enhance the decision-making process in a sufficient way. According to practitioners in this particular Trial case the generated 3D view was characterised by too low resolution to make an appropriate benefit for the practitioners.
	Does the data fusion provide a better quality to assess the situation than the traditional legacy data models?	Does the Airborne and Terrestrial Situational Awareness map in its 2D view provide a better quality to assess the situation than the traditional Copernicus map data?	This question was not able to be answered since we didn´t manage to get Copernicus Map Data during the Trial.

Gaps	Research questions	Sub-Research questions	Results
		Do the solutions provide interfaces for easy and understandable information exchange supporting the commanders in the field for managing an earth-quake disaster?	Practitioners and observers for each tested solution (ATSA, CT, vieWTerra Evolution, ASIGN, PFA) positively or slightly positively rated their advantages which made completing task by commanders easier and (in most cases) faster which may suggest that situational awareness supported by solutions was more holistic and accurate. Additionally, the trial set-up allows to have a look for additional value to Crisis Management functions coming from the possibility of exchanging information among solutions. The results show that solutions which have user interfaces allowed in an easy way to exchange information (text, photos, videos) between commanders on the field and the commanders in the command centre to manage an earthquake.
		Are the solutions of added value in relation to sharing and communicating information (incl. decisions taken) within as well as across agencies and organizations involved to provide a common understanding of the actual earthquake situation?	This question was not answered since the Austrian Red Cross was the only agency coordinating the "Command centre" on the Trial side.
	*Combining answers, it may be concluded that results in the context of the Gap Real-time data and information fusion to support incident commander decision-making shows that usage of Airborne and Terrestrial Situational Awareness system together with vieWTerra Evolution in the situation described in the Trial's set-up allows to **partly** close the Gap.*		

Gaps	Research questions	Sub-Research questions	Results
Incorporating information from multiple and non-traditional sources Insufficiency in the ability to report dangerous areas and situation overview from multiple and non-traditional sources (e.g. crowdsourcing and social media) into response operations.	Do non-traditional or multiple information sources (e.g. social media) add value to decision-making in an earthquake crisis situation?	Is CrowdTasker able to take into account information from non-traditional or multiple information sources (e.g. social media) so that it is of added value for decision-making in an earthquake crisis situation?	CrowdTasker has the ability to use information from different non-traditional and multiple information sources to enhance the decision-making process of commanders in charge in the context of the earthquake scenario. CT supports the practitioners with additional information which is helpful to fulfil their tasks and to work as a team in a safe manner. It is able to collect information via dedicated application as well as using the Telegram App.
		How much is CrowdTasker of added value related to the enhancement and accuracy of the situational and operational picture? Does it positively influence the search and rescue operations (e.g. speed, accuracy, etc.)?	CrowdTasker generates the additional value related to the enhancement and accuracy of the situational and operational picture mostly through the ability to use information from different non-traditional and multiple information sources. Secondly, by providing a benefit in bottom-up communication, especially launched by spontaneous volunteers who can provide and enrich the operational picture with their information (data, observations, etc.).
	*Combining answers, it may be concluded that results in the context of the Gap - Incorporating information from multiple and non-traditional sources) shows that usage of CrowdTasker in the situation described in the Trial's set-up allows to **fully** (with minor exceptions) close the Gap*.		

Annex 5.4 Trial 4 – The Netherlands

Table A17: Results of fulfilment of DRIVER+ Gaps and answers for trialled Research Questions - Trial The Netherlands

Gaps	Research questions	Sub-Research questions	Results
Limitations in the planning of resources (qualified personnel and equipment) for response during large scale and long-term crisis.	How can simulation tools improve resource planning activities in large scale and long-term disaster operations?	How easy is it to adjust the planning according to changing situation?	By monitoring available resources and in parallel illustrating how the threat (e.g. a flood) evolves, solutions in the Trial could report the need for specialised equipment better than without solution support. Solutions also facilitated the organisation of action logistics, e.g. the commander of action knows his assets and resources, proved potential to provide detailed information on the flood forecast and substantiation of the effects of mitigation measures (like emergency dikes or pumps), and proved the possibility to support the decision-making in the deployment of human resources and equipment. Furthermore, solutions proved potential of providing a traffic management plan for best routes available in case of a crisis, optimising these routes with respect to the protective measures, and demonstrated possibilities such as determining the roads to reach the destination as quickly as possible, or gaining information on closed roads. An actual flood mask (aerial image of the flooded area at the peak of the inundation) could be provided, and support in decision-making on the deployment of human resources and equipment was demonstrated.
		How easy interpretable is the output for other people than the planner?	
Shortcomings in the ability to exchange crisis-related information among agencies and organisations (also related to as interoperability).	How can net-centric data exchange improve information sharing between relevant parties and thus improve the	Is the ROT able to share information effectively with external organisations?	The use of solutions resulted in more detailed information, based on the best (actual) data available in an objective manner. Net-centric information exchange provides a shared situational assessment, due to use of more detailed data, e.g. flood maps, cascade-effects and quantified traffic routes. The advantages of net-
		Do all organisations involved have the same situational picture of the area	

Gaps	Research questions	Sub-Research questions	Results
	shared understanding of the current situation?	affected by the flooding?	centric information exchange in the innovation line during the Trial were the following: • Information is shared instantaneous and continuous; all organisations use the same information. • Faster information exchange between Safety Region (using solely the legacy system) and external organisations (using solutions): Information is digitally available, including maps (in contrast to phone or mail communications, followed by importing that information into the systems). • No errors are made in distribution of information and all information is up-to-date because all organisations use the same data. • Unambiguous information, since the organisations share their information. There is no person in between that may distort the information. • Higher efficiency for the external organisations, since their information was available for all Action Centres/Crisis Teams (AC/CT) in contrast to every action centre to individually contact the organisation by mail/phone (or relaying information request via the information manager).
		Can external organisations contribute to the operational picture of the ROT effectively (i.e. is information from these organisations included in the ROT)?	
		Has the ROT an adequate overview of the (expected) side effects (cascade-effects) of the flooding?	
		How detailed is the information shared between organisations?	
		How relevant is the information shared between organisations?	
		In what way is it supportive for the actor?	
Shortcomings in planning and managing the side effects of large-scale evacuation of population in urban areas.	How can simulation tools support the planning and management of a large-scale evacuation under consideration of real-time traffic information?	Is the AC Evacuation table able to quantify the effects of the proposed evacuation strategies?	The trialled solutions were useful for indicating collection points for the evacuees, locating evacuation assembly points, avoiding evacuation assembly points in areas flooded or areas threatened by cascading effect (areas without power), designating routes for transport of evacuees, informing about the current state (who is evacuated, who still needs evacuation), or assessment of necessary resources. Practitioners
		What is the effect of an evacuation strategy in terms of time and resources needed, number of	

Gaps	Research questions	Sub-Research questions	Results
		casualties, etc.	using solutions made decisions based on available simulations. Advantages of the innovation line were detailed information on the forecast flood and substantiation of the effects of protective measures (like emergency dikes or pumps), the provision of a traffic management plan on best routes available in case of a crisis, and optimisation of these routes with respect to the protective measures. Furthermore, dynamic information on cascade-effects (power failure) in case of flooding and effects of protective measures were made available.
		Can the ROT objectively compare different evacuation strategies?	

Annex 5.5 Final Demo

Table A18: Results of fulfilment of DRIVER+ Gaps and answers for trialled Research Questions – Final Demo

Gaps	Research questions	Sub-Research questions	Results
Shortcomings in interoperability i.e. in the ability to exchange crisis-related information among agencies and organisations.	How to combine information from different operating actors to increase the EUCPT and the EUCP Modules situational awareness?		Structured, consistent, coherent and complete information is of high value for the decision-makers. This aim could only be achieved by pulling and sharing information from different actors in a common information environment which is stable and safe. Having such could increase EUCPT and EUCP Modules situation awareness and through this facilitate their performance. Combining information from different actors in order to get upmost possible understanding of a crisis situation is a process which is actually permanently continued in a response phase by collecting, analysing, processing and disseminating better, content and form-wise more adequate information product to the needs of the potential receivers of the information. In case of the Final Demo setup, for trialling reasons the process started when the ERCC briefed EUCPT on a new deployment. Observation relates to both

Gaps	Research questions	Sub-Research questions	Results
			stakeholders, namely the EUCPT and CP Modules team leaders, and reveals high potential of the innovative solutions for improving the quality and efficiency of briefings organised by the EUCPT for the Modules on operational level.
	For this purpose, how to combine systematised reporting methods, communicators, GIS portals and a cloud data storage to improve information exchange? (EUCPT CIS)		Combining systematised reporting methods, communicators, GIS portals and cloud data storage to improve information exchange is possible using trialled solutions (e.g. CrisisSuite and Socrates OC). It was feasible to have information from different sources in a shared CIS. The use of the solutions, including exchanging data between them, systematises the information exchange process by making it automatic. It decreases the work load on the practitioners working on information management processes. In addition, IT systems being operated by the practitioners oblige them to enter certain, critical data. This limits the risk of neglecting or forgetting important data in reporting mode.
	How to optimise communication between descending and ascending (taking over) EUCP Teams?		While the legacy systems cover many different tools (like emails, Microsoft Office or VOSSOC) and formats (like DOC or PDF files), the applied innovative solution in this episode was Socrates OC for the EUCPT, while the Modules applied additionally vieWTerra Evolution and DRM. These solutions give a possibility to connect all type of data, especially with geo-visualisation of these data. CIS is a good opportunity to improve information exchange between the EUCPT and ERCC. Based on the results there is not much room for improvement on *Result* site in this respect. It challenges the innovative solutions since the solution providers should mainly search for added value on the *Effort* site. Even though, in general the results show the practitioners are satisfied with the legacy systems, there were still some elements which provide knowledge on

Gaps	Research questions	Sub-Research questions	Results
			the possible potential of the innovative solutions to improve the current status of the ERCC situational awareness process. In general, the trialled solutions demonstrated some potential to improve situational awareness of ERCC e.g. by providing more optimal *structure* of a SitRep. Therefore, finding a tendency which is confirmed in two runs with all these biases, like it is for *structure*, provides a strong hint on the added value of the solution in the surveyed criterion.
Lack of a "Common Operational Picture" to integrate data sources and calculation results from different models crucial for the decision-making process.	Can access to the EUCPT CIS improve situational awareness of the ERCC?		CIS is a good opportunity to improve information exchange between the EUCPT and ERCC. Generally, the results show the practitioners are satisfied with the legacy systems, there were still some elements which provide knowledge on the possible potential of the innovative solutions to improve the current status of the ERCC situational awareness process. The trialled solutions demonstrated some potential to improve situational awareness of ERCC e.g. by providing more optimal *structure* of a SitRep. Therefore, finding a tendency which is confirmed in two runs with all these biases, like it is for *structure*, provides a strong hint on the added value of the solution in the surveyed criterion.
	How to optimise the EUCPT to ERCC reporting situation?		The main findings suggest that the SitRep needs from the ERCC are met by both the legacy system and the innovative solutions. It must be noted, the assessed benefits are in both cases (i.e. by using the legacy systems and the innovative solutions) at a very high level. However, the perceived *efforts* for the EUCPT working with the innovative solutions have increased significantly, but the second round suggests that a learning effect lowers the increase.
Limitations in the ability to merge and	How can access to recent		Access to recent geoinformation data (i.e. satellite maps, aerial orthophoto

Gaps	Research questions	Sub-Research questions	Results
synthesise disparate data sources and models (e.g. historic events, spreading models, tactical situation, critical assets map) in (near to) real time to support decision-making.	geoinformation data (i.e. satellite maps, aerial orthophoto maps, 3D models) and related analytical products affect the decision-making processes of the EUCP Modules team leaders?		maps, 3D models) and related analytical products could positively influence the decision-making processes of CP Modules team leaders by better understanding of the disaster-stricken area. It is achieved by visualisation of the affected area in close to real time mode. Solutions which mainly give an access to geoinformation are DRM and vieWTerra Evolution. The exchange of the status updates using the innovative solutions, which give a possibility to use geoinformation by the CP Modules, seem to offer an only limited added value. On the other hand, the perceived benefits have decreased on average. However, the practitioners recognised that the trialled solutions bring some added value in *structuring* the information prepared by the CP Modules as a status update to be forwarded to the EUCPT (much lower effort dedicated to structure the information product gives in result a product, which in this aspect, better facilitates the work performed). Moreover, in the criterion *searchability* it was revealed that the solutions provide added value by making the process of searching for specific data in the information product easier than it is in the baseline, dedicating for that the same *effort*.
	How to optimise access to such data and products?		Optimising access to such data is possible by providing a common space to use this type of data e.g. in a form of Test-bed Technical Infrastructure (TTI). In addition, spatial data optimisation can be accomplished by providing spatial data in other solutions e.g. transmitting them from one to another solution via TTI. Additional access to this type of data is often associated with access to the possibility of their quick and efficient use. That's why optimisation of this process should assume the possibility of using this type of solutions (or at least information products of the solutions) on mobile devices. That could open the

Gaps	Research questions	Sub-Research questions	Results
			possibility to use this type of solutions at any time by the ERCC, EUCPT and CP Modules. In addition, the access to such information depends on how much information in their current status is updated. Optimisation of the access to geoinformation data (i.e. satellite maps, aerial orthophoto maps, 3D models) and related analytical products could be also achieved by meeting eight surveyed criteria. Improving *usability, editability, formatting, searchability, structure, visualisation and relevance* of the information products generated with the innovative solutions, facilitate the access to the geoinformation data (i.e. satellite maps, aerial orthophoto maps, 3D models) and related analytical product by e.g. using data filtering functionalities (easy up *searchability*), making the data better visualised in the information product (visualisation) or facilitating the work on electronic access to the products e.g. secured internet linkages (*formatting*). However, the added value was revealed only for some of the criteria, therefore there is a need for further improvement on the solutions in this respect

Annex 6 – Lessons Learned summary based on results from Trials and Final Demo

Analyses made after each phase of each Trial allowed formulating general Lessons Learned which are presented in this Annex. They may sometimes seem even too detailed, however they are described here because they stem from valuable practical experience gained during the Trials and Final Demo and might be useful for any similar events in the future, giving helpful hints and minimizing potential risks.

All the stakeholders involved in the Trials and Final Demo see the potential and added value of DRIVER+ results from their own perspective. For the Trial Committees members the key advantage of the overall Test-bed is the scalability and flexibility – they can easily adapt it to their needs and use it to effectively search for and test new solutions. The practitioners and solution providers agreed that trialling new solutions by implementing each part of the Test-bed, even if demanding and complex (especially at the beginning) could be improved with experience and appropriate support and yield positive results, in particular by enabling better adaptation of the solutions to the users' real needs and requirements. Moreover, this is a good approach to be used within the European Union to stimulate the creation of standards of gathering and evaluating repetitive, verifiable and comparable data for Crisis Management sector, thus helping to increase its overall efficiency.

The overall, highly synthetized observations are as follows:

- A smooth flow of information among different stakeholders and from one place to another is a prerequisite for Crisis Management; Test-bed can enable to share information more easily but internal constrains between agencies (national and international) are still challenging. Test-bed methodological approach may be too complex (difficult) for some practitioners to be used in a proper way without additional support.
- The variety of perspectives represented by different stakeholders participating in the Trial constitute a significant advantage of the trialling, as their joint work leads to common understanding of the needs and expectations of all sides.
- Making a very complex Trial with more than one gap and more than one solution may have negative impact – it might lead to not always fully bridging all the gaps, not obtaining answers to Research Questions or not meeting all the set of objectives. According to Trial Committees the most challenging phases to follow the TGM are Preparation and Evaluation phase – at these stages support from external organisation(s) with experience in this area is needed.
- In the implementation of the TGM the most challenging aspects are: elaboration of a proper data collection plan, evaluation of the collected data and definition of proper research questions. In these respects practitioners strongly indicate their need for support from experienced external organisation(s).
- Trial Action Plan as one of the TGM tools is a good logistic support document, since it responds to the practitioner needs in covering all organisational aspects of Trial preparation.
- It is a problem to test a new way to evaluate solutions (Test-bed) and to evaluate solutions by using the Test-bed at the same time.
- It is important not only to describe, but also to explain the Trial process and way forward to solution providers as early as possible.
- The more training before Trial on solutions for practitioners is conducted, the better. The more the practitioners are familiarized with a solution, the more comfortable they feel operating it.
- In order to support practitioners during a Trial a solution operator (who knows how to use solution from daily work) should be present, allowing them to operate and use functionalities needed in more adequate way.

- Establishing a professional profile (background) of the Observers is crucial to collect valuable and proper data.
- There is a strong need for reliable reference data from the past: emergencies/disasters/exercises comparable to these which are planned to be simulated during the Trial.
- TGM training module is perceived as helpful and useful in understanding of the TGM and the Test-bed concept as a whole.

The subsections below present more in-depth, technical lessons learned related to the three phases of a Trial: preparation, execution and evaluation.

Trial Preparation

1. Challenges in implementation of TGM and the whole Test-bed concept were:
    a. Trial teams were composed of people with different objectives, which was caused by the specifics of the project and reflected in developing of each module of the Test-bed during project duration.
    b. TGM as a new approach for practitioners was a challenge both in the implementation and in changing the way of thinking about organization of this type of event.
    c. After the first two Trials TGM did not specify a milestone between the two major events: Dry Run 1 and Dry Run 2. To rectify the situation one of the TGM tools - Trial Action Plan, was updated and suited to the Trial Owners' needs.
    d. Coordinating the organization of a Trial and solutions involvement is a challenging task and support from more experienced people is needed.
    e. Trial Owners at the beginning had difficulties in understanding some TGM steps and reasoning behind them, but support from TGM developers and more experienced staff helped to overcome that issue during all preparation process.
    f. At the beginning (for the first two Trials) TGM steps were not clear enough for the Trial design teams from technical, practical and organisational perspective, but fortunately continuous support from TGM developers during the whole process was sufficient to prepare the Trials. TGM developers took these problems into account and modified the version two of the TGM and the Trial Guidance Methodology Handbook accordingly.
2. In order to organize a proper Trial support from experienced people (in implementing of the TGM, elaboration of the evaluation plan, operating of the TTI) is needed.
3. The Test-bed implementation has a lot of organisational aspects: technical perspective, solution perspective and integration perspective and can therefore be challenging only for a single party.
4. Research questions have to be interpreted in a certain way in order to avoid receiving a lot of answers which are not relevant.
5. Too many gaps indicated for a Trial make it more difficult to find a certain solution.
6. Support in determining of research questions is valuable: the answers received from the more experienced people (TGM supporting team) are needed.
7. TTI gives the data needed for the evaluation, but the data may not in all cases be fully usable/operational.
8. Dry Run 2 is crucial because the first analyses of the Data Collection Plan showed that most of the types of questions were understood and interpreted in a wrong way. This led to negative results – in many cases the gathered answers were irrelevant and some questions were not addressed at all.
9. Test-bed can be helpful, but it is very, very ambitious. It needs a really dedicated organization that can keep it working and updated.

10. On the technical side Test-bed is complex and would need support to be properly used (specific background).
11. The Portfolio of Solution has to be quickly updated if the solution is changing.
12. It is difficult in some cases to fit all the functions of a specific solution into the organisation and the procedures applied in a certain context of the scenario.
13. It is important not only to describe, but also to explain the Trial process and way forward to solution providers as early as possible.
14. Meetings with practitioners need to be planned long in advance. Delay of work or rescheduling of meetings should be expected due to daily business. Face-to-face meetings should be preferred over communication via email.
15. Looking at the final Trial setup the Research Questions used should be described in a way as specific as possible, and as generic as necessary.

Trial Execution

1. In order to deal adequately with time constraints, it is recommended to not give an overall picture of all functions during hands-on session, but to focus on specific primary function(s) foreseen to be used in Trial instead.
2. In the execution phase a clear division into separate meetings helps to focus on different aspects and get things running. Communication hierarchy is recommended and should be maintained in the Trial execution (red vests escalation process).
3. Trial Integration Meeting (TIM) provides an opportunity to meet all stakeholders involved, get a deeper understanding and align perspectives to kick off important tasks. TIM should be conducted as early as possible, eventually directly connected to the solution demonstration.
4. Train at least one replacement per participating group as backup is needed.
5. In a more complex set-up, the individual effect of all potential losses cannot be foreseen.
6. A limit of interactions between observers and practitioners must be strictly specified as much as possible in order to avoid disturbing or biasing practitioners versus allowing some interactions to facilitate the work of observers.
7. With implementation of the TGM (Dry Run 1 and Dry Run 2) a Trial is preceded by adequate number of tests, which allows to be ready for most of the situations that might be expected to happen. It also gives back-ups in case something goes totally wrong.
8. Following all the TGM requirements is challenging – ensuring the participation of the same group of practitioners for Dry Run 2 and for a Trial is extremely difficult, what causes the need to conduct more in-depth trainings (ex. about solutions) just before Trial execution.

Trial Evaluation

1. It was a challenge for Trial Committees to evaluate at the same time both the Test-bed and solutions tested during Trial which were using a TTI.
2. There is a clear need to plan enough time for evaluation.
3. Evaluation coordinator needs to be involved and able to acquire in-depth knowledge of multiple other tasks (scenario, test-bed, solutions, support tools).
4. Too many observers for one solution influence the trialling process and make finding innovation harder.
5. Establishing a professional profile (background) of the Observers is crucial to collect valuable and proper data.

6. There is a need to plan enough time for appropriate check of the Data Collection Plan by the Observers during the Dry Run 2.
7. Finding and selecting observers with proper experience and also matching the right number of them can be challenging.
8. Proper Data Collection plan allows indicating exactly which data needs to be collected to avoid gathering of inadequate or too much unnecessary data.
9. Proper Data Collection Plan enables to collect sufficient data to answer research questions adequately.

There is a strong need to have reliable reference data from the past: emergencies /disasters/exercises comparable to these which are planned to be simulated during the Trial. Only having these reliable reference data may enable you to avoid running the Baseline run during or before the Trial. If you are not able to gather the reference data from previous events, then it is truly recommended to do the Baseline run in order to generate reference data necessary to compare the results and interpret them in a meaningful way.

Annex 7 – Results of focus group interviews for Trials 1 - 4 and the Final Demo discussion

This annex presents analysis results of the answers obtained to the closed questions asked using Menti-meter. These referred to the Test-bed (e.g. TGM, TTI and TGT) evaluation. The scope of the topics questioned during the focus group interviews has been formulated in respect to the key challenges identified in the course of the TGM, TTI and TGT implementation in the Trials 1 - 4. The aim of the workshops was to figure out and collect specific and possibly detailed opinions and experiences of utilising these DRIVER+ products. Conversations conducted in the regime of the Focus Group technique were aimed at revealing and defining factual sources of identified and potential problems with TGM, TTI and TGT practical implementation.

Deeper elaboration on the Focus Group Workshop realisation (transcriptions from focus group discussions) was recorded in the internal DRIVER+ database (these recordings are not attached to this report regarding the public status of it). Regarding time constrains and parallel development of the TGM, TTI and TGT together with the Trial 1 preparation and execution there was no Focus Group conducted just after this Trial, however the Lessons-Learned meeting has been held. Main results and conclusions of the meeting were used to prepare the Focus Group Workshop of Trial 2, which allowed concluding observations regarding the Test-bed development for both Trials.

Annex 7.1 Trial 1 (Poland) and Trial 2 (France)

The annex presents aggregated conclusions made after the analysis of the Focus Group Workshop results conducted after Trial 2. It contains also conclusions coming from Trial 1 since the TGM and other elements of DRIVER+ during Trial 1 were in a very initial phase of development. Therefore, it was decided to conduct one combined focus group for Trial 1 and Trial 2 after the second one. The reason for that was the fact that the environment was more mature while conducting Trial 2, so that it was far more justified to realistically evaluate it on the base of the experience in its implementation during Trial 2, however, also reflecting on the concept checked in Trial 1. Trial 1 was mostly organised in line with the concept of the TGM and other DRIVER+ tools, however, only few elements were ready to be implemented in practice at that time.

In the first part of the annex open questions (asked during a Focus Group) are listed together with main observations, conclusions and hints for the Test-bed development raised during the Focus Group discussion. In the second part of the annex Figure A1 to Figure A6 present answers to closed questions collected with support of Mentimeter. A total of nine people participated in the focus group research during Trial 2.

Q1. In your opinion, what type of broadly understood solution could contribute to the improvement of the Crisis Management process?

- It depends on solutions. It is not restricted to the type of solution. For example, in COP it is harder to prepare protocols.
- Every solution which is related to human needs.
- Solutions for exchanging information, a solution related to information flow. Information and communication are very important.
- To share information between different organisations. A practical solution which is easy to use. Radio communication tool. Not only technical solution but also supporting organisation of CM processes during crisis situation.
- Private organisation and solution which should help in crisis situation. Cooperation between sectors, cross-border, between companies or organisations.
- Technical solution which gives new possibilities (robots); solution to store data and make data analysis; to organise CM situation; solution which open new horizons for example related to media.

Q2. What are the advantages of using the Trial Guidance Methodology for evaluating CM solutions within an appropriate?

- Crisis Management is about sending information from one place to another, so sharing information is very important; we already focused on cross-border and cross-level, but also, we look for a cross-sector, which is a big challenge.
- We think not only about understanding things, but what's more, about risk reduction, operation reaction, reducing risk - stimulate thinking in appropriate environment.

Q3. What difficulties for your organization are related to the implementation of TGM in Preparation & Execution phase? (Who, in which time, and how can it be solved?)

- Trial Teams are composed of persons with different objectives.
- Practical implementation of TGM is challenging.
- Missing milestones between DR1 and DR2. It is easy to understand but also easy to miss milestones. Coordination and solution coordination are difficult tasks.
- People don`t understand how in detail realise selected TGM's steps. They must do something but they don't understand why they should do it.
- TGM handbook describes how to do and what to do.
- TGM as a scientific document is a really good one, but when one wants to use TGM in practice it is too complex.

Q4. What type of support you could get/have been given in Preparation and Execution phases?

- The Group responsible for Trial designing had a problem to understand parts of TGM. TGM has to be described from different perspectives: technical, practical, organisational.
- Team which design the TGM has different way of thinking than practitioners.
- TGM team is focused on the methodology but not on organisational side of the Trial; there should be more information about logistic, technical issues, etc.
- Logistic support document could be useful.
- TGM was really flexible for Trials 1 and 2 and should be formulated in details for Trials 3 and 4. Only members of the Trial Committee have appropriate knowledge about the Trial. Therefore, they are only people who can understand TGM correctly if they manage to do that? TGM support team should be involved in pre-Preparation phase of the Trial. A training to understand TGM is crucial.

Q5. What type of problems and challenges you perceive important in the Test-bed implementation while implementing it in your organisation?

- It is difficult to understand what the Test-bed is and how it works at this moment of its development.
- It is a lot of organisational aspects of the Test-bed implementation: technical perspective, solution perspective and integration perspective.
- Concepts of DR1 and DR2 are not clear enough.
- There is a challenge to implement the solution to the Trial through the Test-bed at this moment of the Test-bed development.

Figure A1 to Figure A6 present the composition of the answers for closed questions received during the Focus Group Interview.

1. If you wanted to Trial a solution, would you prefer to?

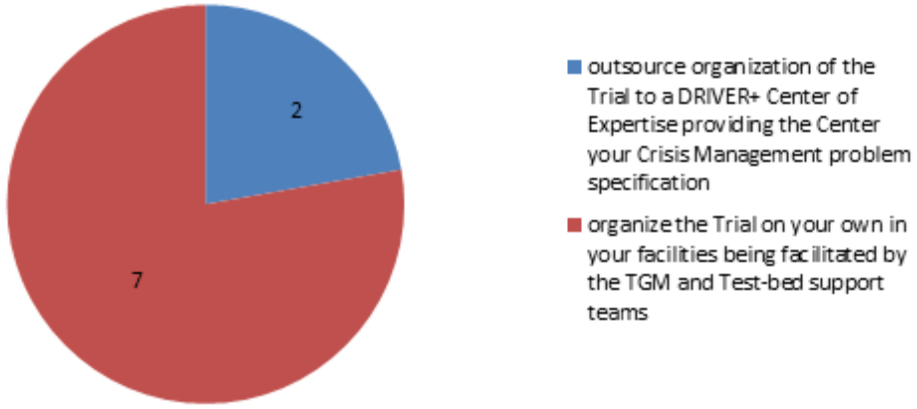


Figure A1: Test-bed utilization possibilities (Trials 1 and 2)

This question was addressed to identify preferences in further Test-bed development strategies. One of the key issues is if the Test-bed would more preferably be used by beneficiaries (Crisis Management practitioners' organizations) on their own or it would rather be outsourced being a product which will be operated by specific "DRIVER+ Centres of Expertise" where Crisis Management practitioners could be served by specialised staff who will organise a Trial for the practitioners' purposes and with their contribution. 7 out of 9 people prefer to organise the Trial at their own facilities, being facilitated by the TGM and the Test-bed support team, over outsourcing its organisation to a "DRIVER+ Centre of Expertise" providing description of a Crisis Management problem specification they experienced.

2. Which step of the TGM seems to be the most challenging to implement it in a Trial realisation *(choose no more than 3 answers)***?**

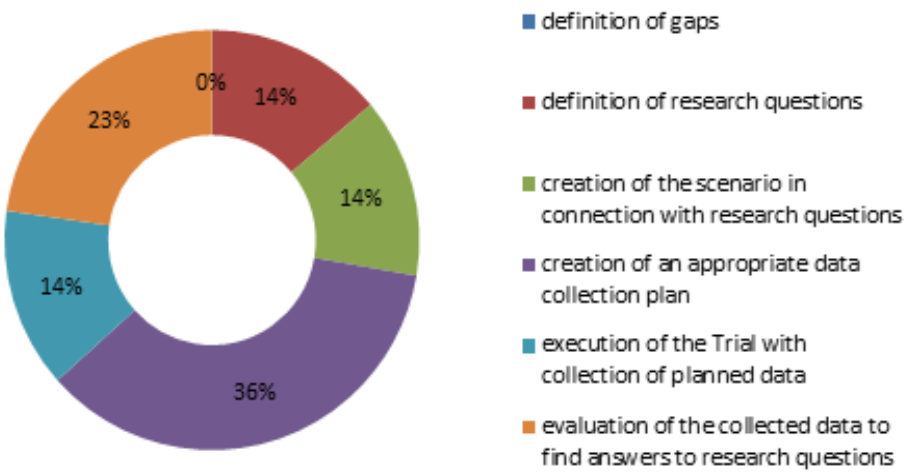


Figure A2: Challenges in TGM implementation (Trials 1 and 2)

This question was asked to identify Trial organizational measures which could require specific attention of the Trial organisers, as well as additional elaborations and special support in order to organise a successful event. In question number 2, about the most challenging steps of the TGM to implement in a Trial realisation, respondents could choose not more than 3 answers. The most repeated answers among respondents were: *"creation of an appropriate data collection plan"* – 36% and *"evaluation of the collected data to find answers to research questions"* – 23%. The next three responses have the same result (14%) and respondents indicated:

- *"Definition of research questions".*
- *"Creation of the scenario in connection with research questions".*

3. Which of the TGM phases should have been more elaborated in the TGM Handbook *(one answer only)***?**

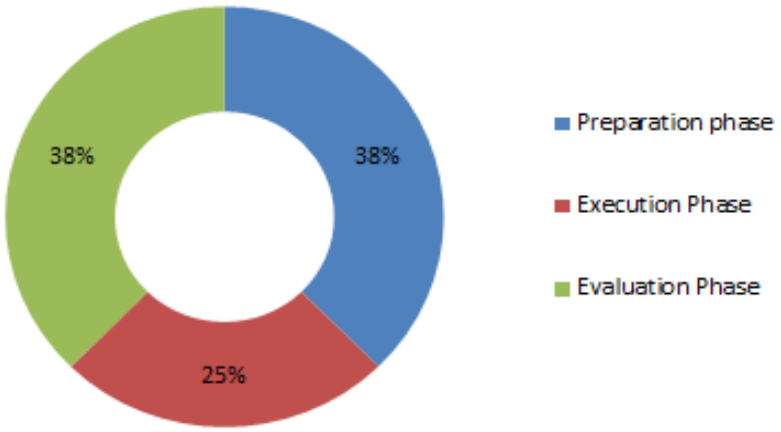


Figure A3: Trial phases description in TGM (Trials 1 and 2)

This question was asked to identify which phase of the Trial realisation requires more attention while updating the TGM Handbook. The respondents indicated that phases which should have been more elaborated in the TGM Handbook are: Preparation phase – 38 % answers, Evaluation phase – 38 % answers; 25 % of the answers indicated the Execution phase. The results of this survey confirm what was revealed in question 2, that planning and execution of proper evaluation processes as well as interpretation of the achieved data are the most challenging element in a Trial. Therefore, it is recommended to put more attention, practical measures, descriptions and concrete examples on evaluation methods, techniques, tools and their utilisation before, during and after a Trial.

4. Having TGM Handbook before a Trial preparation, what type of information would be a priority for you to search for *(choose no more than 3 answers)***?**

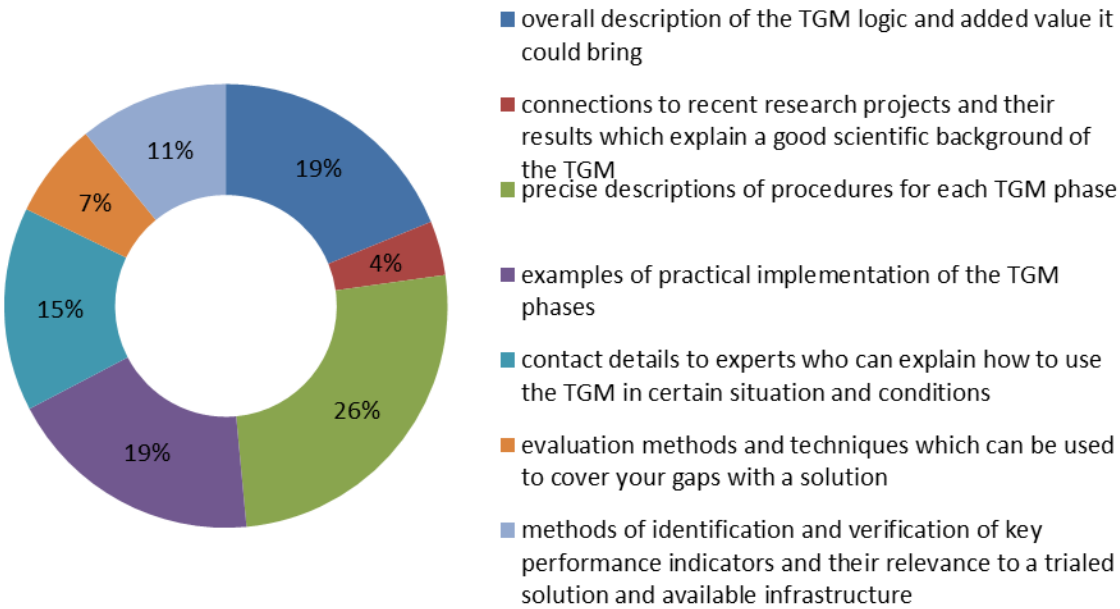


Figure A4: TGM priorities in Trial Preparation phase (Trials 1 and 2)

This question was asked to identify what specifically Trial 1 and 2 Committee members have been searching for in the TGM while organising the Preparation phase of their Trials. The respondents indicated that the most desired information would be:

- *"Precise descriptions of procedures for each TGM phase"* – 26% of given answers.
- *"Examples of practical implementation of the TGM phases"* and *"overall description of the TGM logic and added value it could bring"* – 19% of given answers.

- *"Contact details to experts who can explain how to use the TGM in certain situation and conditions"* - 15% of given answers.
- The least frequently indicated answer (only 4%) was: *"connections to recent research projects and their results which explain a good scientific background of the TGM"*.

5. Which of the TGM phases requires the most engagement from TGM support team *(one answer only)***?**

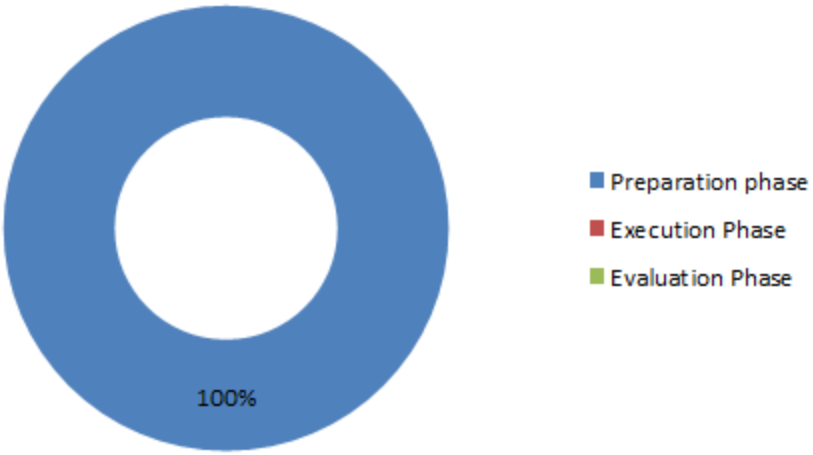


Figure A5: Role of TGM support team (Trials 1 and 2)

This question was asked to identify in which phase the TGM support team should have contributed the most while organising a Trial. In the opinion of all respondents the Preparation phase requires the most engagement from the TGM support team (100% answers). However, it should to be noticed that the focus group for Trial 1 was conducted while the Evaluation phase of Trial 1 was still being performed, and had been just started for Trial 2. It means that the respondents' perception about the Evaluation phase of these Trials, at this particular moment of the survey, was rather based on a concept for the Evaluation phase in TGM than real experiences. This could explain why the Preparation phase was considered to be the one which requires the highest engagement of the TGM support team for that particular moment. Further elaborations based on the experiences from the Evaluation phase of these Trials as well as the other two Trials show that the Evaluation phase is the one in which the support of the TGM team is required as well. This concerns mainly the analytical work on the collected data as well as their visualization.

6. If you had an access to an appropriate Test-bed, how often would you use it to choose a solution for your organization *(choose one answer only)***?**

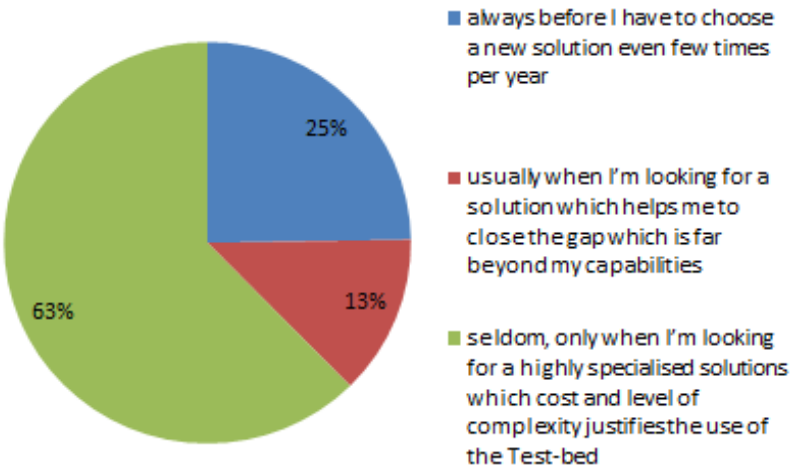


Figure A6: Preferences in Test-bed implementation (Trials 1 and 2)

This question was asked to identify potential spectrum for the future Test-bed utilisation needs. For the above question more than half of the respondents indicated that they would use the Test-bed *"only when I*

was looking for a highly specialized solutions which cost, and level of complexity, justifies the use of the Test-bed" (63 % answers). Every fourth answer was *"always before I have to choose a new solution even a few times per year"* (25 % answers). In 13 % of answers respondents picked *"usually when I'm looking for a solution which helps me to close the Gap which is far beyond my capabilities"*. No one answered *"never, because it looks to me too much complicated, time and resource consuming"*.

Annex 7.2 Trial 3 – 'Austrian Trial'

The annex presents aggregated conclusions made after the analysis of the results of the Focus Group Workshop conducted after Trial 3. The annex is structured in the same manner as previous annexes. Figures present answers to closed questions collected with support of Mentimeter. Due to the organisational constraints (the period of Trial 3 execution was strongly dependent on UCPM IRONORE exercise what determined that the Focus Group was conducted on Saturday evening) the number of people participating in the workshop was limited to 3 respondents. Even though, the respondents represented three main stakeholders (coordinators of practitioners, solution providers as well as the Trial Owner), the results could rather be considered in terms of suggestions for further developments than a general tendency. On the other hand, from quality perspective the respondents were the most involved people in the Trial realisation throughout all the phases (preparation, execution and evaluation). They were key personnel of the Trial, fully responsible for overall management of all aspects of the Trial in respective fields (practitioners, solution providers and Trial organisation aspects). Moreover, they represented a quite limited group of people who knew TGM, TTI and Trial concept by heart, and what is more important they implemented the overall system in practice while performing the Trial. Therefore, despite the low number of respondents, the quality of their opinions is highly rated.

Further below, there are results of the Focus Group Workshop presented. They are structured by the questions asked in this survey.

Q1. In your opinion what (what type of broadly understood solutions, activities, actions, etc.) do we need to bring innovations to Crisis Management?

- Finding a way to integrate the solution into the Crisis Management process, through (for example) trainings.
- A clear Gap and a clear problem are required to start finding a way for improvement.
- Knowledge about how to implement solutions in the Crisis Management process. The problem is that if one believes in own protocols and their reliability it blocks innovation in organisation.
- It has to be a standard defined how to connect a certain solution into the Crisis Management.
- Sharing knowledge about good practice in another organisation.
- Knowledge about how to connect different solutions which are in the market, how to integrate one solution with another.
- There is a need to develop together the solution to a problem (solution and functionality which is dedicated to each other).
- The problem in the implementation of TGM may occur regarding the fact, that TGM does not cover political aspects.

Q2. Why does the Test-bed bring added value to Crisis Management?

- The Test-bed brings interoperability feature for different solutions. It allows to connect together different solutions and gives possibility to share information among them.
- The Test-bed describes process of systematic solution assessment which has potential to make this objectively in a way to find an innovation. However, the Test-bed should be less complex.
- Using the Test-bed the quantitative assessment (using collected data) not only qualitative (through individual perception) is possible. However, it seems that the best Trial could test only one solution and the Test-bed could trial only one solution at the same time.

Q3. Why might the practical implementation of the Test-bed be a challenging task?

Challenges in practical implementation of the Test-bed are:

- Transfer of knowledge and Lessons Learned from the simulated environment to the real crisis situation.
- Finite budget for financing implementation of the Test-bed.
- Technical aspect of the Test-bed is difficult and needs special knowledge to be implemented. Somehow „lighter" version of the Test-bed with easier solution connection/integration method would be appreciate or technical support from outside of the practitioner community.
- The TGM is relatively academic approach so it is additional challenge to implement it to use the Test-bed method effectively. It seems very hard without support of organisations with academic background.
- Scalability, to use the Test-bed at different organisational and decision levels as well as for different Trial scale.

Q4. Has the number of Observers been adequate to fulfil given tasks? Why it was so?

- Too many observers for one solution influence the trialling process and makes finding innovation harder.
- One observer personally observing the certain solution is enough.
- Observers should be people with broad experience.

Q5. Why do you think that you have designed a Trial which was done in line with the TGM and was ready to be executed?

- The Trial was preceded by number of tests which allowed being ready for most of the situations that might come up. It also gave back-ups if something went totally wrong.
- The required data was gathered according to the plan.
- Gap definition, Solution selection and Practitioners selection processes were really close to the TGM. However, execution of the Trial could be more in line with the TGM.

Q6. Why will not the Test-bed be used any longer after completion of the project?

- Final decision to put the Test-bed on the market is a political one. This decision has to be supported by high level EU institutions which could implement a Trial.
- The legal aspect of implementing the Test-bed in to the market has to be clear.
- Implementing of the Test-bed concept needs huge effort and time from practitioner's perspective. This process is really time-consuming.
- It would be good to have several Trials with different practitioners to prove that a certain solution is innovative and closes a Crisis Management Gap. This process is (also) expensive and time consuming.
- The Test-bed seems to be too complex to be easily implemented.

Figure A7 to Figure A11 present the composition of the answers for the closed questions received during the Focus Group Workshop.

Q7. Give your opinion on the below statements:

This question was asked to identify the helpfulness of the DRIVER+ Test-bed and its components. For this question respondents gave their answers by rating each of the mentioned statement on a scale of 1 to 10, where 1 means "strongly disagree", 10 – "strongly agree". The most helpful component of the Test-bed for the respondents is TTI which greatly support organisation process of the Trial (rate 8.0). Also, the Test-bed as a whole in perspective of data collection and finding innovation in Crisis Management as well as its methodology (TGM) seemed really helpful for the respondents (rate 6.0). In the opinion of respondents, the least helpful during the preparation, execution and evaluation of Trial 3 was TGT (rate 4.0) which still needs to be improved.

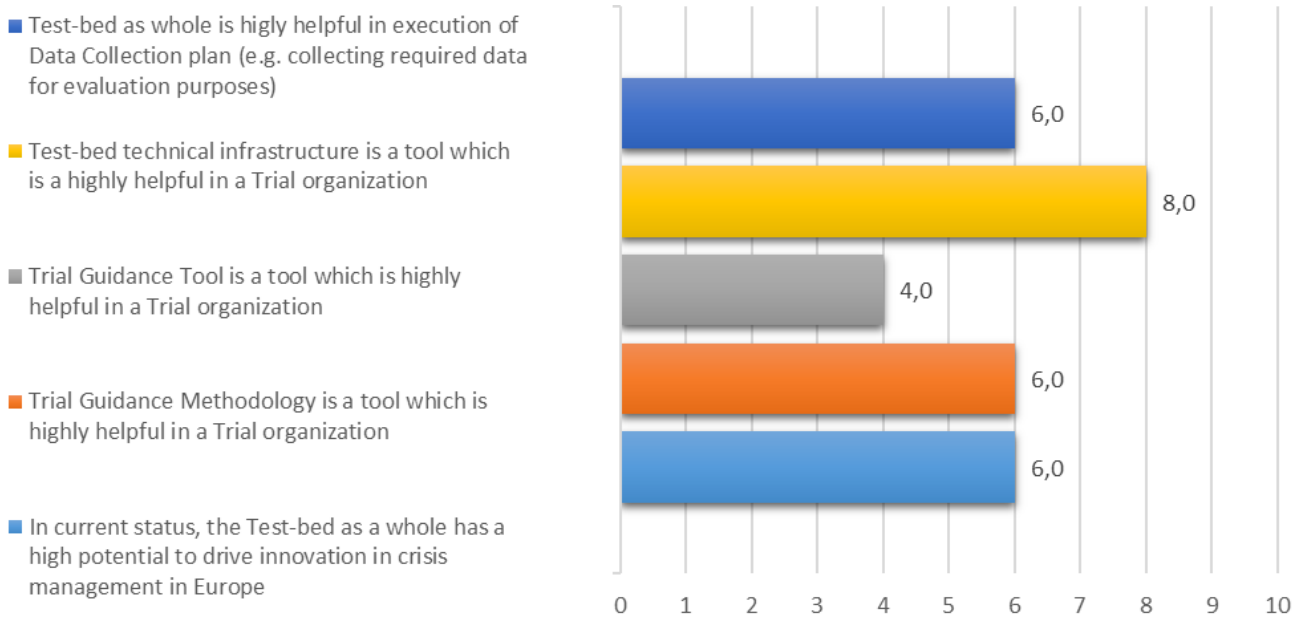


Figure A7: Helpfulness of the Test-bed and its components

Q8. Please assess the below features of the Test-bed

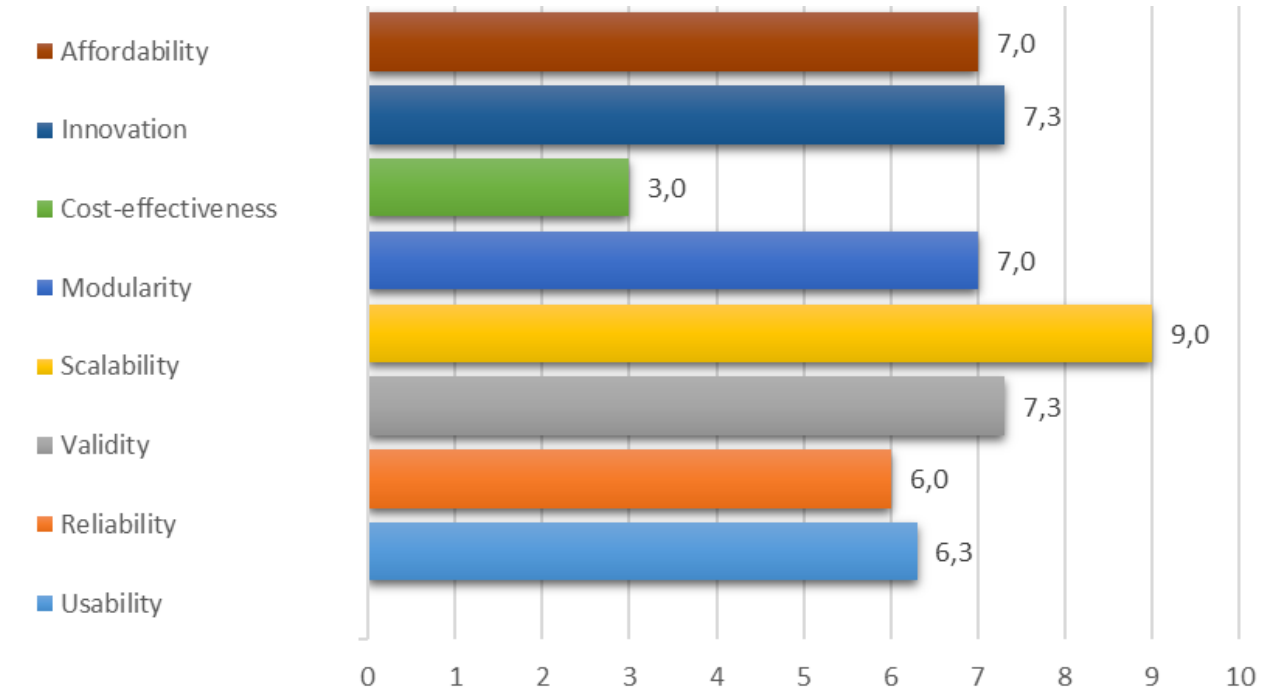


Figure A8: Test-bed's features evaluation

This question was asked to identify different features of the Test-bed as a whole and its potential in broad use for the preparation, execution and evaluation of Trials. For this question respondents gave their answers by rating each of the mentioned statement on a scale of 1 to 10, where 1 means "low potential", 10 – "high potential". In the opinion of the respondents, the best advantage of the Test-bed is its scalability (rate 9.0). Also Test-bed's affordability, innovation, modularity, validity, reliability and usability were assessed as strong features (rates from 6.0 to 7.3).

The lowest rate in opinion of respondents was assessed for cost-effectiveness of the Test-bed (rate 3.0), which seems to prove that the proposed by DRIVER+ approach has a high potential; however, it requires certain effort and resources to receive reliable answers to the asked Research Questions.

Q9. Do you think Trial 3 enabled to collect sufficient data to answer the Research Question?

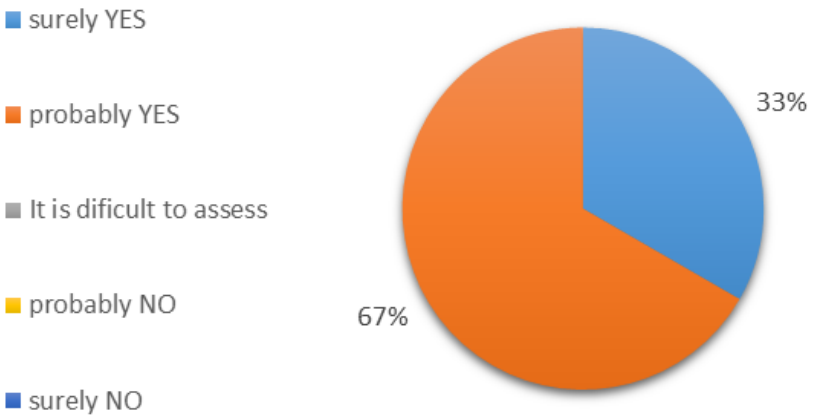


Figure A9: Sufficiency of collected data for the purposes of answering the Research Question

This question was addressed to identify if Trial 3's data collection process enabled to sufficiently answer Research Questions. The question was answered by respondents as follows: 1 out of 3 (33%) definitely agree that data collected during Trial 3 were sufficient to answer to all RQ, 2 other respondents (67%) recognised that most probably the collected data was sufficient.

Q10. Which of the TGM steps was the most challenging for the Trial Committee while organising Trial 3?

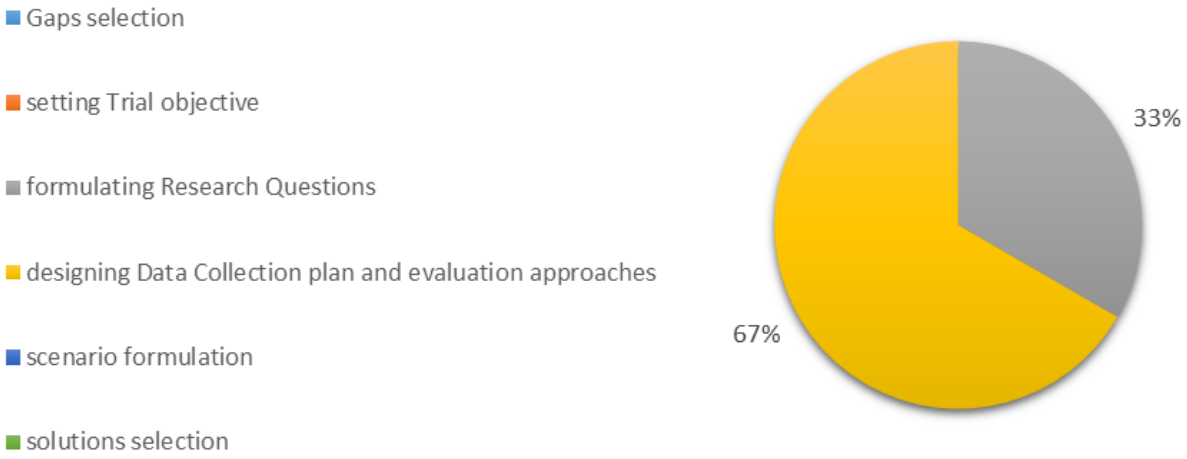


Figure A10: Challenges in TGM for Trial Committee

This question was asked to identify which step of the TGM looks the most challenging for the Trial Committee of Trial 3. For this question respondents gave their answer by choosing only one step. The most challenging step for respondents was *"designing Data Collection plan and evaluation approaches"* (67% of answers). Also *"formulating Research Question"* step (33%) was mentioned as challenging.

Q11. If you identify Crisis Management Gap in your organisation which requires to be covered by implementation of new solution, would you:

This question was addressed to identify preferences in further Test-bed development strategies. The question was answered by 2 respondents. One of them (50%) prefers to organize the Trial by its own organisation using the Test-bed approach, however a second one (50%) prefers to outsource organisation of the Trial to the other organisation (DRIVER+ Centres of Expertise).

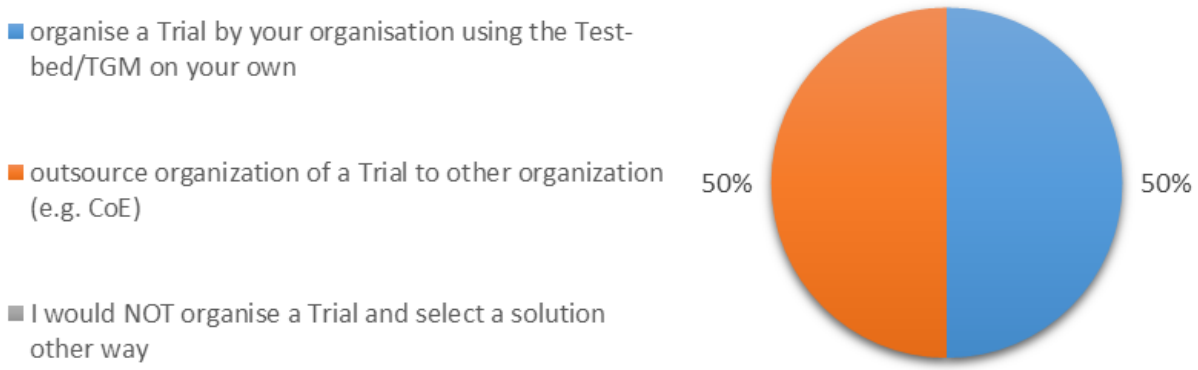


Figure A11: Test-bed readiness to testing new solutions

Annex 7.3 Trial 4 - 'the Netherlands Trial'

The annex presents aggregated conclusions made after the analysis of the results of Focus Group Workshop conducted after Trial 4. The annex is structured in the same manner as previous annex 7.1. Figures present answers to closed questions collected with the support of Mentimeter. In the Focus Group after Trial 4 twelve people participated (Trial staff).

Q1. What type of broadly understood solution could contribute to innovations in Crisis Management?

- Software solutions more or less contribute to the overall picture and more or less to information exchange.
- The procedures how to work together in multi-stakeholder environment, also taking into account the different style of work of different stakeholders.
- Solutions which help to understand information exchange among stakeholders.
- Solutions which help society to understand the situation and behave in a proper manner.
- Systems supporting the decision-making process and help in information validation for example by using digital models and methods.
- Training tools which create a realistic environment of Crisis Management to train different crisis situation.
- Solutions which help to understand what kind of problems are the most important for crisis managers and practitioners.

Hints:

- DRIVER+ should focus more on social solutions not only technical solutions. All solutions to be useful need to be user friendly for practitioners.
- Crisis Management never thinks for someone else. So, there may be information provided and let the other organisations decide what this information mean for them.
- The Test-bed is at the moment in the status that is not a solution or something that can be recommended to use thoroughly with a lot of help; it's still a kind of research in that status, it's in the development stage, but I can't say at the moment it's a product.

Q2 How and why the Test-bed brings added value to Crisis Management?

- Test-bed could be helpful and could be something which is used by other projects for other developments.
- It will lead to better research by using precisely pointed research questions that improves evaluation process and can help see where the progress is.
- Test-bed brings all the components together for organisations themselves to find innovations – it contains Portfolio of Solutions which is very useful especially when practitioners don't have an idea where to find a solution that might help them.

- The methodology (TGM) should be held by a public sector to find the solutions in case of the crisis situation.
- Helps you to start thinking about Gaps and problems.
- Test-bed gives environment of the solutions which together may solve more complicated problems for which one cannot find a single solution.
- Test-bed is a really good product in the end but some countries/practitioners work on standards (evaluation of solutions) for 10-15 years which perfectly fix their problems.
- Test-bed can also be a good environment for training purposes.
- Test-bed sustainability is a key problem – information about possibilities how to find an innovation in Crisis Management has to be disseminated broadly.
- TGT hasn't finished yet as a solution which is supportive in preparation of the Trial.
- Evaluation policy is definitely needed to describe the process of collecting data – Test-bed allows to collect a lot of data but it should be designed more how to describe/process/conclude the results (strict guidelines).
- Test-bed in the end could give credible results for evaluation of solutions.

Hints:

- Test-bed can be helpful, but it is very, very ambitious. It needs really dedicated organisation that can keep it working and updating.
- On a technical side Test-bed is complex and would need support to be properly used (specific background).
- It is a problem to test a new way to evaluate solutions (Test-bed) and to evaluate solutions by using the Test-bed in parallel.

Q3. Why is it a challenging task?

- The core technical infrastructure of the Test-bed is not fixed and stable and in the status that is not changed anymore.
- Trial is way too long for an organisation to assess a solution.
- Too many Gaps for a Trial make it more difficult to find a certain solution.

Hints:

- The Portfolio of Solutions has to be quickly updated if the solution is changing.
- Test-bed methodological approach could be too complex (difficult) for some practitioners to be used in a proper way.

Q4. What type of support would be needed to do that and why?

- Support in determining of research questions: the answers received from the TGM supporting team were on time and satisfied a Trial Owner.
- TGT should provide information and typed in information and upload documents and a list of what is still to do.
- TGT needs a kind of a time scaling meter.
- TGT should have a project management component.
- Test-bed gives the data needed for the evaluation, but not fully usable/operational.
- To analyse the data more time is required; there was not enough time for that during the Trial.

Hints:

- Research questions have to be interpreted in a certain way not to get a lot of answers which are not needed.

Q5. How has applicability of the Data Collection Plan been verified/tested before the Trial?

- First analysis of the Data Collection Plan showed that for the most of the types of questions they were interpreted in a wrong way. In this way a lot of answers didn't need to be collected but also some of the answers which should be answered were not answered.
- The number of Observers involved in the Trial was appropriate, as well as their profiles (background).
- There was not enough time for appropriate check of the Data Collection Plan by the Observers during the Dry Run 2.

Q6. Why will the Test-bed not be used after completion of the DRIVER+ Project?

- There are other ways of achieving the same goal; there are other project doing quite similar things which are being developed and the Test-bed is not competitive enough - it's asking much more attention of practitioners' organisation.
- There is a risk that the Test-bed will simply not be used because of the fact that it is not known that it exists.
- TGM support team has to continue its role after the project.
- It is difficult to install (the Test-bed) from GitHub; there is a need for someone to keep it updated.
- Time available for evaluation has to be extended.

Hints:

- Support of the Test-bed after the project seems to be missing/not precisely defined.

Figure A12 to Figure A15 present the composition of the closed questions' answers received during the Focus Group Interview.

Q7. After up-to-know experiences does the Test-bed as a complex environment has its potential for finding innovation in Crisis Management?

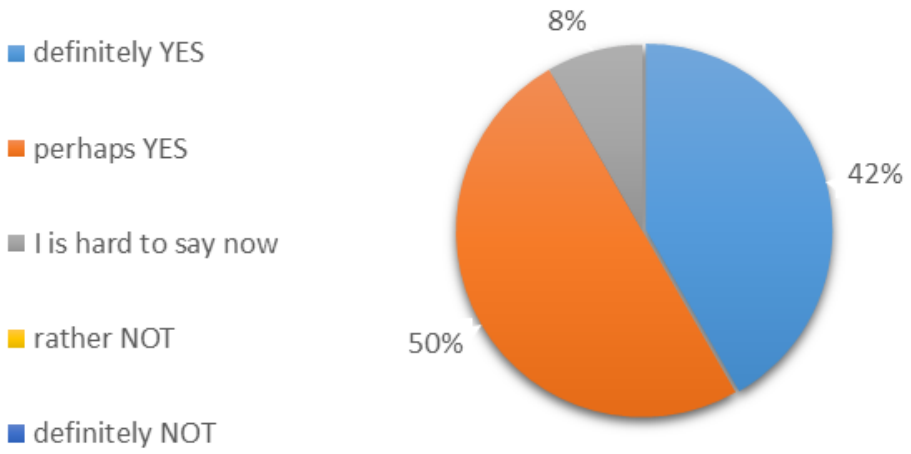


Figure A12: Test-bed potential to find innovation in Crisis Management

This question was addressed to identify if the Test-bed is an appropriate environment to find innovation in Crisis Management. 5 out of 12 respondents (42%) definitely agree that the Test-bed used for preparation, execution and evaluation of Trials 4 is an environment which greatly improves finding innovation process in the CM, 6 respondents (50%) recognise partial potential of the Test-bed in this aspect, 1 respondent (8%) has no opinion on this matter. Answers to this question prove that respondents who were involved in the Trial 4 conduction think that the concept proposed by the DRIVER+ has a capability to support finding innovative processes in Crisis Management.

Q8. Imagine you identified a Crisis Management Gap. If the Test-bed is ready to be used for testing new solution, would you prefer to:

This question was addressed to identify preferences in further Test-bed development strategies. 8 out of 12 (67%) respondents prefer to organize the Trial at their own facilities (being facilitated by the TGM and Test-bed support team), 4 respondents (33%) prefer to contract external organisation to organise a Trial to solve the Gap. This result strengthens the similar conclusion from Trials 1 and 2 focus groups that specific aspects of the Trial and certain expectations of the practitioners lead them to organise a Trial on their own, using their own capabilities.

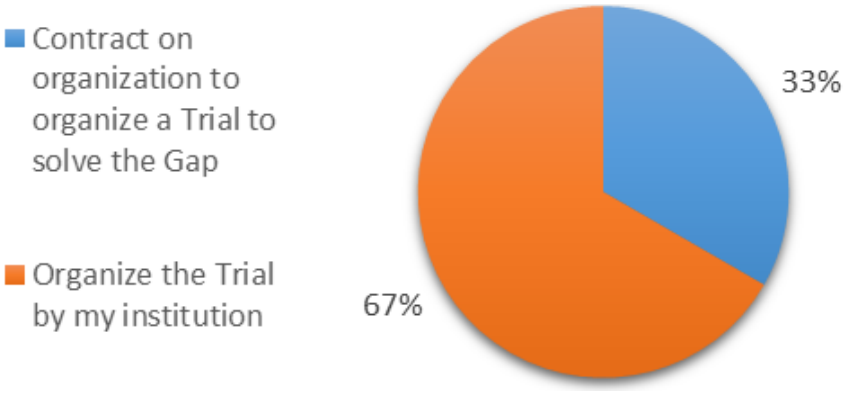


Figure A13: Test-bed readiness to test new solutions

Q9. Reading the Trial Guidance Methodology Handbook, what kind of information You have been looking for the most:

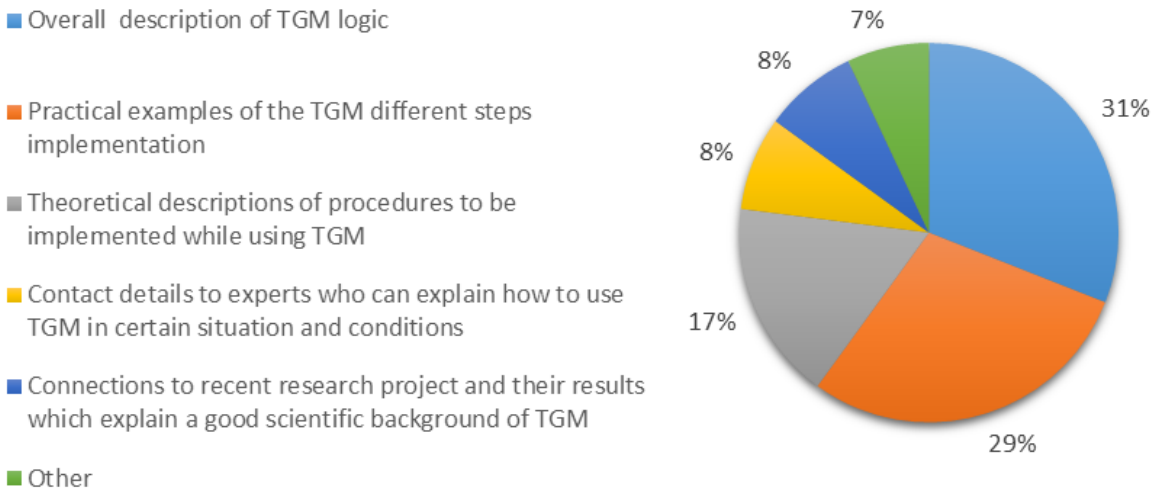


Figure A14: Expectations on TGM Handbook

This question was asked to identify what kind of information is the most interesting for practitioners who want to use TGM Handbook to organise and conduct a Trial. For this question 11 respondents gave their answers (they were allowed to point more than one answer to the question). The respondents indicate that in the TGM Handbook they have been looking the most for "*Overall description of TGM logic*" (31% of all answers) and "*Practical examples of the TGM different steps implementation*" (29%). Also important for them was "*Theoretical descriptions of procedures to be implemented while using TGM*" (17%), however less important were "*Contact details to experts who can explain how to use TGM in certain situation and conditions*" (8%), "*Connections to recent research project and their results which explain a good scientific background of TGM*" (8%) and "*Other*" issues (7%).

Q10. Which step of the TGM looks to be the most difficult to implement in practice?

This question was asked to identify which step of the TGM is the most challenging to implement in practice. For this question 12 respondents gave their answers by rating each of the mentioned step on a scale of 1 to 10, where 1 means "strongly disagree", 10 – "strongly agree". The most challenging (the most difficult to implement) for respondents are steps: "*Creation of an appropriate Data Collection plan*" (rate 7.1) and "*Evaluation of the collected data to find answers to Research Question*" (rate 6.2), also as a difficult respondents evaluate "*Execution of the Trial with collection of planned data*" (rate 5.2), "*Definition of Research Questions*" (rate 5.4) and "*Creation of the scenario in connection with Research Question*" (rate 4.9). In respondents' opinion the easiest step was "*Definition of Gaps*" (rate 3.8).

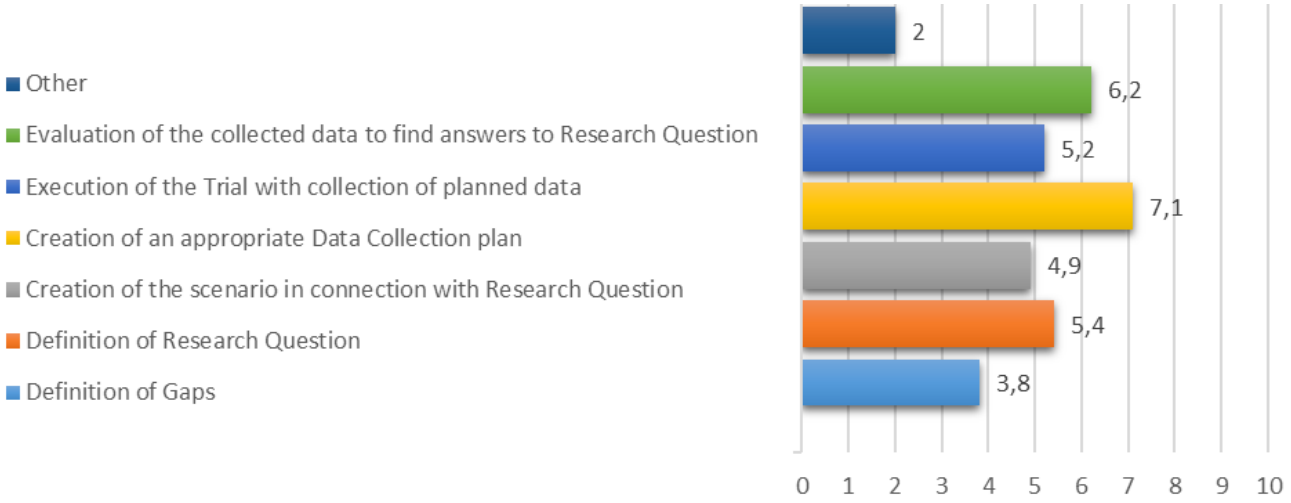


Figure A15: Challenges in TGM implementation

Annex 7.4 Final Demo

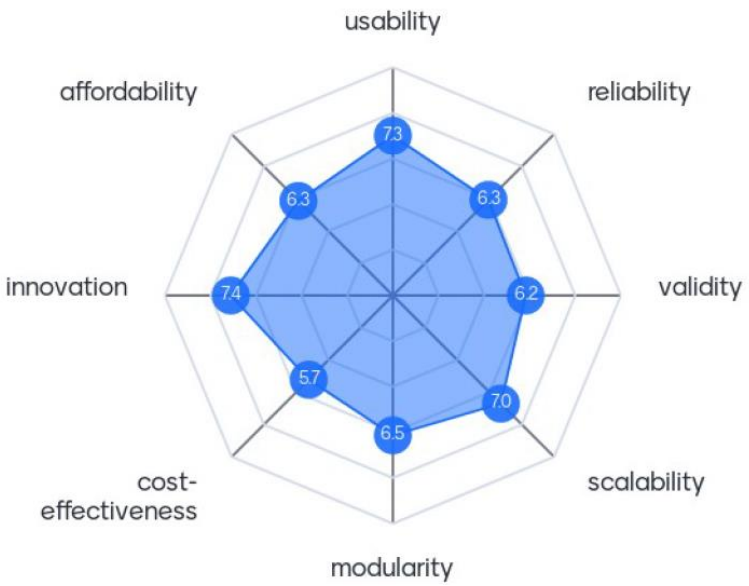


Figure A16: Trial as a method of testing innovative solutions for Crisis Management (FD experience, collected by Mentimeter)

Due to the time restrictions there was no typical focus group interview conducted after the Final Demo. However, during the final session of the Trial there was a survey on the Trial, as a method for testing new solutions, as well as on the TTI, carried out. For these purposes the agreed KPIs were surveyed with the group of key participants of the Trial including the Practitioners, the Solution Providers, the Final Demo

committee members and other invited persons (e.g. including REA reviewers present). The respondents were asked about their perceptions of the above-mentioned aspects based on the experiences of all the Trials and the Final Demo. The survey was done during the final session of the Final Demo, so at the very last stage of all the Trials executions in order to embrace all the possible experiences throughout the project in this respect.

Figure A16 presents the average results of the survey where the group of practitioners, who have taken part in the FD, were asked about the Trial as a method of testing innovative solutions for Crisis Management. DRIVER+ Test-bed evaluation KPIs (scalability, modularity, reliability, innovation, affordability, cost-effectiveness, usability and validity) measured on the scale ranging from 1 to 10 were estimated in the following way: Mentimeter was used to collected respondents' answers. 33 participants gave their response to these questions. All mentioned KPIs were assessed above the middle value, with the highest score for innovation (7.4) and usability (7.3) and the lowest score for cost-effectiveness (5.7).

Figure A17 presents the average results of the survey where the same group of practitioners was asked about the TTI as an environment supporting a Trial realisation. The same set of DRIVER+ Test-bed evaluation KPIs were estimated this way (on the 1 to 10 scale) using Mentimeter. 22 practitioners gave their responses to this question. All mentioned KPIs were rated higher than the middle value with the highest scores for innovation and modularity (8.2) and the lowest score for cost-effectiveness (6.6).

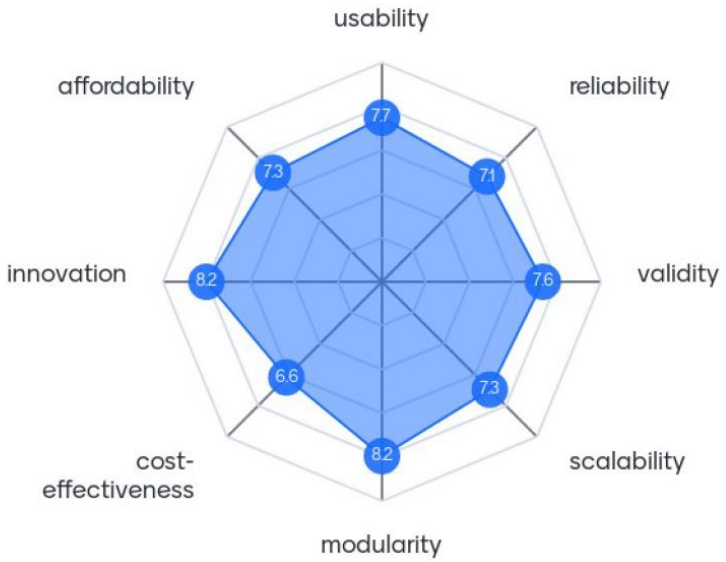


Figure A17: Test-bed Technical Infrastructure as an environment supporting a Trial realisation (FD experience, collected by Mentimeter)

Annex 8 – Detailed result of comparison of evaluation survey results from Trial to Trial (KPIs measurement)

The KPIs (EU added value, usefulness, scalability, modularity, reliability, innovation, affordability, cost-effectiveness, usability and validity) were calculated in the way described in Section 3.4. Figure A18 to Figure A27 present the resulting values of these KPIs measured on the 5-point Likert scale (from -2.0 to 2.0) for all survey's corresponded questions (overall), as well as for each Trial phase.

Please note that for the following graphics the Trials are ordered chronologically instead of numerically, to provide a better visualisation of changes/improvements over the course of the project.

Annex 8.1 EU added value

The overall value of the "EU added value" KPI of the DRIVER+ Test-bed was assessed for each Trial (1 to 4) as positive (Figure A18). The lowest rate (0.27) was measured for Trial 2; the highest rate (0.77) was measured for Trial 4. The separate analysis of this KPI for Preparation phase shows that: for Trial 1 and Trial 4 it was assessed as positive (0.90, 0.63), for Trial 2 and Trial 3 it was assessed as close to neutral (-0.06, -0.11). The separate analysis of this KPI for Execution phase shows that for all Trials it was assessed as positive with the highest value for Trial 3 (0.99) and the lowest value for Trial 1 and Trial 2 (0.35). The separate analysis of this KPI for Evaluation phase shows that for all Trials it was assessed as positive with the highest value for Trial 3 (1.18) and the lowest value for Trial 1 (0.32).

In general, the Trial Committee members' opinion on the EU added value of the DRIVER+ Test-bed and methodology has been improving within consecutive Trials with the exception of the Preparation phase, which was rated negative by the TC of the second and the last Trial (Trial 3). Moreover, the KPI's value for Execution phase of Trial 2 did not show any progress. These low levels can be explained by the unavailability of the TGM and TGT during Preparation phase of Trial 2 as well as by the complexity of the TGM v2 description, which was made available before Trial 3 in combination with a long time Gap between Workshop "0"/ updated Workshop "0" and respectively Trial 2/Trial 3. The preparation for Trial 1 and Trial 4 started directly during these events, therefore Trial Owners and Trial Committees could be more supported by DRIVER+ methodological team on the face-to-face meetings from the very beginning.

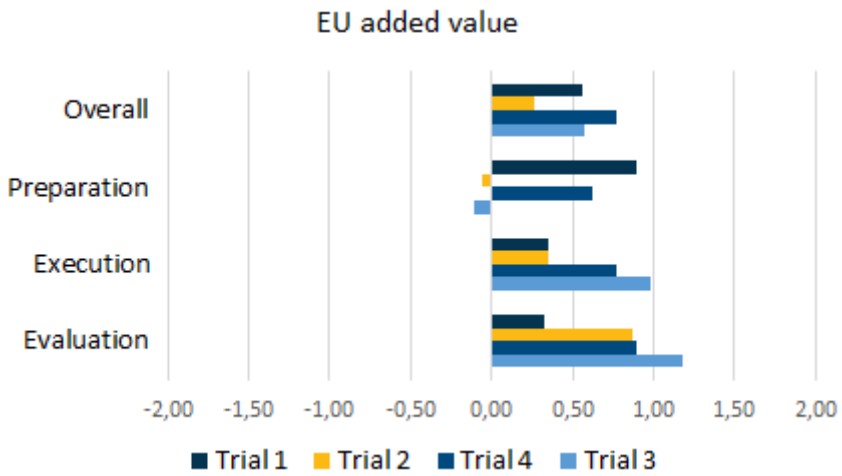


Figure A18: EU added value of the DRIVER+ Test-bed in reference to Trial 1, 2, 3 and 4

Higher results for Execution and Evaluation phases in Trial 4 and Trial 3 suggest broader understanding of respondents for the Trial as concept having a potential to bring EU added value. It surely is also connected to the maturity level of the Test-bed on further stages of the DRIVER+ development.

Moreover, there is a tendency revealed that the respondents realise the EU added value while they execute and evaluate the Trial. It confirms a logical assumption that these phases, in which the results of the Trial

are more tangible and visible (during execution – practical cooperation of practitioners, during evaluation – generation of the outcomes from the Trial), reveal stronger perception of the real EU added value. This observation provides a solid foundation of meaningfulness for the DRIVER+ concept.

Annex 8.2 Usefulness

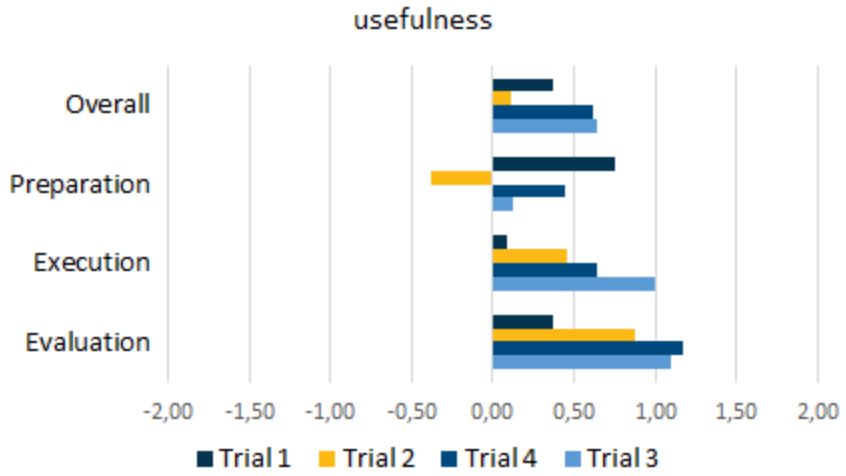


Figure A19: Usefulness of the DRIVER+ Test-bed in reference to Trial 1, 2, 3 and 4

The overall value of the "usefulness" KPI of the DRIVER+ Test-bed was assessed as positive for Trials 1, 3 and 4 and as close to neutral for Trial 2 (Figure A19). The lowest rate (0.12) was measured for Trial 2; the highest rate (0.64) was measured for Trial 3. The separate analysis of this KPI for the Preparation phase shows that: for Trials 1 and Trial 4 it was assessed as positive (0.76 and 0.45 respectively), for Trial 3 it was assessed as close to neutral (0.12), for Trial 2 it was assessed as negative (-0.38). The separate analysis of this KPI for Execution phase shows that for Trials 2, 3 and 4 it was assessed as positive with the highest value for Trial 3 (0.99) and as neutral Trial 1 (0.09). The separate analysis of this KPI for Evaluation phase shows that for all Trials it was assessed as positive or strongly positive with the highest value for Trial 4 (1.17) and the lowest value for Trial 1 (0.37).

Similar to "EU added value" KPI, the "usefulness" didn't show improvement in case of Trial 2 and Trial 4 Preparation phase, which may be explained by unavailability and complexity of TGM at that time.

Except for Trial 1, which was conducted more in realities of the DRIVER+ theoretical concept than real DRIVER+ tools implementation, there is a constant tendency for an increase of the usefulness from preparation to evaluation for all following Trials. The same as in case of the previous criterion the results confirm a logical assumption that the phases in which the results of the Trial are more tangible and visible lead to higher value of perception of the Trial.

Annex 8.3 Scalability

The overall value of the "scalability" KPI of the DRIVER+ Test-bed was assessed for each Trial (1 to 4) as positive (Figure A20). The lowest rate (0.25) was measured for Trial 2; the highest rate (1.16) was measured for Trial 3. The separate analysis of this KPI for Trial phases shows that for the Preparation phase it was evaluated as positive (with the highest score (1.00) of Trial 4), except for Trial 2 with the score -0.50, and for the Execution phase it was assessed as positive for all Trials with the highest value for Trial 3 (1.32) and the lowest value for Trial 1 (0.39). The scalability KPI has not been measured for the Evaluation phase as for this Trial phase the TGM is scalable by definition (the evaluation depends on the collected data).

Overall experience on scalability assessment shows that in Trial 3 it was scored the highest. The reason for this could be the fact that Trial 3 was organised in connection to the UCPM IRONORE full scale exercise as a huge training event. It proved that the DRIVER+ concept could be implemented both for smaller Trials like

e.g. Trial 4 (table-top) as well as for big events like Trial 3 (international full-scale). The highest rate in the scalability criterion for Trial 3 seems to be logical. It was a huge event, generating massive interrelations and workload, and at the end appeared to be feasible using DRIVER+ tools.

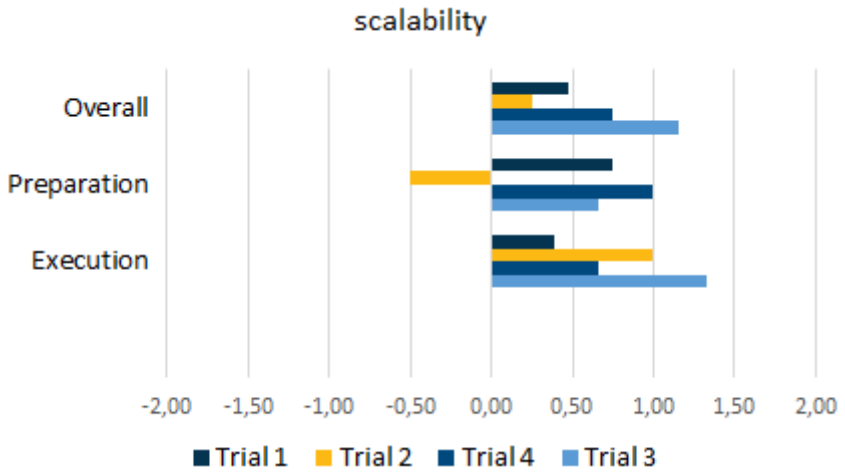


Figure A20: Scalability of the DRIVER+ Test-bed in reference to Trial 1, 2, 3 and 4

Annex 8.4 Modularity

The overall value of the "modularity" KPI of the DRIVER+ Test-bed was assessed for each Trial (1 to 4) as positive (Figure A21). The lowest rate (0.49) was measured for Trial 1; the highest rate (1.02) was measured for Trial 3. The separate analysis of this KPI for Preparation phase shows that: for Trial 1, Trial 4 and Trial 3 it was assessed as positive (0.92, 1.00 and 1.52 respectively), for Trial 2 it was assessed as close to neutral (-0.13). The separate analysis of this KPI for Execution phase shows that: for Trial 3 it was assessed as positive (0.90), for Trial 4 it was assessed as neutral, for Trial 1 it was assessed as negative (-0.44), for Trial 2 the corresponding questions have not been answered (perceived as not adequate). The separate analysis of this KPI for Evaluation phase shows that for all Trials it was assessed as positive with the highest value for Trial 4 (1.43) and the lowest value for Trial 3 (0.57).

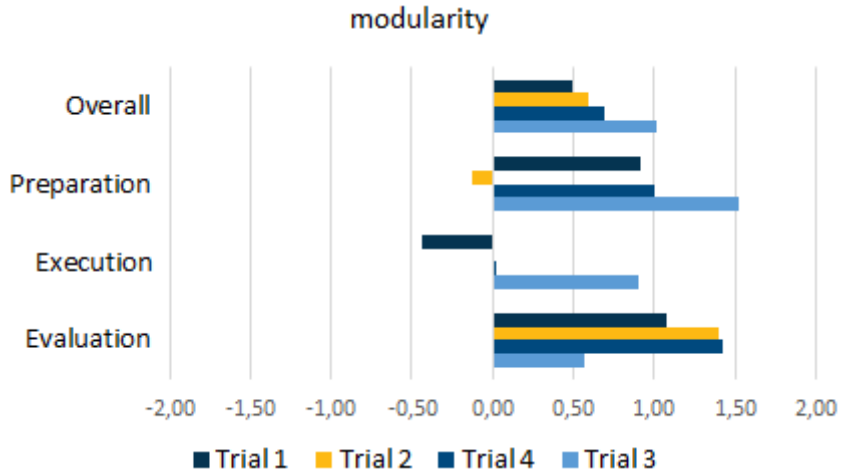


Figure A21: Modularity of the DRIVER+ Test-bed in reference to Trial 1, 2, 3 and 4

The Evaluation phase for each Trial, besides the biggest one (Trial 3), was perceived as the phase which has the highest modularity potential. The reasoning behind these opinions could be that this phase is mainly focused on desk work what naturally brings credits to this phase in comparison to the other two phases engaging much more physical and organisational effort in respect to modularity aspects.

Results for Trial 3 in these analyses differ from the other three Trials. Indeed, it was a different Trial from the others due to the fact it was interconnected with a big international UCPM IRONORE exercise. In this context the highest ratings for modularity criterion in Preparation and Execution phases seem to be logical. For Trial 3 exclusively these phases are rated higher than the Evaluation phase since having the data collected, evaluation was perceived as similar work as for the other, smaller Trials in the end. Moreover, what draws interest is the fact that, considering the overall rating, Trial 3 is validated the highest. It confirms that in general the DRIVER+ environment is indeed prepared to work in modular context e.g. being a part (module) of Crisis Management or civil protection exercise, even at international level.

Annex 8.5 Reliability

The overall value of the "reliability" KPI of the DRIVER+ Test-bed was assessed for each Trial (1 to 4) as positive (Figure A22). The lowest rate (0.29) was measured for Trial 1; the highest rate (0.96) was measured for Trial 3. The separate analysis of this KPI for Preparation phase shows that: for Trial 1, 4 and 3 it was assessed as positive (0.37, 0.35 and 0.63 respectively), for Trial 2 it was assessed as negative (-0.55). The separate analysis of this KPI for the Execution and Evaluation phases shows that for all Trials it was assessed as positive with the highest value for Trial 3 (1.04 and 1.06 respectively) and the lowest value for Trial 1 (0.31 and 0.14).

For all Trials, the Trial Execution phase and Evaluation phase in the reliability criterion are assessed as positive and its value increases from Trial to Trial. It suggests that the Trials were performed in more and more close to Crisis Management reality manner. This observation reinforces the value of the Trials findings with an argument that the Trials were performed in an environment able to generate realistic background for such type of tests and the results of evaluation were reliable.

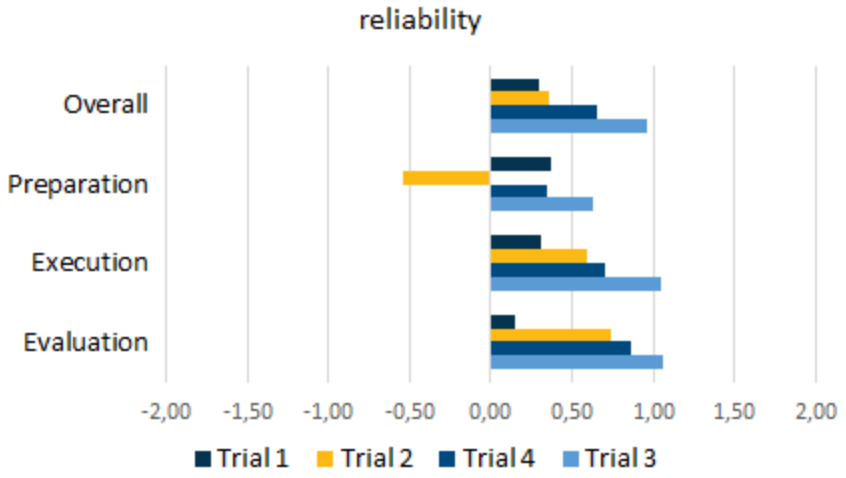


Figure A22: Reliability of the DRIVER+ Test-bed in reference to Trial 1, 2, 3 and 4

Annex 8.6 Innovation

The overall value of the "innovation" KPI of the DRIVER+ Test-bed was assessed for each Trial (1 to 4) as positive (Figure A23). The lowest rate (0.13) was measured for Trial 2; the highest rate (0.84) was measured for Trial 1. The separate analysis of this KPI for the Preparation phase shows that: for Trial 1 and 4 it was assessed as positive (1.12 and 1.00 respectively), for Trial 2 and 3 it was assessed as neutral (-0.03 and -0.01 respectively). The separate analyses of this KPI for Execution phase and Evaluation phase show that for all Trials it was assessed as positive with the highest value for Trial 3 (1.03 and 1.25 respectively) and the lowest value for Trial 1 (0.27 and 0.78).

Innovation criterion is perceived to be the highest for the Evaluation phase since that is the moment when the collected data during a Trial are analysed, synthetized and interpreted in a clear, uniform and

consistent way in order to form particular recommendations. This observation proves the logic of the overall concept of DRIVER+ to generate new knowledge and, through that, having an impact on triggering innovation in Crisis Management.

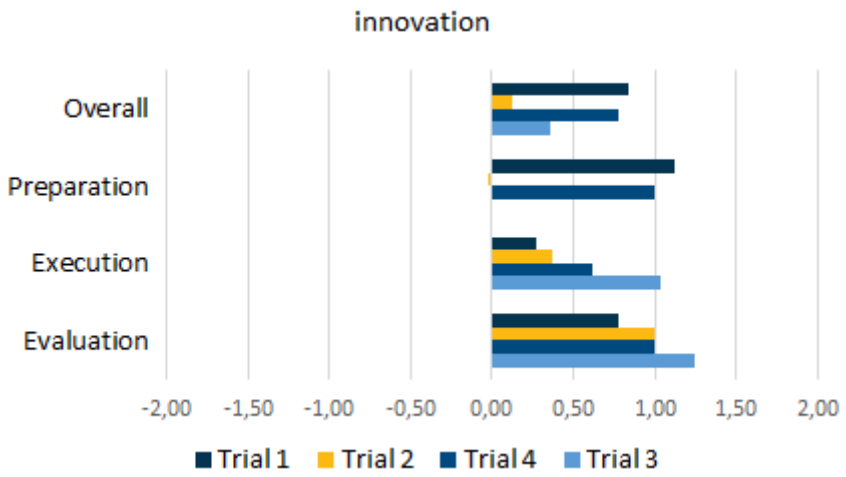


Figure A23: Innovation of the DRIVER+ Test-bed in reference to Trial 1, 2, 3 and 4

Annex 8.7 Affordability

For all Trials (1 to 4) the overall value of the "affordability" KPI of the DRIVER+ Test-bed was assessed as positive (Figure A24). Overall the lowest rate (0.23) was measured for Trial 1; the highest rate (0.64) was measured for Trial 3. The separate analysis of this KPI for the Preparation phase shows that: it was assessed as positive for Trial 1 (0.50), neutral (0.00) for Trial 2 and negative for Trial 3 (-0.50). The Trial Committee of Trial 4 did not assess this criterion. The separate analysis of this KPI for the Execution phase shows that for all Trials it was assessed as positive with the highest value for Trial 3 (1.21) and the lowest value for Trial 1 (0.10).

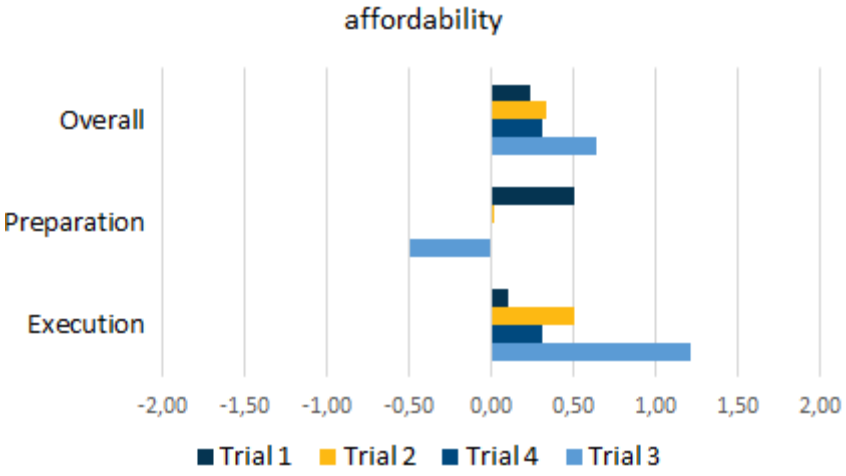


Figure A24: Affordability of the DRIVER+ Test-bed in reference to Trial 1, 2, 3 and 4

Since the DRIVER+ Test-bed is a kind of prototype environment, not commercialized yet, affordability is perceived mostly by the overall effort dedicated to an event organization which is obviously positively correlated with potential financial cost of its usage. The high result could be explained by relation of the DRIVER+ Trial module to the entire massive venture, including UCPM full-scale exercise. Therefore, in this criteria Trial 3 is rated the highest due to the fact that the Trial was combined with big UCPM exercises what could built a biased impression that the effort dedicated to run the Trial was relatively small when perceived by the prism of the joint event as whole.

In general, the affordability has been assessed better for the Execution phase than for the Preparation phase, which may be due to the fact, that the Preparation phase is the most time-consuming phase and hence the costliest phase of a Trial.

Annex 8.8 Cost-effectiveness

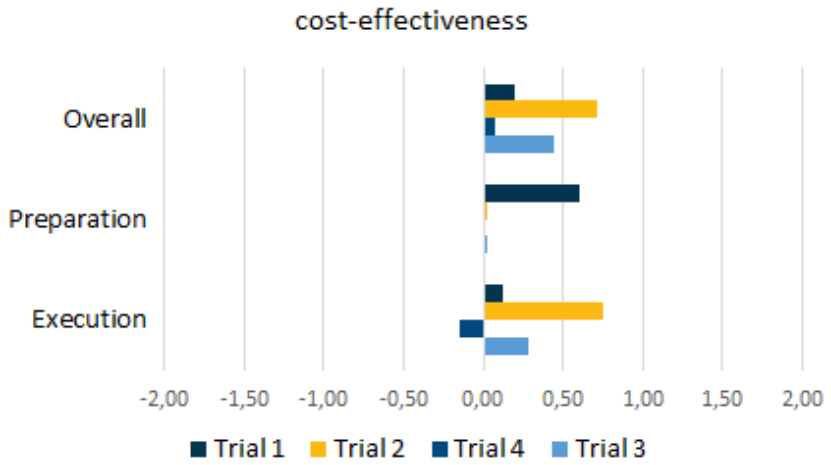


Figure A25: Cost-effectiveness of the DRIVER+ Test-bed in reference to Trial 1, 2, 3 and 4

The overall value of the "cost-effectiveness" KPI of the DRIVER+ Test-bed was assessed for each Trial (1 to 4) as positive (Figure A25). The lowest rate (0.07) was measured for Trial 4; the highest rate (0.71) was measured for Trial 2. The separate analysis of this KPI for the Preparation phase shows that for all Trials it was assessed as neutral (0.00) for Trial 2 and Trial 3, positive for Trial 1 (0.60). The Trial Committee of Trial 4 did not assess this criterion. The separate analysis of this KPI for Execution phase shows that: for Trial 1, 2 and 3 it was assessed as positive (0.12, 0.75 and 0.29 respectively), for Trial 4 it was assessed as neutral/negative (-0.14). The separate analysis of this KPI for Evaluation phase shows that for all Trials it was assessed as positive with the highest value for Trial 4 and Trial 2 (both 1.00) and the lowest value for Trial 1 (0.15).

The Evaluation phase for each Trial was perceived as the one which had the highest cost-effectiveness potential. The reasoning behind these opinions could be that this phase is mainly focused on desk work what naturally brings credits to this phase in comparison to the other two phases engaging much more physical, organizational and because of that economic efforts. Moreover, a strengthening factor in this respect is that the Evaluation phase brings the final results of a Trial what gives additional credits to this particular phase in respect to the cost-effectiveness criterion.

Annex 8.9 Usability

For all Trials (1 to 4) the overall value of the "usability" KPI of the DRIVER+ Test-bed was as positive (Figure A26). The lowest rate (0.14) was measured for Trial 2; the highest rate (0.59) was measured for Trial 3 and Trial 4. The separate analysis of this KPI for Preparation phase shows that: for Trial 1 and 4 it was assessed as positive (0.75 and 0.44 respectively), for Trial 3 as neutral (0.05) and for Trial 2 it was assessed as negative (-0.24). The separate analyses of this KPI for Execution and Evaluation phases show that for all Trials it was assessed as positive with the highest value for Trial 3 (1.02 and 1.12) and the lowest value for Trial 1 (0.18 and 0.14).

Usability criterion of the DRIVER+ Test-bed was analysed as easiness of understanding and implementation in practice. Therefore, the usability perception was influenced by the Trial Owner experience and knowledge about the use of scientific approach to the evaluation of Crisis Management solutions in realistic or semi-realistic environment. There is a constant tendency for an increase of the usability for the Execution and Evaluation phases for all Trials which allows to conclude that from Trial to Trial the Test-bed

was more and more complete, better described and presented to Trial Owners and Trial Committees. The influence of the Trial Owners' subjective perspective to the Test-bed usability is recognised for the Preparation phase, where for Trial 1 it is the highest, for Trial 2 it is even negative and close to neutral for Trial 3. This result may suggest that the usability of the Test-bed environment is strongly "owner" dependent. It seems that Trial Owners with more scientific background and experience in preparation of quasi-experiments have seen the DRIVER+ Test-bed easier to implement. However, it has to be mentioned that Trial 1 was conducted more in realities of the DRIVER+ theoretical concept than real DRIVER+ tools implementation, what probably influenced the higher usability score in the Preparation phase of this Trial than for the other Trials. In addition to that, Trial 2 was the first Trial which used the real DRIVER+ tools implementation based on DRIVER+ products (TGM, TTI).

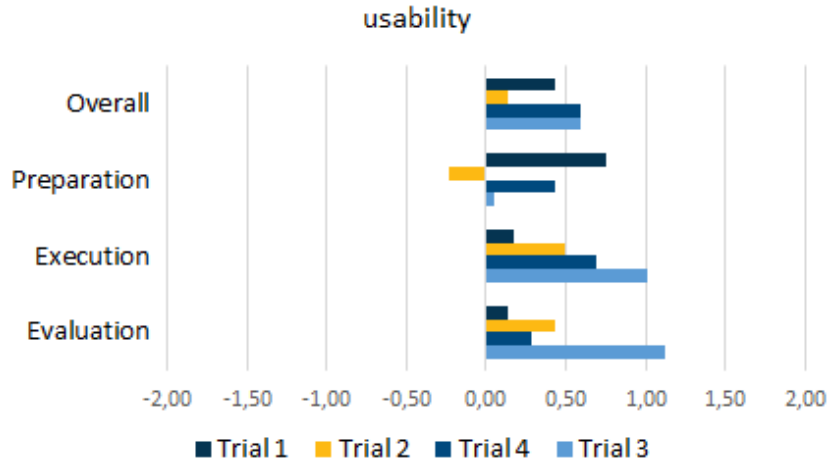


Figure A26: Usability of the DRIVER+ Test-bed in reference to Trial 1, 2, 3 and 4

Annex 8.10 Validity

The overall value of the "validity" KPI of the DRIVER+ Test-bed was assessed for each Trial (1 to 4) as positive (Figure A27). The lowest rate (0.41) was measured for Trial 2; the highest rate (0.97) was measured for Trial 3. The separate analysis of this KPI for Preparation phase shows that: for Trial 1, 3 and 4 it was assessed as positive (0.82, 1.00 and 1.00 respectively), for Trial 2 it was assessed as neutral (0.00). The separate analysis of this KPI for Execution phase shows that for all Trials it was assessed as positive with the highest value for Trial 3 (0.93) and the lowest value for Trial 1 (0.27). The separate analysis of this KPI for Evaluation phase shows that for all Trials it was assessed as positive with the highest value for Trial 4 (2.00) and the lowest value for Trial 1 (0.60).

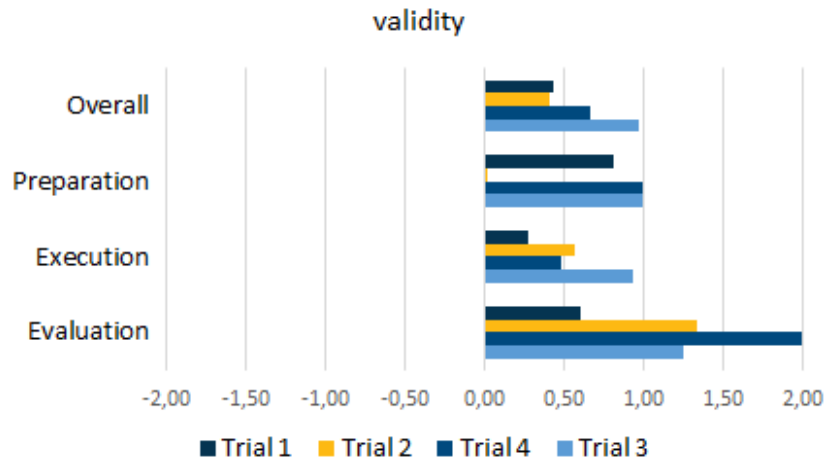


Figure A27: Validity of the DRIVER+ Test-bed in reference to Trial 1, 2, 3 and 4

Naturally, the validity criterion confirms the importance of the Evaluation phase for each Trial. High ratings for this phase prove the value of the outcomes generated in Trials. It also emphasises the aspect of objectivity of the findings, which is the critical feature of the research, so challenging to be achieved in surveys conducted for complex and dynamic sociotechnical systems typical for the Crisis Management environment.

Annex 9 – Final Demo – detailed results of the First Impression Evaluation

Annex 9.1 Episode 1: FIE Session 1

The main Crisis Management task in the first episode refers to the preparation and sharing of the initial briefing documents by the ERCC for the EUCPT. Before the session started, each ERCC and EUCPT Final Demo practitioner was asked to assess his/her experience on preparing and sharing the initial briefing documents by the legacy systems. Those results are depicted by the blue dot on the Figure A28 and Figure A29 (and for sessions 2, 3 and 4 respectively on: Figure A30, Figure A31, Figure A32, Figure A33, Figure A34, Figure A35). The orange dot (in the same figures) represents the same assessment based on the application of the innovative solutions applied in the FD. The arrow between the blue (Baseline) and orange (Innovation Line) represents the perceived changes in the assessments from the legacy to the innovative solutions.

When looking at the initial briefing documents, which were prepared by the practitioners from the ERCC to be further distributed to the EUCPT the following findings were received:

1. **Usability** (see left top of Figure A28): The application of the innovative solutions, here mainly CrisisSuite, the usability has been perceived lower compared to the legacy systems. The following question has been asked to the producers of the information product: “How easy is it to include content in BRIEFING DOCUMENTS?” This effort has increased from 1.6 (out of 10) to 4 (n=3). In turn, the perceived usability of the briefing documents reduced from 6.6 to 3.6 by the EUCPT Final Demo practitioners (n=5). The responders answered the following question: “How easy is it to work with BRIEFING DOCUMENTS (e.g. data analysis)?”. While the ERCC representatives mentioned Microsoft Word as a very easy to use solution, the EUCPT members emphasised the ability to work on printed documents by adding personal notes. Still the legacy systems seem to be not optimal simply because of the amount of information; one respondent also mentioned that the effort to produce the briefing documents also highly depends on the mission. Additionally, the ERCC members noticed that the added value compared to Word is rather low, but the overall perception is also affected by the fact that the innovative solutions still need to be learnt.
2. **Editability** (see right top of Figure A28): The results for the editability show a similar but lower change. The assessment on the required efforts by the ERCC moved from 2 to 2.67 (n=3) by answering the question “How easy is it to edit (e.g. rewriting, changing content) BRIEFING DOCUMENTS?” As main reasons for the worse assessment on the innovative solutions, are the experienced data lost by simultaneous edits and other technical difficulties. The assessment of the benefits by the EUCPT decreased from 4.4 to 2.8 (n=5). The according question was formulated as “How easy is it to edit (e.g. rewriting, changing content) BRIEFING DOCUMENTS?”. The main reason was that the received reports were presented as PDF documents (very low editability) while two responders claimed that the system was not used properly.
3. **Formatting** (see left bottom of Figure A28): The results in this category can be described as an almost zero-sum game at a rather low level. While the ERCC concluded to having spent slightly more effort regarding formatting issues (from 2 to 2.3; n=3), the EUCPT perceived a small increase in the benefits (from 3 to 3.6; n=5). The question to the producers was framed as “How easy is it to format (e.g. changing fonts or size of pictures/graphs, including/excluding pictures, make use of links) BRIEFING DOCUMENTS?”. The ERCC responders mentioned they did not use formatting functionalities of the

innovative solutions a lot in the episode. The respective question to the EUCPT did not cover the formatting results itself, but rather their ability to work with the information product: "How easy is it to adjust the format (e.g. changing size of pictures/graphs, make use of links) of BRIEFING DOCUMENTS?" The EUCPT respondents added that while the formatting functionalities is broad, the quality of pictures and figures is decreasing with the innovative solutions.

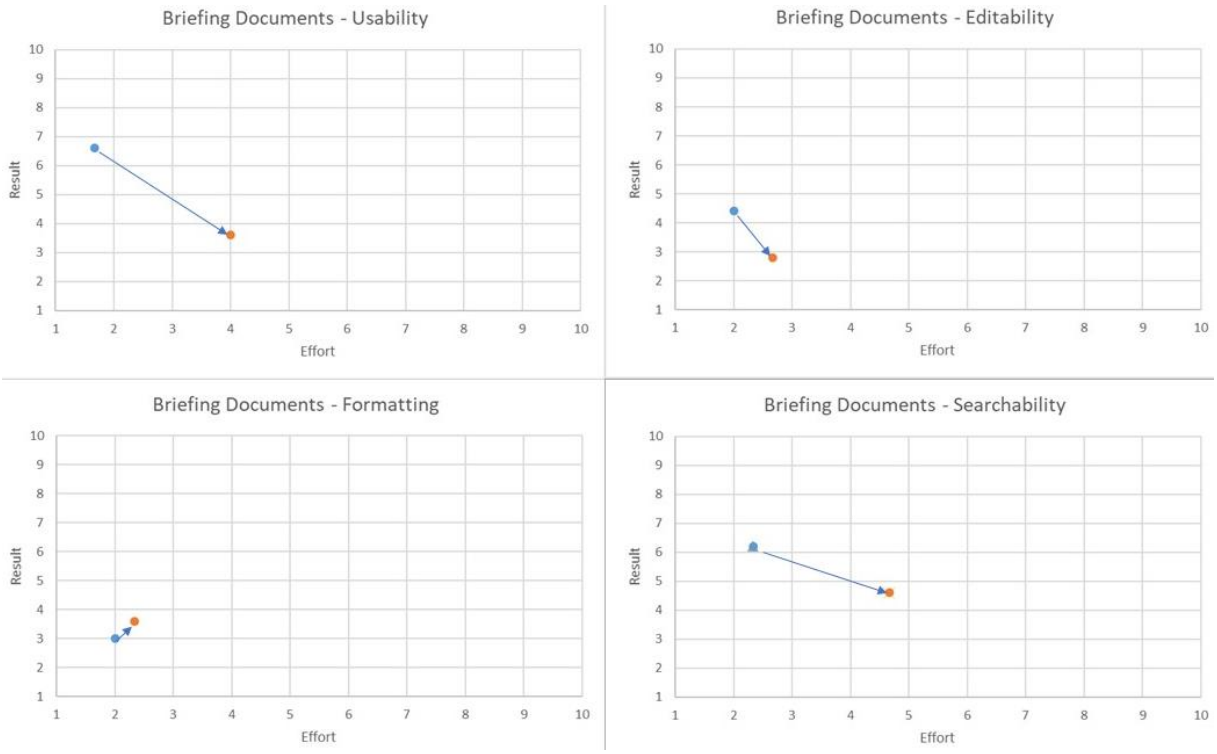


Figure A28: FIE Results Session 1, Part 1

4. **Searchability** (see right bottom of Figure A28): The assessment of the ability to find the right information in an efficient manner shows the same tendency as the first two criteria, usability and editability. The ERCC as a producer of the briefing documents answered the following question: "How easy is it to identify the proper place to include specific data in BRIEFING DOCUMENTS?" The perceived effort increased from 2.3 to 4.6 (n=3). At the same time, the perceived benefit by the EUCPT decreased from 6.2 to 4.6 (n=5). The ERCC explained their assessment with the ease of highlighting key information in Word as well as mentioned an existing template supporting the searchability. The EUCPT stated to be less satisfied with the innovative solutions.

5. **Structure** (see left top of Figure A29): The quality of structure has been assessed lower from 6.8 to 4.6 (n=5) by the recipients of the briefing documents, while the perceived effort by the ERCC using the innovative solution even slightly increased from 1.67 to 2.67 (n=3). In response to the question "How easy is it to follow the structure of BRIEFING DOCUMENTS?" the ERCC highlighted an easy structure, which first need to be understood/learnt. The equivalent question "How easy is it to follow the given structure of BRIEFING DOCUMENTS and to understand information during BRIEFING MEETINGS" showed however, that the EUCPT did not realize and/or make use of the structure of the briefing documents.

6. **Visualisation** (see top right of Figure A29): The innovative solutions had no impact on the perceived effort needed to create visualisations or other analytical means in the briefing documents (no change of the 3.67 baseline with n=3). In addition to the numerical results, the textual replies showcase the variety of used legacy systems. The concrete question was: "How easy is it to create BRIEFING DOCUMENTS and provide information to the EUCPT during BRIEFING MEETINGS with support of the LEGACY TOOLS / NEW SOLUTIONS (e.g. visualising numerical data)?" The responses indicate that several communication tools are used here to communicate mainly about the mandate rather than

discussing data. The feedback on the applied innovative solutions suggests several technical limitations, like dedicated notifications or simultaneous use. This impression is supported by the perception of a lower visualisation quality by the EUCPT, with a decrease from 6.4 to 4.4 (n=5). The question was phrased as following: "How easy is it to digest the content (e.g. make use of the content for your purposes) from BRIEFING DOCUMENTS and BRIEFING MEETINGS?" According to the textual answers, it can be stated that this task is perceived as difficult because of the high amount of operation-specific information which needs to be gained and processed. The applied innovative solutions seem to either not be used or to be perceived as not useful.

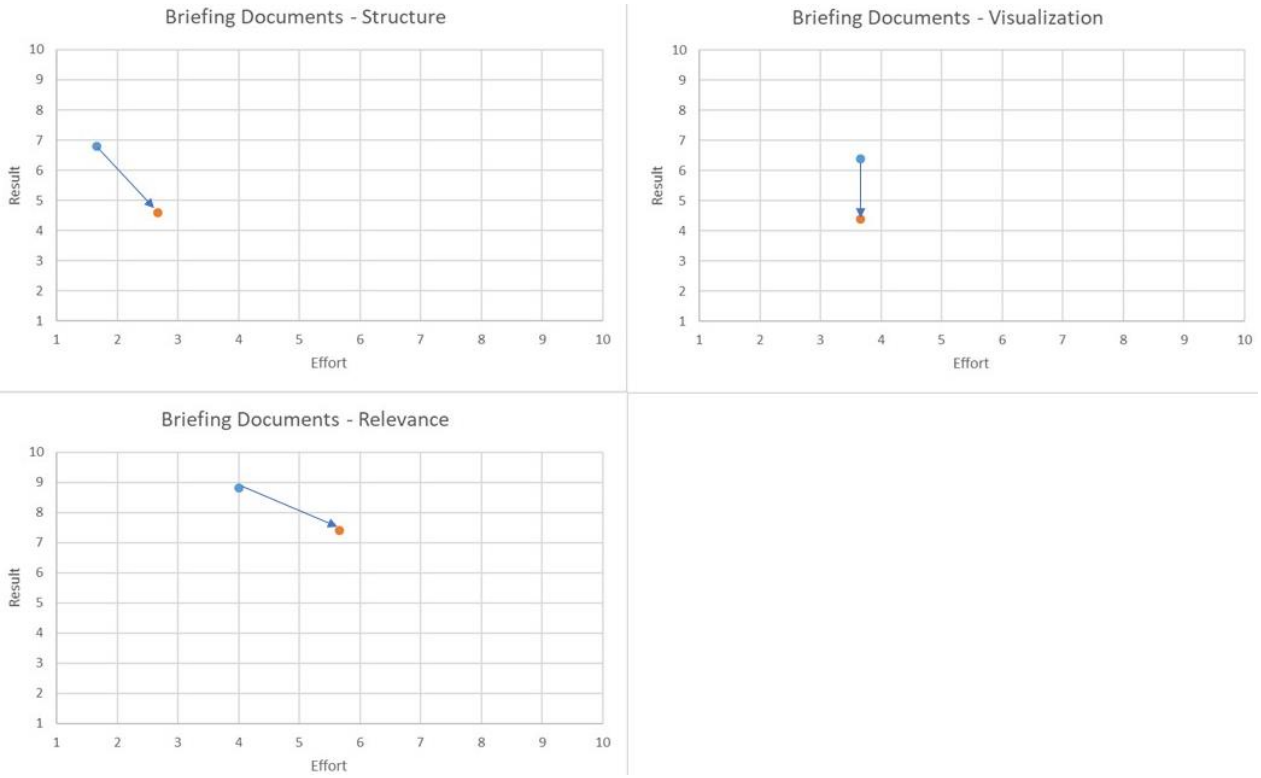


Figure A29: FIE Results Session 1, Part 2

7. **Relevance** (see left bottom of Figure A29): When talking about relevance, the following question has been asked to the providers of the briefing documents: "How easy is it to target the information needs of the recipient using LEGACY TOOLS/NEW SOLUTIONS in BRIEFING DOCUMENTS and during BRIEFING MEETINGS?" The perceived effort increased from 4 to 5.67 (n=3). The ERCC indicated that it is mainly a thorough structure and experience does have an influence on its quality, while a collaborative platform could further increase the situational overview. When using the solution, however, it has been noticed that it would be critical to be able to fundamentally refine the sections, including the addition of new ones (e.g. separate deployments or a logistics section). There was also confusion about the intended use of an additional mobile application, which could support the use of the initially planned web interface only. On the other hand, the EUCPT perceived the relevance of the briefing documents as relatively lower (decrease from 8.8 to 7.4, n=5). It should be noticed that the reference data is quite high already, which might imply that the Trial gap is not fully validated by the EUCPT practitioners in this category. The related question was "How relevant are BRIEFING DOCUMENTS and BRIEFING MEETINGS for your information need?". The mission objectives have been emphasised here as of high importance, while it was also expressed that the given information is all the practitioners do have at hand. While one practitioner mentioned that using a video conference avoided the use of the innovative solution, others mentioned that the provided information was sufficient.

In sum, it can be concluded that in most cases more efforts are required to generate the briefing documents, while its benefits seem to be lower when using the innovative solutions. Main reasons seem to be the strength of the variety and flexibility of the legacy systems (technical, organisational, in

combination), the need to adjust the innovative solution to the needs of ERCC and EUCPT as well as the simple need to familiarise with the solutions.

Annex 9.2 Episode 2: FIE Session 2

The main CM task in the second episode refers to the preparation and sharing of daily situation reports (SitReps) by the EUCPT with the ERCC. In turn, those SitReps are used by the ERCC to figure out the latest up-date of the situation in the disaster-stricken country as well as consider potential options for UCPM measures meeting the newest needs on site. For the assessment the same questions have been applied per each category as in the above section, while only the name of the information product has been changed (from briefing documents to SitRep). The only difference is, that two rounds of SitReps have been simulated: the first SitRep has been written and shared on the first day of the Trial (27/11/2019), while the second SitRep was shared on the second day of the Final demo (28/11/2019). By doing so, it was assumed to receive a better picture of the learning effect as well as to reflect the dynamic element of SitReps having an impact on the amount and change of information. The use of the innovative solutions led to the following perception on the preparation and reception of the SitReps.

1. **Usability** (see top left Figure A30): When looking at the usability it can be observed that only a slightly higher effort is perceived to prepare the SitRep by the EUCPT. While the legacy systems have been rated with 4.2, the first SitRep led to an increase to 4.6 which decreased during the second SitRep back to 4,2 (n=5). The perceived benefit by the ERCC first increased from 8.67 to 9, and then back to 8.67 (n=3), so that in total no change has been perceived. Most EUCPT practitioners valued the ease of use due to the well organised and limited text fields. Even though one ERCC practitioners complained about an ineffective structure and only little described map, while the other replies from ERCC highlighted the ease of use and the good structure.

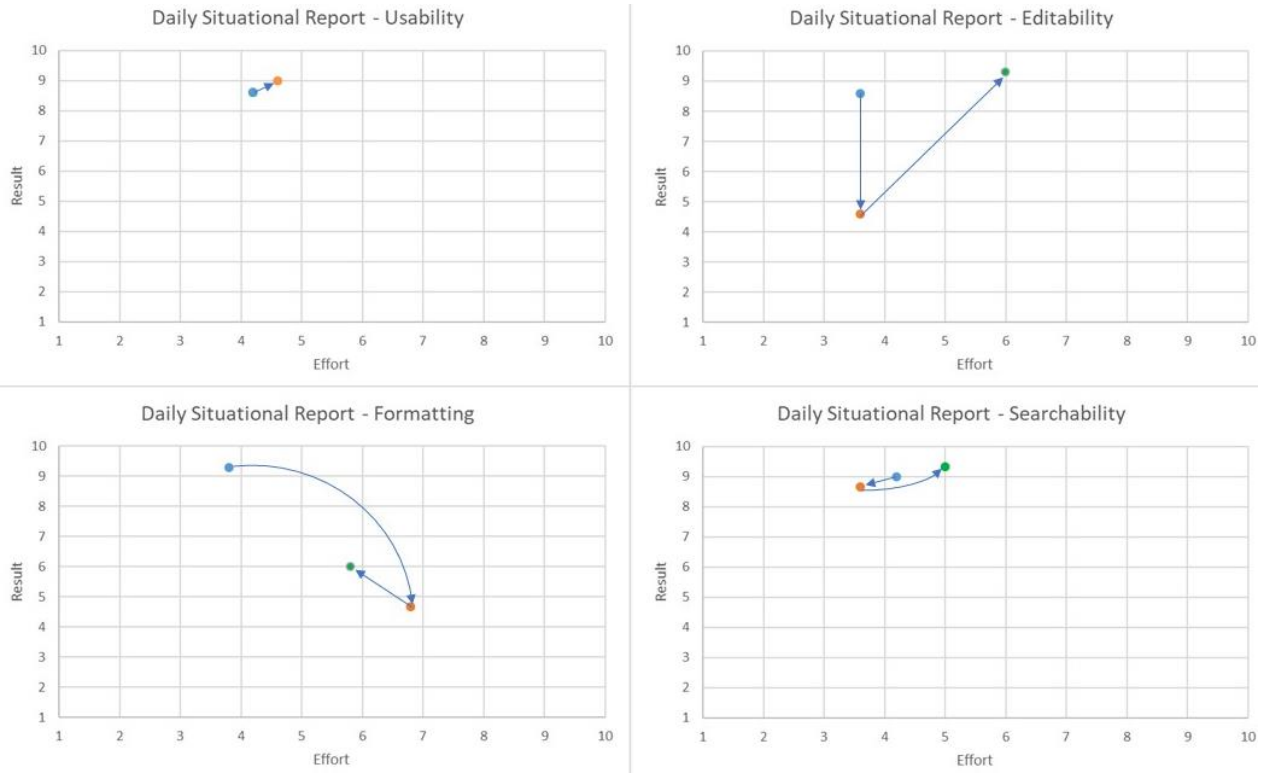


Figure A30: FIE Results Session 2, Part 1

2. **Editability** (see right top Figure A30): The assessment of the editability remained the same when looking at the required efforts for the first SitRep and increased from 3.6 to 6 for the second SitRep (n=5). While the first SitRep was perceived largely less beneficial when compared to the legacy

systems (8.67 to 4.67) it exceeded the initial reference data from 8.67 to 9.3 (n=3). The EUCPT as producer of the SitRep emphasised the easiness of editing ("click on edit and you can make all changes"), even though some answers mentioned an overhead and missing automation. In turn, the ERCC highlighted the helpfulness of copying and pasting different parts of reports. In total, the efforts increased relatively high, while the benefits slightly increased on a very high scale.

3. **Formatting** (see left bottom Figure A30): The results for the formatting show a rather big disadvantage of the innovative solution. While the effort needed SitRep increased from 3.8 to 6.8 in the first and to 5.8 in the second SitRep (n=5), the perceived benefit decreased from 9.3 to 4.6 in the first and to 6 in the second SitRep. This rather negative change can be explained by the many mentions of using Word as legacy solution, which allows several functionalities not available in CrisisSuite and Socrates OC, which both were used to create the SitReps (like missing spelling check or formatting text parts).

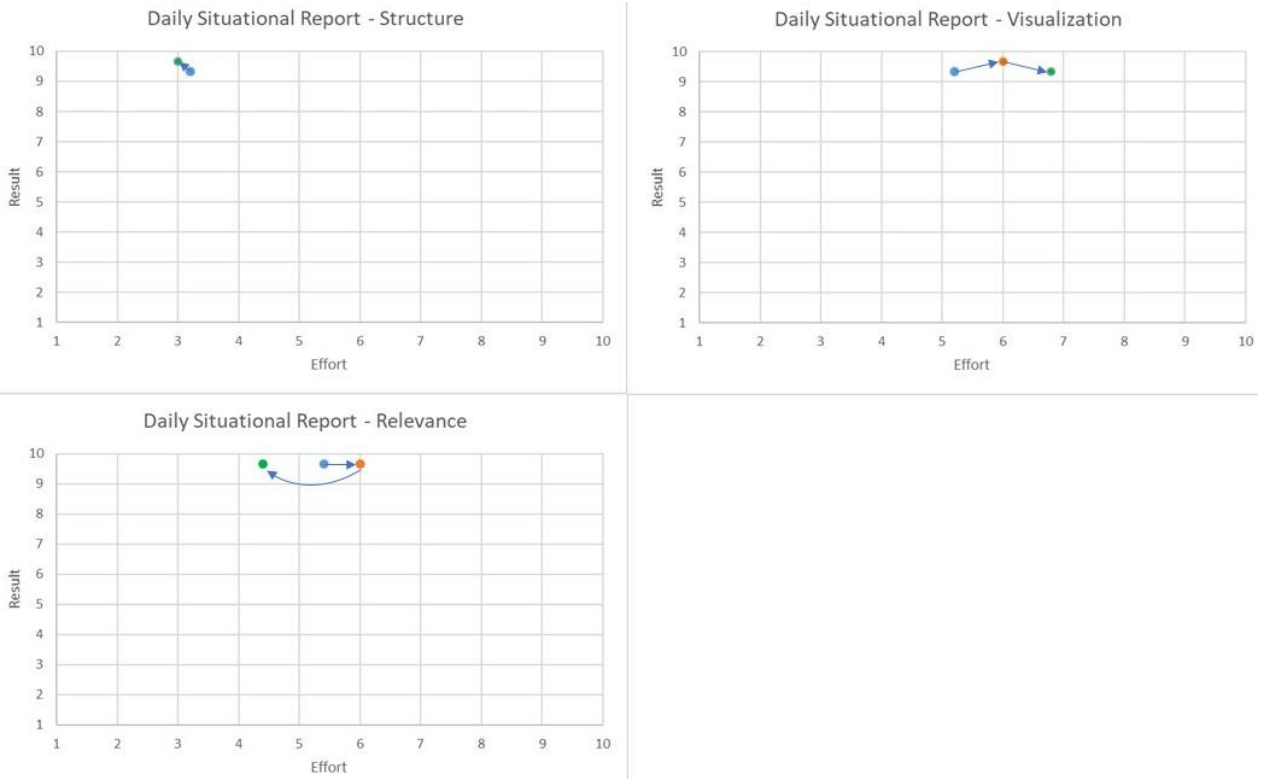


Figure A31: FIE Results Session 2, Part 2

4. **Searchability** (see left bottom Figure A30): The impact on the searchability was relatively low. The perceived efforts decreased first from 3.8 to 4.2 and then increased to 5 for the second SitRep (n=5). The perceived benefits slightly decreased at first from 9 to 8.67 and then increased to 9.3 (n=3). The EUCPT mentioned that the innovative solutions do not change the way of working in this regard dramatically, as the main criteria is seen in the quality of the applied template. The ERCC seems to mainly value the search function, which is the same as in the legacy system (CTRL+F).

5. **Structure** (see left top Figure A31): The changes in the context of structure are marginal for both the producers and the recipients of the SitReps. The perceived effort by the EUCPT changed from 3.2 via 3.2 to 3.0, i.e. it slightly decreased (n=5). The perceived benefits slightly increased from 9.3 via 9.3 to 9.6 (n=3). For both groups the familiarity with the pre-defined structure and the templates were the main reason for the (very) small improvement in both dimensions. It should be stressed that especially the perceived benefits of both the legacy systems and the innovative solution are extremely high.

6. **Visualisation** (see right top Figure A31): When looking at the visualisation a small increase in the perceived efforts can be observed (from 5.2 via 6 to 6.8; n=5). At the same time, only a very small increase of the perceived benefits has been expressed for the first SitRep, while the second one remains on the same level as the reference data (from 9.3 via 9.67 to 9.3; n=3). The practitioners did

not provide much background information to their judgment; the majority mentioned the ease of use. Again, it can be observed that the perceived benefits for both the legacy systems and the innovative solutions are extremely high.

7. **Relevance** (see left bottom Figure A31): The perceived effort in the relevance category shows first an increase from 5.4 to 6, which is followed by a decrease to 4.4 after the second SitRep preparation (n=5). With 9.67, the perceived result remains unchanged between the reference data and the results from both SitReps (n=3). The justifications emphasise the similarity of the legacy system to the innovative solutions as well as the ability for both the ERCC and EUCPT to work on the same documents. However, some EUCPT practitioners mentioned that a further adaptation of the templates could further address the needs of the recipients.

In sum, two main findings can be concluded: 1) It seems that in most categories the SitRep needs from the ERCC are met by the legacy system and the innovative solutions (six out of seven categories are rated above 8); 2) the perceived required efforts in using the innovative solutions seem to allow for learning effect in only two out of seven cases (plus one minor one with a change of 0,2). However, in four out of seven categories the efforts increased significantly. At the same time, in four cases the perceived benefits increased slightly but at a very high level.

Annex 9.3 Episode 3: FIE Session 3

The main CM task in the third episode refers to the preparation and sharing of briefing documents by the EUCPT to the in-coming (innovation line) Modules. While the legacy systems cover many different tools (like emails, Microsoft Office or VOSSOC) and formats (like DOC or PDF files), the applied innovative solution in this episode was Socrates for the EUCPT, while the Modules additionally applied vieWTerra Evolution and DRM.

1. **Usability** (see left top Figure A32): The perceived effort increased from 4.6 to 5 (n=5) with a relatively higher increase of the benefit by the Modules (from 6 to 7.25; n=4). The EUCPT respondents highlight the easy use of the innovative solution, because of the appropriate template in combination with a higher familiarity of the solution itself. The Module practitioners mainly value the virtual workspace and stressed the time saving effect. Thus, the slight increase of efforts corresponds well with the higher increase in the perceived benefits by the Modules. **Editability** (see right top Figure A32): The required efforts in the context of editability decreased from 4.6 to 3.8 (n=5), while the benefit significantly increased from 5.75 to 8.25 (n=4). The improvement for both the perceived efforts and benefits showcase a significant added value provided by the innovative solution. The respondents emphasise the similarity with well-known tools (like Word) and the ability to pause their tasks without losing content.

2. **Formatting** (see left bottom Figure A32): While the effort increased here from 4 to 6 (n=5), the benefits have been perceived relatively higher (from 3.25 to 7; n=4). The perceived increase of the benefits working with the innovative solutions by 4.25 compensates the increase of required efforts by 2. The EUCPT respondents mainly mention the limited ability to format the text. The Module practitioners seemed to be overwhelmed a bit with the high functionalities of vieWTerra Evolution and DRM, but valued highly the easy input functionalities to Socrates.

3. **Searchability** (see right bottom Figure A32): Similar to the category “formatting”, a relatively smaller increase in the efforts (4 to 5.4; n=5) corresponds with an increase of 2.75 (from 4.75 to 7.5). In contrast, the difference in the increase of benefit and efforts is slightly lower than in the formatting category. The EUCPT practitioners mainly mentioned the limited applicability of the template, while the Modules acknowledged the technical support during the episode.

4. **Structure** (see left top Figure A33): The changes for both the required efforts (from 3.6 to 4.6; n=5) and the perceived benefits (from 6.25 to 7.25) are almost the same. The additional efforts are sort of compensated by the additional benefits. The EUCPT members value the appropriateness of the new

solutions in combination with a fitting structure, while the Modules practitioners acknowledge the received training on the solutions first.

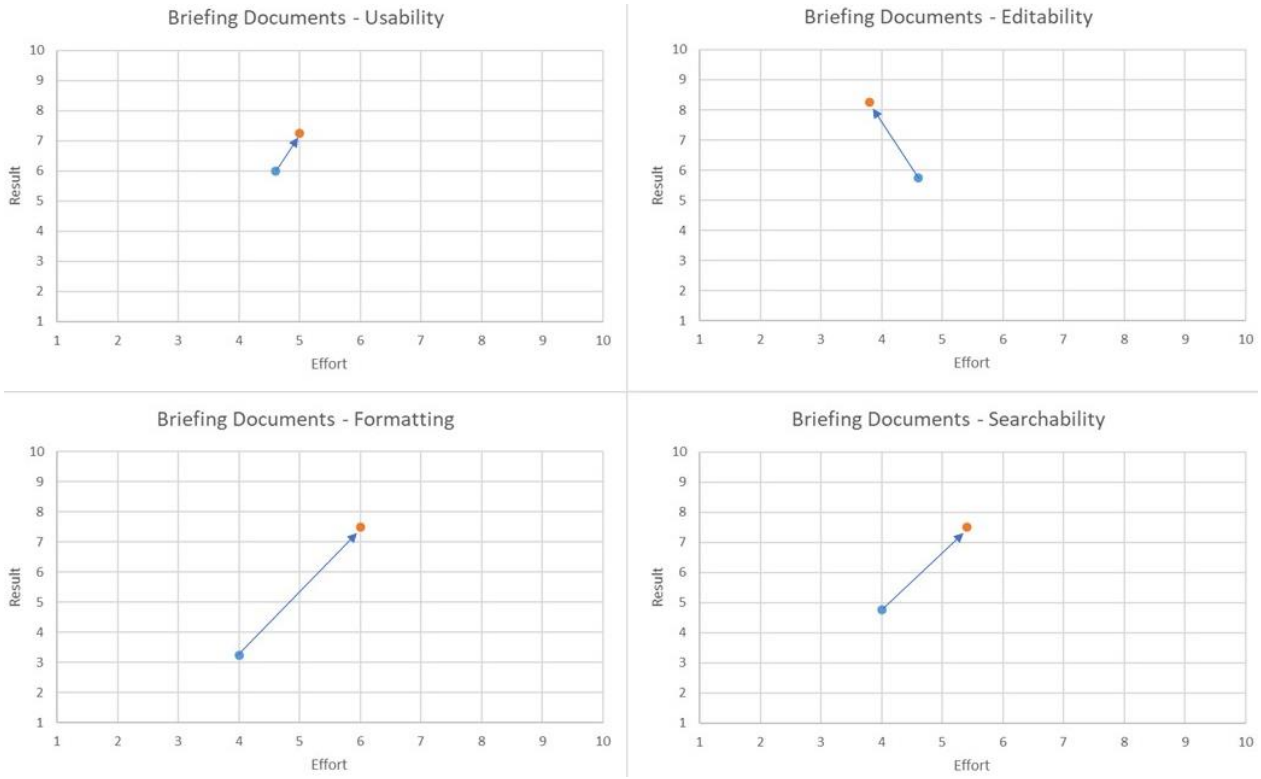


Figure A32: FIE Results Session 3, Part 1

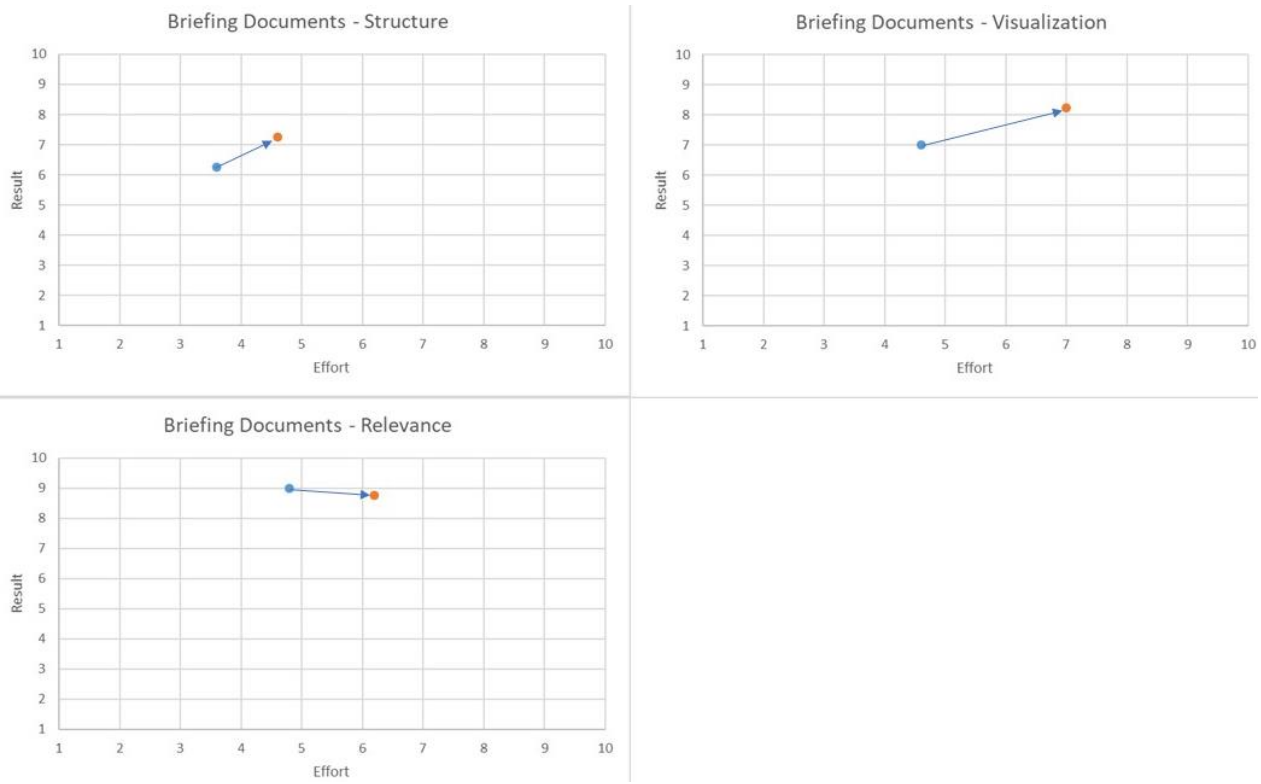


Figure A33: FIE Results Session 3, Part 2

5. **Visualisation** (see top right Figure A33): In this category the EUCPT perceived a higher increase of the efforts (from 4.6 to 7; n=5), than perceived additional benefit by the Modules (from 7 to 8.25). Only

two (out of five) EUPT practitioners commented their assessment and stressed that more practice is needed in order to utilise the visualisation capabilities of the applied solutions. The Modules practitioners did not further justify their slightly increased efforts.

6. **Relevance** (see left bottom Figure A33): The only outlier can be found in the relevance category. Here, the perceived effort by the EUCPT increased from 4.8 to 6.2 (n=5), while the perceived benefits by the Modules decreased slightly from 9 to 8.25 (n=4), which is still a very high rating. However, this category is the only one in the third episode, where both perceived efforts and benefits have (slightly) worsened by using the innovative solutions. While the producers of the briefing documents, the EUCPT, mainly criticise that they would have needed a better training and more practice, the recipients of the briefing documents mentioned that parts of the information were not relevant to the specific Modules' profile. However, other Modules practitioners agreed that the information was fully relevant.

In sum, it can be concluded that the application of the innovative solution did lead – in most cases – to an only slight increase of the required efforts corresponding with a relatively higher increase of the perceived benefits. The category editability stands out here with a positive impact on both the perceived effort and benefit of the innovative solution. A negative outlier can be seen in the last category namely relevance, where a small increase of the efforts led to a slightly lower benefit. Thus, it can be concluded that the applied set of innovative solutions largely improve the perceived benefits the Modules, while the small increase of the required efforts by the EUCPT can be mostly addressed with a better training and practicing of the solutions.

Annex 9.4 Episode 4&5: FIE Session 4

The main CM task in the fourth episode covers the status updates reported by the (innovation line) Modules to the EUCPT. The mainly applied innovative solution by the EUCPT was, as in the third episode, Socrates OC. The Modules, however, were additionally using vieWTerra Evolution and DRM.

1. **Usability** (see left top Figure A34): While the efforts decreased from 2.75 to 2 (n=4), the perceived benefit decreased relatively largely from 7.5 to 5 (n=5). Thus, the quality declines (2.5) and the benefits come along with a relatively lower improvement of the efforts (0.75). The Modules noted that it was beneficial to only insert the data, while its compilation has been supported by the solutions. However, the EUCPT criticised that a possibility to merge the incoming information from the Modules was missing.

2. **Editability** (see right top Figure A34): The application of the innovative solution led to an only marginal change in the perception of efforts and benefits. While the perceived effort decreased from 2.25 to 2 (n=4), the benefit decreased as well from 6.5 (n=6) to 6.4 (n=5). The perceived changes both for the EUCPT and the Modules are quite marginal. While the producers of the status updates, the Modules, emphasise the ease of use, the EUCPT again points to the missing opportunity to merge the updates from different Modules.

3. **Formatting** (see left bottom Figure A34): The formatting criteria received a negative assessment for the application of the innovative solution. The Modules indicated an increase of the required efforts from 2.5 to 3 (n=4). At the same time, the EUCPT assessed the resulted status updates as significantly less beneficial as the rating decreased from 6 (n=6) to 3.4 (n=5). The Modules mentioned that several network issues occurred which slowed them down when working with graphic materials. The EUCPT noted that adjusting the format was not possible.

4. **Searchability** (see right bottom Figure A34): At the same time, the searchability within the status updates seems to provide a bigger benefit. While the perceived efforts by the Modules remained the same with 2.25 (n=4) when compared to the reference data, the corresponding benefits increased from 6 (n=6) to 6.8 (n=5). While the Modules commented that the evolved familiarity with the

solutions fostered an easy use, the EUCPT valued the ability to force the Modules to make use of the templates.

Figure A34: FIE Results Session 4, Part 1

5. **Structure** (see left top Figure A35): The perceived structure of the status update messages has decreased the required effort by the Modules by 1.25 from 3 to 1.75 (n=4). At the same time the perceived benefit increased from 6.5 (n=6) to 7.2 (n=5). The results indicate that the biggest positive impacts by the innovative solutions are related to the ability to follow the structure of the updates. Here, both the EUCPT and the Modules mentioned the pre-defined structure as beneficial, but it was also emphasised that the opportunity to adjust was an added value.

6. **Visualisation** (see right top Figure A35): In the context of the ability to visualise data, the innovative solution had no impact on the perceived efforts, which remained 2.75 (n=4) for the reference data and innovative solution results. However, the perceived benefit reduced from 6.5 (n=6) to 5 (n=5). Thus, it can be stated that the innovative solutions did not improve the required efforts, while the benefits are perceived lower. This is surprising, as one module practitioner mentioned that actually all data to be shared was already in the system, while it still needed to be copied to the status update itself. On the other hand, the EUCPT claimed that the way how data is displayed makes it harder to use the solution.

7. **Relevance** (see left bottom Figure A35): Looking at the last criterion, a decrease of the required efforts to generate the status update messages from 3.75 to 2.5 (n=4) has been identified. At the same time, the perceived benefit decreased from 8.67 (n=6) to 7.2 (n=7,2). Even though the efforts for the Modules decreased, the overall added value needs to be questioned if the price is to decrease the perceived benefits by the EUCPT. Unfortunately, no explanations were given by the EUCPT to justify the lower perception of the benefits. In the contrary, the Modules practitioners emphasised the advantage of having all relevant data already in the system which is used to prepare and send the status update.

In sum, it can be concluded that the added value of the innovative solutions is limited when looking at the information chain from the Modules to the EUCPT. On the one hand, in four out of seven cases the efforts to generate the messages are perceived lower, while only one very slight increase in the context of formatting has been observed. On the other hand, in four out of seven cases the perceived benefit has

been worse and only two small improvements have been found (searchability and structure). Given the comments on the added value of the forced but evolving structure over time, one could assume that these perceptions could be improved in further status updates.

Figure A35: FIE Results Session 4, Part 2

Annex 10 – Public summaries of the Trials and Final Demo

Annex 10.1 Trial 1: Poland

1. Background

From **23 to 25 May 2018**, the first Trial organised as part of the DRIVER+ project (Trial 1) took place in Warsaw, Poland, at the Main School of Fire Service (SGSP) and at the SGSP training ground located 30 km away from Warsaw. This event involved more than 150 firefighters from 12 European countries, and 24 other practitioners from 13 countries. The **general purpose** of Trial 1 was to improve cross-border communication, coordination and resource management between different organisations and agencies from different countries, in large scale and complex (multi-event) crises resulting of cascading effects.

The Main School of Fire Service (SGSP), Warsaw, Poland

2. Context

This section presents the practitioners' needs (gaps) which the selected solutions aimed to address, the research questions guiding the Trial overall process, as well as the scenario on which the Trial realisation is based.

2.1 Crisis Management capability gaps

In DRIVER+, a capability gap is understood to be "the difference between a current capability and the capability considered necessary for the adequate performance of one or more disaster management tasks."[4] The list of Crisis Management capability gaps proposed by Trial 1 practitioners is presented below.

- Limitations in the ability to model real-time (response phase) or pre-event (preparedness phase) dynamics of the chemical and radiological threat and visualisation of obtained results in a form that can be used directly by the Head of the Rescue Operations.

[4] ECORYS and TNO for European Commission DG HOME. First Responders - Identifying capability gaps and corresponding technology requirements in the EU. January 2016.

- Lack of a Common Operational Picture (COP) environment to integrate data sources and calculation results from different models crucial for decision making process from the perspective of Head of Rescue Operation.
- Limitations in the cross vulnerabilities (people, property, environment) assessment to optimize task prioritisation and decision making.
- Insufficiencies in terms of resource management (human resources, hardware, etc.) during multi-stakeholder long-term rescue operations.
- Lack of effective public warning system with the ability to verify whether the information reached the recipient.

All these gaps have been discussed and validated during the DRIVER+ gaps assessment workshop[5] in January 2018 and subsequently prioritized by the Trial 1 Committee.

2.2 Main Research Questions

The main research questions driving the Trial 1 process are the following.

I. How can visualisation of a chemical threat dynamics support communication and information exchange?
II. How can an integrated COP support decision-making processes at tactical and operational level?
III. How can models of chemical threat dynamics support taking decisions sooner, faster and better?
IV. How can models of cascading effects support taking decisions that minimise the impact on people, infrastructure and environment?
V. How can cross-border resource management be supported through socio-technical solutions during multi-stakeholder long-term rescue operations?
VI. How can information on needed and available resources of multiple stakeholders be shared to increase the operational performance?

2.3 Scenario outline

The scenario of the Trial 1 includes a massive release of liquid toxic substances as a result of maintenance failure in a reservoir collecting chemical wastes. A valve failure causes that pumps pumping chemical waste liquid to the reservoir cannot be switched off. Due to this, there is a rapid inflow of a significant amount of a liquid, mud-like toxic chemical to the retention reservoir. Dikes of the reservoir are weakened after prolonged rainfall during past few days and under the influence of pressure the reservoir, the dikes break. The affected land includes a river that crosses the border between the two neighbouring countries Landpol and Manyger.

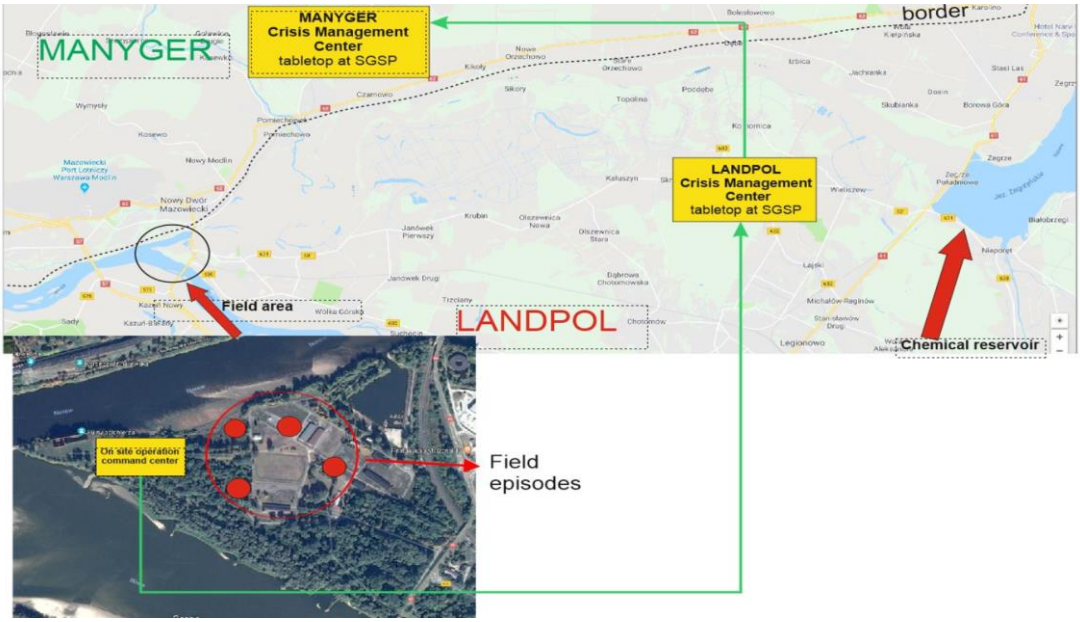
The scenario is based on the disasters which took place in Romania in 2000 (Baia Mare cyanide spill) and in Hungary in 2010 (Ajka alumina sludge spill).

Trial 1 was realized as a table-top and field Trial. The table-top part was conducted at SGSP, while the field part was conducted at the SGSP training ground outside Warsaw.

Trial 1 was divided in five sessions. **Sessions 1 and 2** focussed on shortening decision-making time, and improvement of situational reports' quality; **session 3** on improving the decision-making process during the response; **session 4** was dedicated to trial a Common Operational Picture software solution, in particular to

[5] DRIVER+ Project. D922.11 List of CM gaps. March 2018 (https://www.driver-project.eu/wp-content/uploads/2018/08/DRIVERPLUS_D922.11_List-of-CM-gaps.pdf)

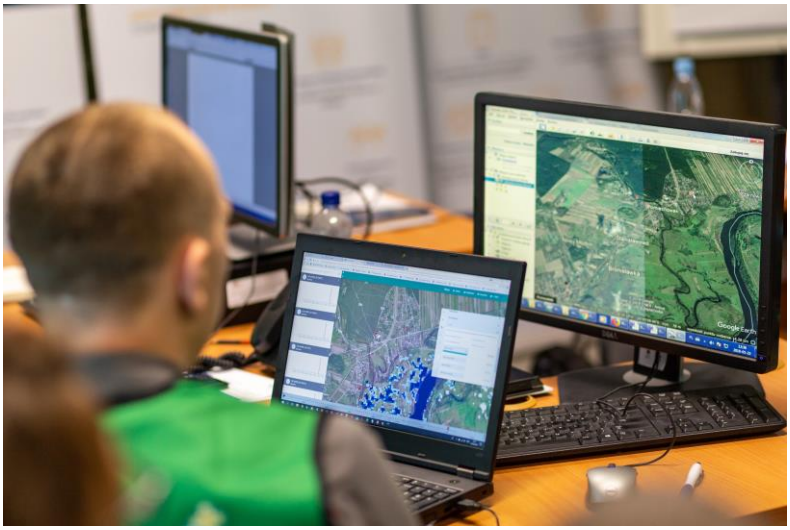
improve the quality of Requests for Assistance; and **session 5** focussed on improving the decision-making time and decision quality related to conducting damage and needs.



The conceptual set up of Trial 1

3. Solutions

After passing the Call for Application and the selection process, the Dry Run 1 and Dry Run 2, the following three solutions were implemented in Trial 1. Two of them (3Di and Drone Rapid Mapping), were provided by non-DRIVER+ partner companies while the third one (Socrates OC) was from a DRIVER+ partner.



3Di

3Di (provided by Nelen and Schuurmans, the Netherlands) enables flood forecasting on the basis of a detailed model. The model is able to predict flooding locations, water depths, and water arrival times, among others. The results can easily be analysed and processed via a ready-to-use plugin in open GIS software tool QGIS. 3Di is a fast, accurate and interactive modelling suite, in which users can easily adapt the model during runs. For example, users can open breaches, or add portable levees to investigate the effects of implementing possible mitigation measures for flood scenarios. The Crisis Management functions addressed for Trial 1 were: mitigation of effects through identification of vulnerabilities, raise awareness

and anticipate supporting decision makers with protection and response measures, Communication between stakeholders for shared situational awareness, and support C3 decision-making.

SOCRATES OC (provided by GMV, Spain) enables the exchange and sharing of the information (expandable and customizable) among SOCRATES nodes and with other external systems enabling the reporting and tracking of events and inter-organisational tasking (mission assignment) and resource management (request, offer and transfer of resources). The information is displayed on a Common Operational Picture (COP). The Crisis Management functions addressed for Trial 1 were: conduct coordinated tasking and resource management, maintain shared situational awareness, and support C3 decision-making.

SOCRATES OC

Drone Rapid Mapping (provided by Hexagon Safety & Infrastructure, Poland) enables rapid mapping of incident/crisis area. The solution enables very fast generation of orthophoto maps based on imagery acquired by any drone (RPAS) available to rescue or Crisis Management actors. The additional product is a 3D terrain model, enabling better and more intuitive understanding of the area of interest. Rapid generation of maps is enabled by cloud computing. A drone operator is expected to conduct a flight over the area of interest and acquire imagery (using standard on-board camera) in line with the standard operational procedures. Data is uploaded into cloud and automatically processed. The resulting orthophoto map is available within the dedicated geoportal that can also provide access to other maps (satellite, topographic, etc.). The 3D model can be viewed in any standard program (3D viewer). The Crisis Management functions addressed for Trial 1 were: assess damage and needs, provide and maintain shared situational awareness, and provide information to media, decision makers and the general public.

Drone Rapid Mapping

4. Results

The results are structured along three dimensions: the Trial dimension, the solution dimension and the Crisis Management dimension. The **Trial dimension** relates to the Trial organisation: everything that has to

do with the Trial run in a very "hands-on" manner is part of this dimension. The **solution dimension** tackles all functionalities as well as the usability of each solution that is trialled. The most important dimension is the **Crisis Management dimension**, because this is looking at the potential impact a solution has on the selected CM gaps.

4.1 Trial Dimension

There were no critical weaknesses regarding the Trial execution. However, there are some elements which could have been done better like the organization of the various sessions and the number of practitioners for these sessions. The respondents confirmed that data collection on the solution was carried out in a sufficient way to evaluate the specific functionalities of the solution. Furthermore, observation indicates that a high impact on the quality of the reports prepared by the teams is highly influenced by the team's configuration including the team's knowledge, experience, spirit, etc. It is therefore suggested to use the same teams twice in order to generate and collect data both for the baseline and the innovation line. The proposed approach has the risk of another bias, which is the lesson learned effect from the first to the second run (e.g. from the baseline to the innovation line run), which will naturally lead to better results in the second run. However, it seems that biases connected with the broadly understood human differences in a team (in knowledge, skills and competences) create more severe disturbances than these resulting from the lesson learned effect.

4.2 Solutions Dimension

The objective of this evaluation in the solution dimension is, for each innovative solution, to provide a detailed answer to the question "Does the selected solution fulfil the expected functions during the Trial?"

In order to focus strictly on the gaps selected for Trial 1, not all of the solutions' functionalities were evaluated. The general feedback from the practitioners was that the solutions provided the trialled functionalities, and were rated as innovative having a serious potential to improve Crisis Management activities. There were no negative opinions of the practitioners on the trialled solutions. This was based both on their experiences from the solution training and using the solution during the Trial execution. However, on the following elements of the solutions the practitioners had a neutral opinion:

- Reduces workload.
- Is necessary to complete the given task.
- Is better than solutions currently used (baseline).
- Would be used by them again.
- Is easy to set-up/initialise.
- The solution is absolutely necessary.
- The solution does everything I expected it to do.
- The use of COP supports decision making at an operational level.
- Learning how to use the solution is easy.

These results may suggest a need for further improving the interfaces of some solutions and/or additional training.

4.3 Crisis Management Dimension

Comparing the accomplishment of the tasks between baseline and innovation line after each run, gives an indication about the potential value of each new socio-technical solution. It was illustrated that the trialled Common Operational Picture solution (Socrates OC) has the potential to **improve communication through an increase of the quality of situational reports and as well the Request for Assistance.** Although the increase of quality of these documents is not related to all established criteria, the Trial showed that some criteria, such as reproducibility, were positively affected by the solution. Increasing this kind of feature in

the operational documents leads to more effective horizontal (cross-border, cross-sector) and vertical (between hierarchical levels) communication during Crisis Management. This finding was confirmed in the opinions of the practitioners and the observers.

The **quality of communication during decision-making** can be improved by a dynamic modelling solution (3Di) and a visualization solution (Drone Rapid Mapping/DRM). 3Di showed to be a potential "game changer" in decision-making processes by limiting the number of information taken into account and prioritizing the information related to the time available for implementing response measures. It leads to shortening the decision time and through this supporting the coordination and resource management. DRM showed it can potentially shorten the time for **damage and needs aerial assessment** and through that accelerating coordination and resource management processes. Both solutions were positively assessed in the practitioners' and the observers' opinions.

5. Answers to the research questions

I. How can visualisation of a chemical threat dynamics support communication and information exchange?

Visualization of the chemical threat dynamics supports communication and information exchange with shortening decision-making time as well as making the decision easier through taking less number of factors into consideration (which are dominated by time oriented factors). It could lead to higher quality of the decision since the decision makers could more consciously manage the available time for the evacuation operation. Furthermore, it allowed formulating more operationally oriented decisions, with time frames for the operational task, which could be easier implemented in the field by first responders and lower level crisis managers. The increased quality of the decision improves the communication and information exchange in the crisis team as well.

II. How can an integrated COP support decision-making processes at tactical and operational level?

An integrated COP supports the decision-making process at tactical and operational level by improving situation reports quality only at the uniqueness criteria. The integrated COP used in the innovation line did not demonstrate its supportive role in shortening decision-making time at tactical and operational level; the average decision-making time achieved in the baseline is two times shorter than the time achieved in the innovation line. It reduces communication barriers, simplifying the decision process and information exchange.

Dynamic simulation models of threat development contribute to the COP as one important information input. Working on the models, which are shortening decision making time as well as making the decision easier through taking a smaller number of factors into consideration, bring a support to the decision making process at tactical and operational level. It could lead to higher quality of the decision since the decision makers could more consciously manage the available time for the evacuation operation as well as formulate more operationally oriented decisions, including time frames for the operational task that needs to be completed by the first responders in the field and lower level crisis managers. Increased quality of the decision contributes positively to the communication and information exchange in the crisis team as well.

Finally, an integrated COP supports the decision making process at tactical and operational level through providing a positive impact on the quality of a Request for Assistance (reporting about required civil protection assets) and supports the decision making process by reducing communication barriers as well as the simplification of information exchanges.

III. How can models of chemical threat dynamics support taking decisions sooner, faster and better?

The model of threat dynamics gives a positive impact to create and be integrated into a Common Operational Picture and, in this way, supports the decision making process by making decisions sooner, faster and better. Chemical threat dynamics simulations need data input to provide models. The innovation line enables to measure the width of the destroyed embankment with higher accuracy. Such information might be used to calculate the intensity of the outflow. Better accuracy in measurements however, may

need longer time to process the data and provide a 3D model or an orthophoto map. Using this solution might improve decision making by providing more accurate data but has a negative impact on the time until the decision can be made. The Drone Rapid Mapping provides outputs (3D model and 2D orthophoto map) which might serve other kinds of analyses as well (including distance, height or area measurements) by using different simulation tools.

IV. How can models of cascading effects support taking decisions that minimise the impact on people, infrastructure and environment?

The innovation line did not show the innovative potential in shortening the decision-making time which could decrease the risk of cascading effect. The model of threat dynamics gives a positive impact to the modelling of cascading effects and in this way supports taking decisions that minimize the impact on the dimension people, property, infrastructure and environment.

V. How can cross-border resource management be supported through socio-technical solutions during multi-stakeholder long-term rescue operations?

The innovation line implementation can support the cross-border resource management with a cross border shared COP, that enables sharing information about used and available resources of neighbouring the country. Cross-border resource management can be supported through the innovative socio-technical solution by sharing information about the use of resources across different countries and by supporting the process of formulating a Request for Assistance which increases the quality of the document.

Managing the resources of units from different countries, according to their specialization, requires a detailed identification of needs and tasks to be carried out. The innovation line can support this assessment by providing information in the form of a 3D model and orthophoto map of an area of limited accessibility. Identification of the needs of the population (by color-coded sheets) may enable better assessing the needs of the affected population to provide adequate assistance. The solution can partly support cross-border resource management during multi-stakeholder long-term rescue operations by providing 3D map of the affected area. The biggest constraint in this case is the time to provide outputs, especially in case of low data transfer at the area.

The Drone Rapid Mapping solution provides data which might be shown in COP tools as well, providing latest imaginary of affected area in form of orthophoto map.

VI. How can information on needed and available resources of multiple stakeholders be shared to increase the operational performance?

The innovation line with the cross border shared COP reduces communication barriers and simplifies information exchange between stakeholders in order to increase the operational performance. Information shared by the COP solution improves the quality of bottom-up reporting. Through this quality improvement the information about needed and available resources is more accurate, complete, better composed, formatted and easier to be reproduced. Information about needed and available resources of multiple stakeholders shared via a COP increases the operational performance. A shared COP reduces communication barriers and simplifies information exchange.

6. EU policy recommendations

The outcomes of the Trial provide ground to formulate the following recommendations related to EU policies, regulations and mechanisms:

Use of the integrated information systems providing Common Operational Picture may improve pooling and sharing civil protection assets during cross border disaster by better communication (incl. cross-border reporting). This may positively influence host nation support activities of the country affected by a disaster as information about shared resources will be available earlier at different levels of command.

Use of dynamic modelling for flood simulation may result in improved precision of emergency planning (risk management related to floods and to critical infrastructure). It may also improve forecasting of possible impacts in response phase – during the development of actual disaster.

Use of the integrated information systems providing Common Operational Picture between authorities of different levels (vertical configuration) may improve assessment of the operational needs and gaps and facilitate formulation of a more precise Request for Assistance under the Union Civil Protection Mechanism. Such approach increases participation of local and regional level authorities in formulation of the needs.

Capabilities enhancing use of drones, such as orthophotomap generation and 3D modelling, may support operations of the European Emergency Response Capacity assets (modules/teams) which have “searching competence”. Aerial observation and mapping may improve realization of post disaster needs assessment, especially in case of major, wide area disasters.

Annex 10.2 Trial 2: France

1. Background

From **22 to 25 October 2018**, the second Trial organized as part of the DRIVER+ project (Trial 2) took place in Aix-en-Provence, France, at the Entente Pour La Foret Méditerranée (Valabre), a public Civil Protection organisation. This event involved more than 70 persons from 14 countries, among which 16 practitioners from France and Italy, with the purpose of demonstrating how to best support the cooperation and coordination between different organisations and agencies from different countries in a large-scale crisis situation. The **general purpose** of Trial 2 was to improve cooperation and coordination between different organisations and agencies from different countries, using innovative solutions for large scale and complex (multi-event) crises.

Valabre simulation centre in which Trial 2 was hosted

2. Context

This section presents the practitioners' needs (gaps) which the selected solutions aimed to address, the research questions guiding the Trial overall process, as well as the scenario on which the Trial realisation is based.

2.1 Crisis Management capability gaps

In DRIVER+, a capability gap is understood to be "the difference between a current capability and the capability considered necessary for the adequate performance of one or more disaster management tasks."[6] The list of Crisis Management capability gaps proposed by Trial 2 practitioners is presented below.

- Limits in the ability to merge and synthetize disparate data sources and models in real time (historic events, spreading models, tactical situation, critical assets map, etc.) to support incident commander decision making.

[6] ECORYS and TNO for European Commission DG HOME. First Responders - Identifying capability gaps and corresponding technology requirements in the EU. January 2016.

- Shortcomings in the ability to exchange crisis-related information among agencies and organisations (also related to as interoperability).
- Limits in the ability to ensure a common understanding of the information exchanged (terminology, symbology) by all crisis managers involved in the response operations.
- Lack of common doctrines and procedures supporting international cooperation in aerial firefighting.
- Insufficiency in the ability to incorporate accurate and verified information from multiple and non-traditional sources (e.g. crowdsourcing and social media) into response operations.
- Lack of efficient coordination mechanism to overcome the limited capacity to deal with large numbers of severely burned casualties at Member State level.
- Limited ability to identify the location of injured/trapped/deceased casualties in large forest fires.
- Barriers in the capability to provide medical assistance to casualties by either transporting them to a safe place or bringing Emergency Medical Service to the scene (when medical care is not provided by fire-fighters).

All these gaps have been discussed and validated during the DRIVER+ gaps assessment workshop[7] in January 2018 and subsequently prioritized by the Trial 2 Committee.

2.2 Main Research Questions

The main research questions driving the Trial 2 process are the following:

I. How to improve and maintain, in real time, a shared situational awareness by supporting the exchange of crisis-related information among agencies and organisations?
II. How to improve the coordination of fire-fighters' response operations and Emergency Medical Service rescue operations during a large forest fire with casualties?
III. How to transform raw data from social networks into actionable information directly useful to the incident commander?

2.3 Scenario outline

The Trial 2 overall scenario is a large forest fire in the South East of France with cascading effects on:

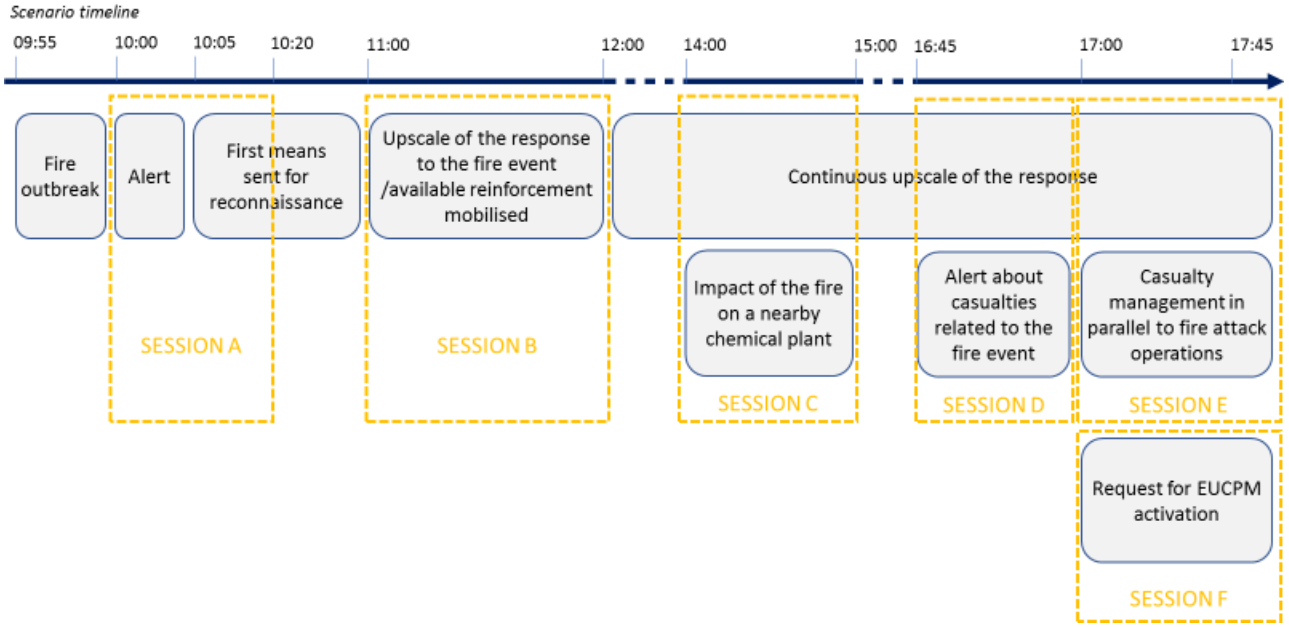
- A chemical infrastructure: the industrial process of a plant is impacted because of power outage related to the forest fire crossing the electric lines supplying the plant.
- Human settlements: a campsite with tourists is threatened by the fire and people disrespect security advices and escape the campsite on foot.

The later element was introduced to consider the CM capability gap on cooperation between fire-fighter and Emergency Medical Services as well as the recent forest fire with casualties in Portugal (2017) and Greece (2018).

[7] DRIVER+ Project. D922.11 List of CM gaps. March 2018 (https://www.driver-project.eu/wp-content/uploads/2018/08/DRIVERPLUS_D922.11_List-of-CM-gaps.pdf)

Trial staff injecting simulated inputs to bring the scenario to life

In Trial 2, the various sessions comprising the Trial shared the same scenario and set up. The difference between the sessions are the time in the storyline where each session occurs, the roles that are active at this specific point in time, and the solutions that are available to the practitioners.



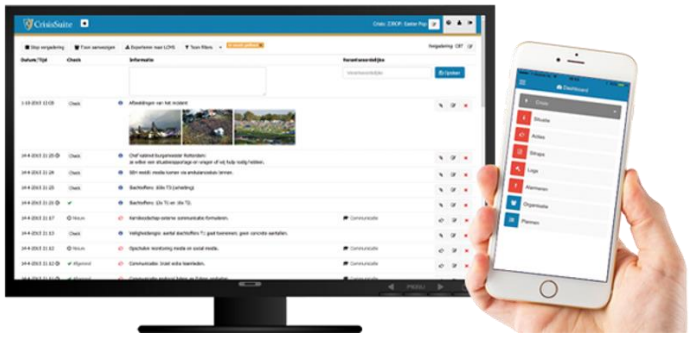
Breakdown of the scenario storyline into sessions

3. Solutions

After passing the Call for Application and the selection process, the Dry Run 1 and Dry Run 2, the following four solutions were implemented in Trial 2. One of them (CrisisSuite), was provided by a non-DRIVER+ partner company while the other three (MDA C2, SMAP, LifeX COP) were from DRIVER+ partners.

CrisisSuite (provided by Merlin, the Netherlands), performing the following main functions:

- Provide a centralized platform for the exchange of formal and informal information.
- Manage the overall tasking of all organisations involved (task definition, progress management).
- Manage the overall crisis day log of all organisations involved.
- Manage SITREP generation based on tasking and day log.



CrisisSuite

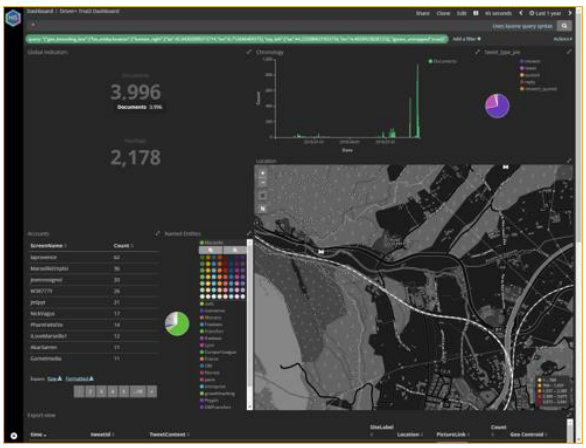
MDA C2 (provided by MDA, Israel), performing the following main **functions**:

- Call taking.
- Dispatching EMS vehicles to take the victims in charge and send them to hospital.
- Route EMS vehicle avoiding danger area(s).
- Report on victims status and victims being sent to hospital.

MDA C2 mobile terminal

SMAP (provided by **Thales** Communication Services, France), performing the following main functions:

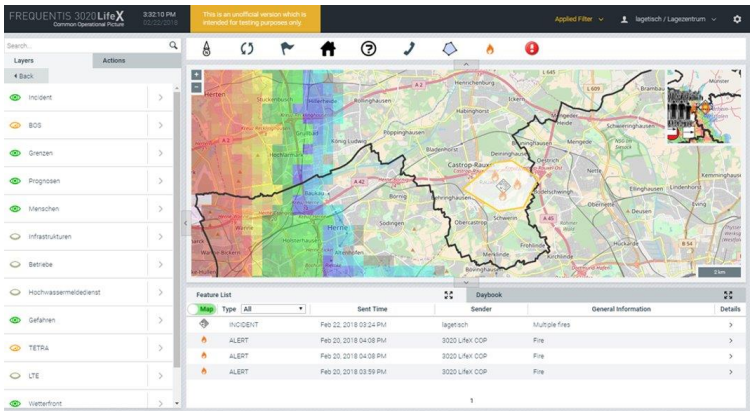
- Collect Twitter data relative to a crisis of interest.
- Filter down collected information to identify tweets of interest.
- Export tweets of interest to a Common Operational Picture (COP).



SMAP dashboard

LifeX COP (provided by Frequentis, Austria), performing the **following** main functions:

- Manage a geographical Common Operational Picture based on reporting of other solutions.
- Define danger zone(s).
- Manage day log.



LIFEXCOP dashboard

4. Results

The results are structured along three dimensions: the Trial dimension, the solution dimension and the Crisis Management dimension. The **Trial dimension** relates to the Trial organisation: everything that has to do with the Trial run in very "hands-on" manner is part of this dimension. The **solution dimension** tackles all functionalities as well as the usability of each solution that is trialled. The most important dimension is the **Crisis Management dimension**, because this is looking at the potential impact a solution has on the selected CM gaps.

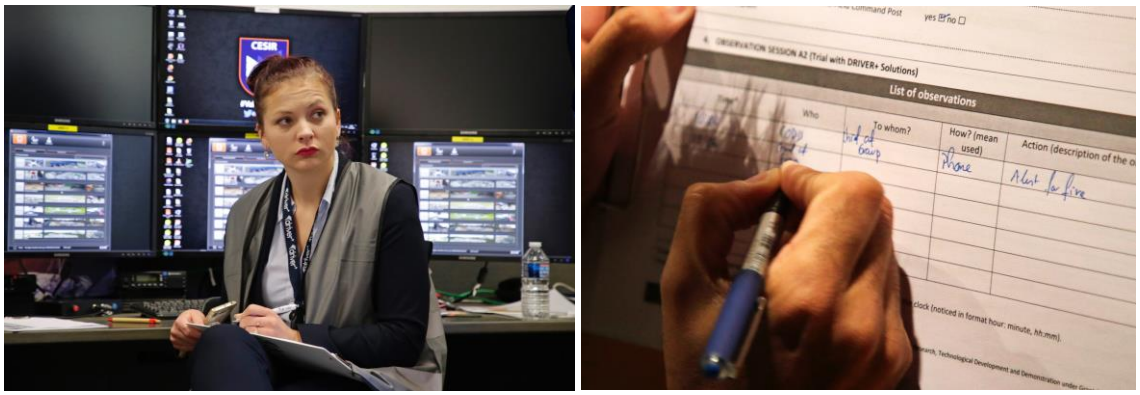
4.1 Trial Dimension

The participants' number, background and commitment supported the Trial adequately. The scenario and the simulated environment were deemed realistic for the practitioners' immersion.

The training of solutions turned out to be a major issue and was considered insufficient by the practitioners and the observers to allow an efficient use of the innovative solutions.

Several time-delays had almost no impact on the execution of the Trial runs but did have a major consequence on the post-Trial data collection. Technical failures also caused the loss of important data, which negatively impacted the quality of the data analysis. It is important to keep in mind though that at the time of Trial 2, the components of the Test-bed Technical Infrastructure that are dedicated to data collection and evaluation, were not yet available.

All participants valued the high quality organisation of the Trial.



Observer taking notes during Trial execution

4.2 Solutions Dimension

The objective of this evaluation in the solution dimension is, for each innovative solution, to provide a detailed answer to the question "Does the selected solution fulfil the expected functions during the Trial?"

In order to focus strictly on the gaps selected for Trial 2, not all of the solutions' functionalities were evaluated. The general feedback from the practitioners was that the solutions provided the trialled functionalities, however they did not consider them highly innovative.

CrisisSuite was easy to use but is, according to the practitioners, more suitable for control rooms (strategic or non-first responders´ organizations) than in field environments.

LifeX COP would require the creation of an information manager role to be effectively used; in addition, the existing information management function should be better explained during the training.

MDA C2 is regarded as a rather complex solution which requires longer training. It is particularly useful at Operational Centre level, especially in the management of even larger events with bigger noria (i.e. chain of ambulances) of Emergency Medical Services vehicles to be dispatched and routed.

SMAP was evaluated by the practitioner as quite easy to learn and use, and its crowd sourcing function was recognized as quite relevant and mature. Nevertheless, SMAP was not considered as bringing much novelty in an operational fire department. The practitioner's opinion is that a solution like SMAP would be more suitable for authorities at the prefect level (i.e. strategic CM level in France).

In addition to each solution individually, the value of the system of systems aspect (i.e. the integration of the solutions) was investigated in the participant's questionnaire. This was deemed particularly important in the Trial as the solutions were all integrated, in the sense of automatic exchange of data to each other. For instance, all the situation reports created in CrisisSuite were displayed on LIFEX COP, all the ambulances managed through MDA were tracked on LIFEX COP, and it was possible to send selected tweets from SMAP to LifeX COP. The scores were all positive or neutral for the five statements:

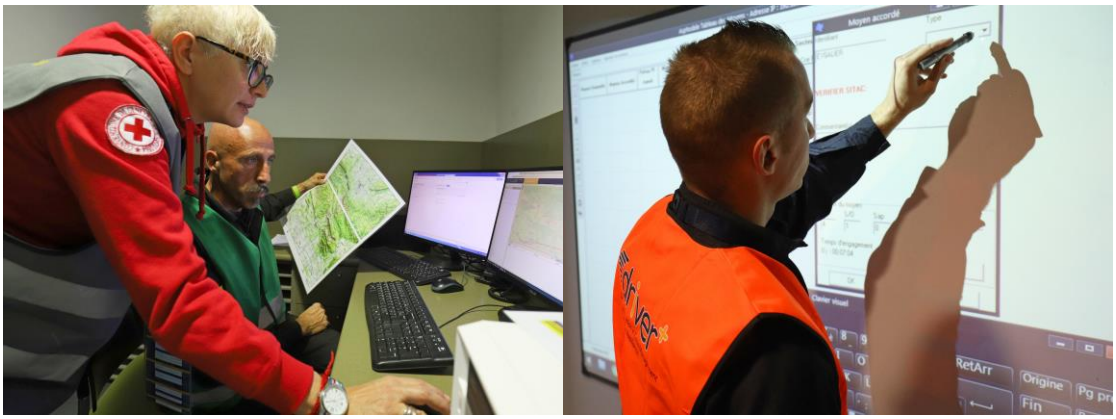
- Less time needed for practitioners in their search for relevant information.
- Less time needed for practitioners to read data from one solution and entering data manually into another solution.
- Lower probability of wrong information caused by human errors while reading/entering data from/into a solution.
- More time to define, communicate, execute and supervise response actions.
- Higher quality of the Crisis Management outcome due to the time savings, better data quality and improvement of communication.

4.3 Crisis Management Dimension

Overall results indicate that the innovative solutions make the data gathering faster and hence shortening the time to dispatch, even though the actions carried out through the innovative solutions are always doubled by radio. **Time saving** is expected to be further improved with more training and with more people available in the advanced medical post as it would be the case in real crises.

Furthermore the **accuracy of the information** seems to be improving due to the new solutions. In particular an unusual event (injured fire-fighter) was better dealt with in the innovative run.

Especially for one of the French organisations involved (DREAL) the innovative solutions were considered really helpful to **organize the information** and share them internally (via CrisisSuite), as well as to have a visualization through the COP. The results show a better structuring of the information shared and an improved **visualisation** of supporting resources.



Practitioners using solutions during Trial execution

5. Answers to the research questions

I. How to improve and maintain, in real time, a shared situational awareness by supporting the exchange of crisis-related information among agencies and organizations?

It was demonstrated in Trial 2 that time-delays, sharing and quality (accuracy) of the information could be effectively improved by some of the trialled solutions.

The sharing of relevant information can be improved by the access to a common logbook and the exchange of SITREPS (CrisisSuite), while visualization of information (in particular other's organizations means) is improved by the use of a COP. However, it is expected that the solutions could be more efficient in this regard by a better structuring and categorization of information in the logbook (and the automatic generation of SITREPS from the logbooks) and if the static and dynamic layers of the COP were not mixed. The trialled solutions nonetheless contribute in enhancing the quality (in terms of accuracy) of the information, especially with regards to the exact localization of means or events.

Time-saving effects have been observed in most of the CM processes of Trial 2. This was particularly clear at the alert step, when it comes to localization of victims. The knowledge of the solution, and practice by the user, plays a key role in time-saving. Therefore, complete training is a prerequisite before evaluating time-saving effects. Also, it is expected that with more hands-on experience on the solutions, users will have more trust in these, and consequently will stop double checking information with traditional means (like radio) which will result in additional time saving.

II. How to improve the coordination of fire-fighters' response operations and EMS rescue operations during a large forest fire with casualties?

A specific focus was made on the cooperation between EMS and fire-fighters organizations. The sharing of a COP between the fire-fighters and the EMS supported a better situation assessment both concerning the crisis dynamics (fire contour visible for the EMS) and the dispatch of means (ambulances visible for the fire-

fighters chain of command). However, it is believed that for such a socio-technical solution to completely pay off, a better understanding of the procedures and the organizational culture appears as a prerequisite. Some limitations are also due to the fact that some practitioners had to take several roles within the Trial, making their participation more complex. The observed improved victims' management (session E) likely came from the fact that a fire-fighter at the Advanced Medical Post and the EMS manager were sitting together and explaining to each other their respective way of working, rather than because the COP was shared. This has been indicated by the practitioners themselves and noted by the observers. This shows how much the role of a liaison officer remains fundamental, even with the integration of innovative solutions.

III. How to transform raw data from social networks into actionable information directly useful to the incident commander?

SMAP facilitates the retrieval of information from Twitter for response operations. This might be different for other social media that could not be included in this Trial. While the solution proved its capability to share the selected information by displaying it in a COP (therefore providing visualization of the messages that are geo-referenced), such information was not considered useful by the incident commander and, in consequence, the gap between the retrieval of information and its actual use in the operations was not closed. Here, a cultural resistance might also come at play, as the involved practitioner did not share the interest of having such information during the operations and suggested that such a solution would be more suitable for authorities at the prefect level, meaning at a distance from the operations. Therefore, before integrating that type of solutions into operational procedures, preparatory work is deemed necessary to discuss with the practitioners the added value that this type of information could bring into operations management. The solution looks promising, but it has to be trialled more extensively before drawing firm conclusions.

6. Conclusions and EU policy recommendations

The work carried out in Trial 2 has highlighted some shortages that were not identified at the beginning of this activity which are deemed important and could therefore be developed in terms of policy recommendation. This Trial has demonstrated the difficulty to evaluate crises in the forest-fire domain, because there is no pre-existing set of criteria or evaluation method. Furthermore, there is no diagnosis of the current situation against which to assess progress or at least evolution.

In Europe, a tool to evaluate interoperability and inter-organisation cooperation is lacking. In the US, the Department of Homeland Security, following the 9/11 attacks, has developed the Interoperability Continuum tool to assess the performance of cross-agencies interoperability. This tool focuses on communication aspects and provides an interesting approach to assess the overall dynamics of interoperability (governance, SOPs, technologies, training and exercises, usage) among different agencies, like law enforcement, fire-fighters, and Emergency Medical Services). It is believed that a similar assessment tool to evaluate inter-operability at the European level would be highly beneficial. It would enable the diagnosis of the current situation and thus the evaluation of the benefit of the development of the European civil protection policy. This relates in particular to RescEU, which considers assets for fighting forest fires (especially Aerial forest fire-fighting Modules) as the key resources of the RescEU pool managed by the Emergency Response Coordination Centre (ERCC).

Annex 10.3 Trial 3: Austria

1. Background

From **12 to 14 September 2019**, the third Trial organized as part of the DRIVER+ project (Trial 3) took place in Eisenerz, Austria. It was organised by the Austrian Institute of Technology and hosted by the Austrian Red Cross in the Community Centre of Eisenerz/Münichtal. This event involved more than 100 persons from 8 countries, including Trial staff, commanders from the different branches of the Austrian Red Cross, national/international observers, and volunteering students from the nearby Business School (Bundes Handelsakademie, Eisenerz).

Community centre in Münichtal/Eisenerz in which Trial 3 was hosted

The Trial was conducted as a multi-day combined table-top and field Trial run in parallel to the large-scale European Civil Protection field exercise IRONORE2019, that involved around 1,000 participants and numerous emergency vehicles and ambulances. IRONORE participants came from the Red Cross of Styria, Bavaria and Hungary, Fire Service, Police, Government Styria, Austrian Army, Mountain rescue and cave rescue organisations.

The cooperation between DRIVER+ and IRONORE, and the participating national emergency organisations allowed to share the exercise area as well as various resources (e.g. volunteers, cars, commanders) and contributed to a shared understanding in disaster and Crisis Management. The **general purpose** of both, IRONORE and the DRIVER+ Trial 3 was to strengthen the preparedness and response to an earthquake disaster within Austria in an alpine region.

2. Context

This section presents the practitioners' needs (gaps) which the selected solutions aimed to address, the research questions guiding the Trial overall process, as well as the scenario on which the Trial realisation is based.

2.1 Crisis Management Gaps

In DRIVER+, a capability gap is understood to be "the difference between a current capability and the capability considered necessary for the adequate performance of one or more disaster management tasks."[8] The list of Crisis Management capability gaps proposed by Trial 3 practitioners is presented below.

- Volunteer Management: Insufficiencies in the management of spontaneous and affiliated volunteers on the crisis scene in terms of location, tasking, capabilities, and shift duration.
- Real-time data and information fusion to support incident commander decision-making: Limitations in the ability to merge and synthesise disparate data sources and models in real time to support incident commander decision making.
- Incorporating information from multiple and non-traditional sources: Insufficiency in the ability to report dangerous areas and situation overview from multiple and non-traditional sources (e.g. crowd-sourcing and social media) into response operations.
- Psycho-social support: Lack of having the capability to measure stress and/or improving the communication and the awareness of psychological stress of those affected, especially spontaneous and affiliated volunteers.
- Interaction with the population: Improving the process of communicating with the population.

All these gaps have been discussed and validated during the DRIVER+ gaps assessment workshop[9] in January 2018 and subsequently prioritized by the Trial 3 Committee.

2.2 Main Research Questions

The main research questions driving the Trial 3 process are the following:

How to improve volunteer management, and in particular the process of managing spontaneous volunteers in terms of tasking, monitoring and locating volunteers working on the scene?

I. How to improve real-time data and information fusion to support incident commander decision making?
II. How to incorporate information from multiple and non-traditional sources (e.g. social media) so that this is of added value for decision-making, in particular for search and rescue operations in an earthquake crisis situation?
III. To which extent is psycho-social support (PSS) improving the awareness on psychological stress by crisis managers dealing with volunteers?
IV. How to improve the interaction with the population / communication with the public during a large crisis?

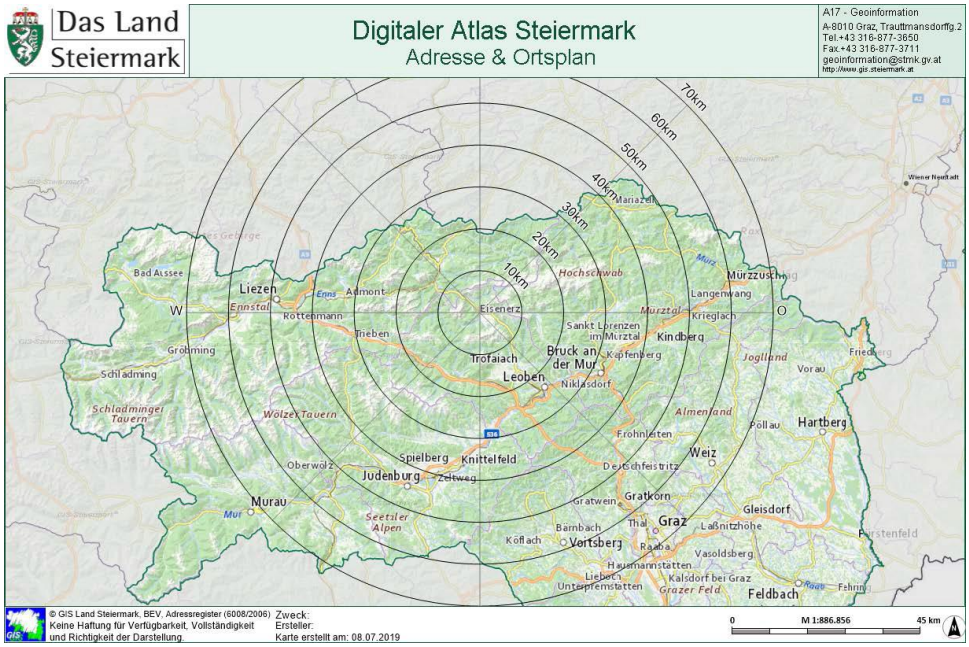
2.3 Scenario outline

The Trial 3 overall scenario is that the central area of Austria has been struck by a severe earthquake and subsequent heavy rain. The local region of Eisenerz (in Styria) is one of the most affected with missing persons, casualties, collapsed buildings, blocked roads, and endangered industries working with hazardous substances. Inhabitants have left their houses for fear of aftershocks and collapsing buildings. Lifelines such

[8] ECORYS and TNO for European Commission DG HOME. First Responders - Identifying capability gaps and corresponding technology requirements in the EU. January 2016.

[9] DRIVER+ PROJECT. D922.11 List of CM gaps. March 2018.

as water, food, shelter, transportation and medical care have been disrupted. Electricity and mobile networks have been severely damaged.

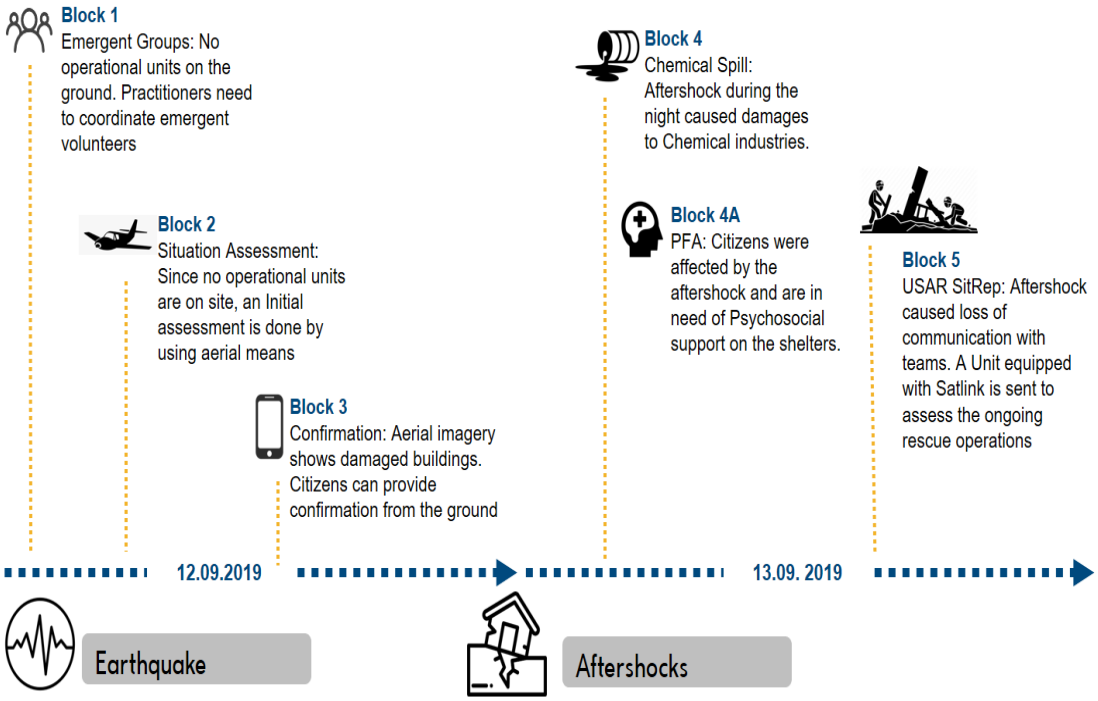


Earthquake Epicentre (Trial 3 scenario)

All local and national emergency response organisations have been deployed on site (Austrian Red Cross, fire brigades, police and the army). However, due to the extension of the affected area and overwhelmed national response capacities, the Union Civil Protection Mechanism was activated. A request of international assistance was made with regards to medical treatment, water purification and search and rescue. Due to the difficulty of accessing the affected area and considering the impact of the disaster, there is an urgent need for humanitarian assistance and assessment. A large number of volunteers and rescue equipment is needed to cope with the increasing number of affected people i.e. for search and rescue operations, making shelter, providing medical care, water, food and transportation.

Spontaneous volunteers bringing water to shelters

In Trial 3, various blocks comprising the Trial were aligned with IRONORE exercise in order to efficiently share resources, staff and participants.



Trial 3 scenario blocks

3. Solutions

After passing the Call for Application and the selection process, and after being tested during Dry Run 1 and Dry Run 2, five solutions were implemented in Trial 3. Two of them (vieWTerra Evolution and ASIGN), were provided by non-DRIVER+ partner companies while the other three (CrowdTasker, Airborne and Terrestrial Situational Awareness and PFA) were from DRIVER+ partners.

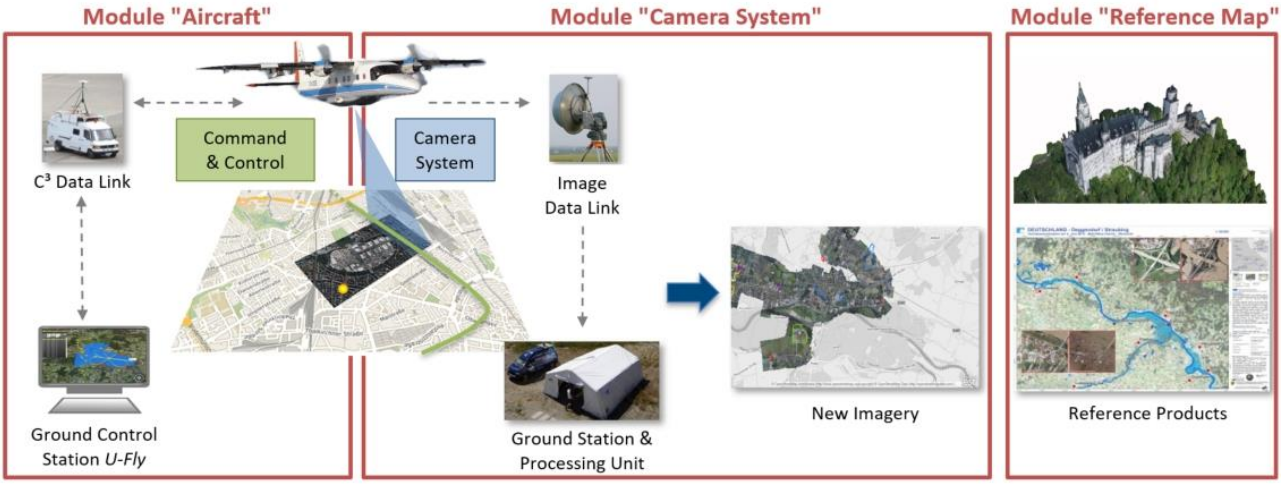
CrowdTasker (provided by AIT, **Austria**)

This is a solution for citizen involvement and community interaction. It supports informing citizens, eliciting contributions to the common operational picture by pre-registered parties and integrating efforts of self-organisation. This is achieved by issuing assignments and situational information to a selected crowd of citizens based on their location and skillset, as well as offering a chatbot interface for emergent groups to participate using their own organisational infrastructure (such as social media groups).

CrowdTasker

Airborne & Terrestrial Situation Awareness (provided by DLR, Germany)

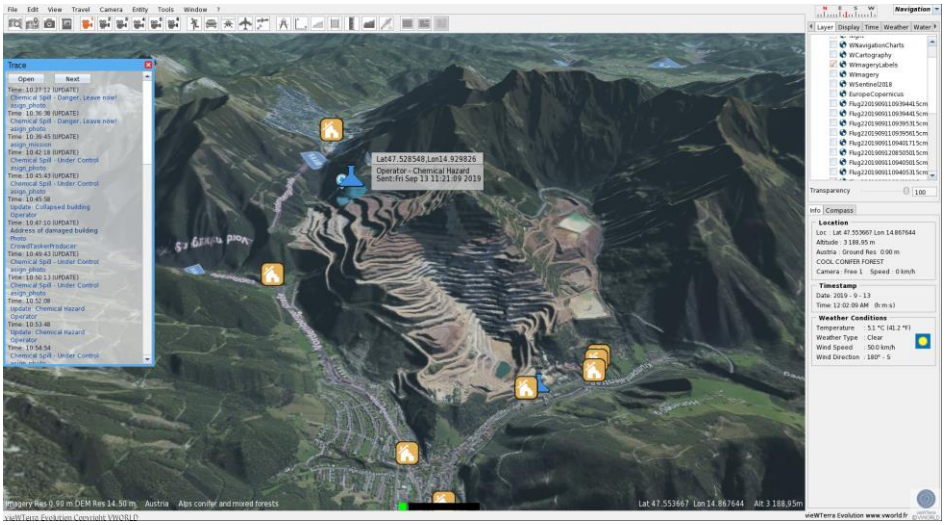
This solution is comprised of four modules to provide real-time aerial imaging to enhance situational awareness during major and large- scale disasters. Module 1 is the ground control station U-Fly, used to plan, engage and monitor aerial missions. The full-size research aircraft D-CODE executes the missions. Module 2 is the 3K aerial camera system, specifically developed to acquire and evaluate aerial photographs in near real-time. In addition, it can transfer aerial imagery via data link directly from the aircraft to a mobile ground station to provide the data to decision makers and rescue forces immediately. Module 3 is the Center for Satellite based Crisis Information, which analyses aerial imagery and generates crisis information maps. Module 4, called KeepOperational, has traffic analysis and route planning capabilities. The solution can be applied as a complete system or the individual modules can stand alone.



Airborne & Terrestrial Situation modules

vieWTerra Evolution (provided by VWORLD, France)

vieWTerra Evolution, vieWTerra Base, vieWTerra Mobile form a combined “GIS & Simulation” suite of products allowing responders to rapidly build a virtual 4D representation (3D synthetic environment + Time dimension) of any potential crisis area on earth. These solutions provide a Common Operational Picture to both the Crisis Centre and the rescue units out in the field. vieWTerra Evolution is a 4D Earth Viewer as well as a data & assets integration and development platform. It presents an ellipsoidal model of the Earth allowing its users to integrate their own precise datasets anywhere on the Globe, without any area coverage limitations, or to access data streams (imagery, cartography layers).



vieWTerra Evolution

ASIGN (provided by AnsuR, **Norway**)

ASIGN supports the collection and communication of photos, videos, geo-texts, tracking, geo-zones, geo-alerts and assessment forms in a very bandwidth-efficient manner. Specifically, it can communicate photos and video with 99% bandwidth reduction, enabling communication even through low bandwidth cellular and satellite communication networks while maintaining full precision and accuracy. While the ASIGN Apps work perfectly with regular mobile networks, they also allow satcom to be used when needed, with a lower cost. ASIGN is comprised of the ASIGN Server, a cloud-based platform from which the incoming information is managed, plus the field user ap- plications ASIGN PRO and UAV-ASIGN, which collect and send information from the field to the Server, all with end-to-end encryption.

ASIGN

Psychological First Aid (provided by the Danish Red **Cross**, Denmark)

The Psychological First Aid (PFA) training for spontaneous volunteers is a one-day training course to practise the main skills needed to give good PFA in a crisis situation. It addresses the internationally recognised principles of Look Listen Link, developed by the World Health Organisation (WHO). The training includes sessions on these three principles as well as role plays, discussion sessions, and sharing knowledge and experience between participants. Organisations responding to a crisis can implement the training to leverage the resources that spontaneous volunteers bring to a crisis in a positive and safe way. It also has a dedicated Leadership seminar.

Psychological First Aid

4. Results

The results are structured along three dimensions: the Trial dimension, the solution dimension and the Crisis Management dimension. The **Trial dimension** relates to the Trial organisation: everything that has to do with the Trial run in very “hands-on” manner is part of this dimension. The **solution dimension** tackles all functionalities as well as the usability of each solution that is trialled. The most important dimension is the **Crisis Management dimension**, since it aims to measure the potential impact of solutions on the selected CM gaps.

4.1 Trial Dimension

The participants' number, background and commitment supported the Trial adequately. Looking at the average of all answers, the respondents rather agreed that they were satisfied with the organisation of the Trial. Most respondents emphasized the aspect of safety and security, communication and division of tasks as particularly positive. However, the scenario set-up was commented to be not very realistic.

Problems were reported with understanding of the project terminology (e.g. difference between Trial and exercise, observing and evaluating) which was most likely caused by limited training time to get the participants more familiar with the DRIVER+ Trial terminology.

All participants valued the high-quality organisation of the Trial.

4.2 Solutions Dimension

The objective of the evaluation in the solution dimension is, for each innovative solution, to provide a detailed answer to the question "Does the selected solution fulfil the expected functions during the Trial?"

In order to focus strictly on the gaps selected for Trial 3, not all of the solutions' functionalities were evaluated. The general feedback from the practitioners was that the solutions provided the trialled functionalities and were rated as innovative having a serious potential to improve Crisis Management activities. However, additional training and improving some interfaces were recommended.

CrowdTasker showed the advantage regarding its full operational services related to supporting operational commanders in interaction with volunteers and also to facilitate volunteers in creating digital artefacts and receiving updates or organizing intra-groups coordination. It showed the ability to share information with ASIGN as well as with vieWTerra Evolution, and the ability to provide more detailed (in comparison to baseline tools) information to fulfil practitioners' tasks. However, the integration of CrowdTasker into current practitioners' organisational workflows seems to be difficult as well as the functionality to send easy to understand alerts to staff at the entrance of a danger zone.

Airborne and Terrestrial Situational Awareness provided high quality images, facilitated the decision-making process, and was perceived by the practitioners as a useful solution. However, completing tasks by the practitioners using the solution seemed to be not any faster than using baseline tools, which may suggest a need for further development of the solution and/or a better training.

ASIGN showed the advantage regarding its capability to send important messages and its possibility to mark a danger zone. It demonstrated its ability to share geo-imagery with vieWTerra Evolution, to allow the transmission of requests between different users, to display 360° videos, to complete tasks of practitioners faster and more reliable, and finally to manage tasks more easily providing more detailed (in comparison to baseline tools) information to fulfil their tasks.

vieWTerra Evolution demonstrated the ability to present 2D and 3D images without lags and distortions, as well as an improvement in complementarity of information provided to practitioners. However, the ability to clearly present the danger zone as well as to intuitively orient the practitioners in vieWTerra Evolution's 4D Earth landscape was rather difficult. This may suggest a need for further development of the solution and/or better training.

Psychological First Aid (PFA) showed the advantage with applying knowledge of psychological first aid training especially to (spontaneous) volunteers. However, according to the practitioners, PFA has a low usefulness for commanders supporting the decision-making process.

4.3 Crisis Management Dimension

Overall, the results show that the solutions contributed very to rather well to **real-time data and information fusion to support incident commander decision-making.** The accuracy and speed of information transfer was improved considerably.

Furthermore, the solutions showed a high potential to **incorporate information from multiple and non-traditional sources**. The results are limited to the specific conditions of Trial 3, and further testing and demonstrating when using other sources would be recommended.

The **interaction with the population**, including the **management of volunteers**, can be improved with some of the tested solutions. In particular, an improved psychological support to volunteers can contribute to a more effective and responsible involvement of these citizens during Crisis Management situations.

5. Answers to the research questions

I. How to improve volunteer management, and in particular the process of managing spontaneous volunteers in terms of tasking, monitoring and locating volunteers working on the scene?

The management and tasking functionality of the tested solution (e.g. Crowdtasker) with regards to managing of spontaneous volunteers and distribution of tasks generates added value related to the volunteer management with respect to managing an earthquake and heavy rain situation.

It was demonstrated that in case of an urgent need for collecting information from population and including spontaneous volunteers, facilitates getting an operational overview of the actual situation necessary for better decision making.

II. How to improve real-time data and information fusion to support incident commander decision making?

Information provided by the Airborne and Terrestrial Situational Awareness solution (e.g. high-quality photos) as well as information from ASIGN (text, photos, videos) was fused by the vieWTerra Evolution which clearly enhanced the understanding of an ongoing crisis situation.

In this way it was demonstrated that the tested solutions (Airborne and Terrestrial Situational Awareness and vieWTerra Evolution) support the decision-making process. However, independent usage of Airborne and Terrestrial Situational Awareness by commanders in charge would require a special training on how to interpret the photos in order to fully understand the provided information (for example: automatic photo/video analysing system for different types of damages).

Furthermore, the results of Trial 3 prove that ASIGN and CrowdTasker have user interfaces that allow easy information exchange (text, photos, videos) between units deployed in the field and the commanders in the command centre to deal with an earthquake-related crisis situation. Information in the command centre retrieved via the TTI was displayed either in ASIGN or CrowdTasker but was also fused and visualised in vieWTerra Evolution for commanders in the command centre to produce an actual common operational picture to assist them in decision-making.

III. How to incorporate information from multiple and non-traditional sources (e.g. social media) so that this is of added value for decision-making, in particular for search and rescue operations in an earthquake crisis situation?

The tested solution (i.e. CrowdTasker) incorporated the functionality of a social media interface by using Telegram and therefore has the ability to use information from different non-traditional and multiple information sources that enhanced the decision-making process of the commanders in charge in the context of the earthquake scenario. It generates the additional value related to the enhancement and accuracy of the situational and operational picture. In addition, it provides a benefit in bottom-up

communication, especially launched by spontaneous volunteers who can provide and enrich the operational picture with their on-sight information (data, observations, etc.).

However, a positive influence on the search and rescue operation itself is minor due to the fact that the current functionality does not provide a feature to task specific individuals or groups (this impacts top-down tasking and as a consequence, the time required for managing volunteers). A legal framework for integrated spontaneous volunteers seems to be required.

IV. To which extent is psycho-social support (PSS) improving the awareness on psychological stress by crisis managers dealing with volunteers?

Psychological First Aid training used to train participants (e.g. team leaders) increases their awareness regarding the stress experienced by volunteers in emergencies. The PFA demonstrates its potential to enhance the key knowledge and skills of its participants. However, exact measuring of added value is difficult due to some other factors that need to be taken into consideration (e.g. age of participants, previous traumatic experiences, previous knowledge in the area, etc.). Overall, the tests before and after the training indicate a change from "low" and "medium" to "high" ability ratings, and thus participants reported that abilities they were asked to assess have improved on the day of training. Participants stated they were able to identify some signs of distress on the persons who were performing the role playing (victims) they would not have been aware before.

V. How to improve the interaction with the population / communication with the public during a large crisis?

Functionality of CrowdTasker demonstrates a potential to be used as a channel for early warning purposes. CrowdTasker has the ability to send out related alarms/warnings as well as getting back alarms/warnings from the population. CrowdTasker enables bottom-up communication (from the spontaneous volunteers to the coordination unit/stakeholder). Based on the opinion of practitioners, an acknowledgement of information is an issue (functionality to send easy-to-understand alerts to staff when entering a danger zone). CrowdTasker lacks the functionality to properly verify the users who create a risk report to avoid launching of fake communication streams intentionally or unintentionally. Therefore, it seems that the system could easily be compromised. These restrictions result in limited usability of CrowdTasker as a means of communication.

6. EU policy recommendations

Trial 3 findings are mainly addressed to the policies which are naturally related to Crisis Management by definition. These are civil protection and humanitarian aid covering prevention, preparedness and response to disasters. Furthermore, the results could have an influence on the Solidarity Fund which is an instrument dedicated to the recovery phase of EU Crisis Management.

The outcomes of the Trial 3 provide ground to formulate the following recommendations related to EU policies, regulations and mechanisms.

In the context of EU **civil protection policy** (Regulation (EU) No 2019/420 and 1313/2013/EU and 2014/762 and No. 2018/142) The Airborne and Terrestrial Situational Awareness solution as well as vieWTerra Evolution, could be broadly used for improving situational awareness, including needs and damage assessments, particularly in case of limited availability of Copernicus services. This type of support is required mainly in case of major disasters like earthquakes, wildfires and floods due to the wide geographical area affected. There may be several reasons to launch the solutions in a disaster situation, in a need for ad hoc urgent assessment of a specific area or a general need for situation overview in poor weather conditions (which limit the potential use of satellite imagery). The aerial imagery could also improve communication and reporting in horizontal scheme, among the stakeholders involved in the operation, as well as vertical, from the field to HQs (e.g. from EUCPT to ERCC). Supplementing reports and maps with respective images of affected area may significantly improve clarity of communication. Furthermore, availability of the two solutions may facilitate the work of European civil protection assets by

providing information on preferable location for a Base of Operation, Reception and Departure Centres and other crucial information which may be obtained from aerial observation and clearly presented in the form of 2D and 3D maps and imagery.

The trialled solutions (Airborne and Terrestrial Situational Awareness solution, vieWTerra Evolution) could represent an additional asset in the European Emergency Response Capacity which is deployed by ERCC on commercial or other bases if needed. It could also be a part of a national capacity offered within the voluntary pool if agreed between the producers and a member state where the company is operating.

In the context of **humanitarian aid** (Regulation (EU) No 375/2014 and No 1244/2014 and No 1398/2014) it is truly visible that training programmes as provided by Psychological Frist Aid (PFA) for volunteers is extremely valuable. Thus, we recommend using such trainings as training programme for EU Aid Volunteers Corp which ensures that candidates are thoroughly prepared before their departure to a non-EU country. PFA could be introduced as a solution improving quality of their trainings and resulting in better quality of psychological aid offered on site of a humanitarian crisis.

The CrowdTasker solution can be recommended for the communication, collaboration and early warning in humanitarian crises, it can especially contribute to initial phase of a response when high number of NGOs respond, and communication and collaboration structures between the stakeholders are being launched. Airborne and Terrestrial Situational Awareness solution as well as vieWTerra Evolution could improve provision of humanitarian aid by providing information about accessibility of the suitable areas for humanitarian aid transports, geographical and other conditions for IDP and refugee camps settlements, etc.

In the context of the EU **Solidarity Fund** (Article 212 of the Lisbon Treaty the Airborne and Terrestrial Situational Awareness solution as well as vieWTerra Evolution could be used to document the 'major' disaster losses in case the stricken EU member state is applying for a support from the Solidarity Fund. In specific cases it could be considered as a sufficient evidence of the damage and enable assessment of its scale.

Annex 10.4 Trial 4: The Netherlands

1. Background

From **21 to 23 May 2019**, the fourth Trial organized as part of the DRIVER+ project (Trial 4) took place in The Hague, the Netherlands, at the Safety Region Haaglanden (SRH). The organisation of the Trial was a shared responsibility between the Trial Owner (DLR) and the Trial Host (SRH). This event involved 140 persons from 13 countries. The majority of the organisational staff naturally represented the hosting country – the Netherlands. Since the scenario was performed on all three levels of the Dutch national emergency response system, including a request for international assistance, there was a broad representation of Dutch practitioners who represented 10 different emergency action centres/crisis teams of the Netherlands. However, there was significant contribution from other states like Germany and Poland reflecting the trans-European network and cooperation within the DRIVER+ project.

The **general purpose** of Trial 4 was to improve cooperation and coordination among agencies and organisations during severe flooding, using innovative solutions providing support in handling large scale and long-term crises.

Multi-disciplinary participants of Trial "The Netherlands"

2. Context

This section presents the practitioners' needs (gaps) which the selected solutions aimed to address, the research questions guiding the Trial overall process, as well as the scenario on which the Trial realisation is based.

2.1 Crisis Management Gaps

In DRIVER+, a capability gap is understood to be "the difference between a current capability and the capability considered necessary for the adequate performance of one or more disaster management tasks."[10] The three 'high priority' Crisis Management capability gaps proposed by Trial 4 practitioners is presented below:

[10] ECORYS and TNO for European Commission DG HOME. First Responders - Identifying capability gaps and corresponding technology requirements in the EU. January 2016.

- Gap 1: Limitations in the planning of resources (qualified personnel and equipment) for response during large scale and long-term crisis.
- Gap 2: Shortcomings in the ability to exchange crisis-related information among [emergency management] agencies and [consulted] organisations (also related to as interoperability).
- Gap 3: Shortcomings in planning and managing the side effects of large-scale evacuation of population in urban areas.

All these gaps have been discussed and validated during the DRIVER+ gaps assessment workshop[11] in January 2018 and subsequently prioritized by the Trial 4 Committee.

2.2 Main Research Questions

The main research questions driving the Trial 4 process are the following:

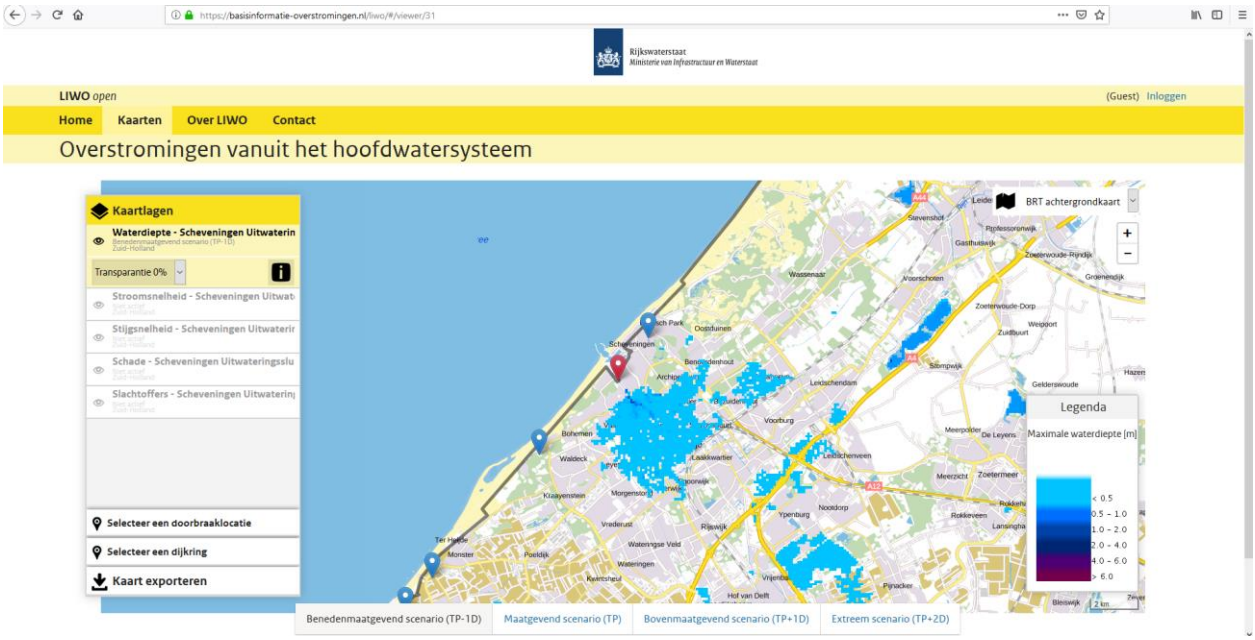
I. How can simulation tools improve resource planning activities in large scale and long-term disaster operations?
II. How can net-centric data exchange improve information sharing between relevant parties and thus improve the shared understanding of the current situation?
III. How can simulation tools support the planning and management of a large-scale evacuation under consideration of real-time traffic information?

2.3 Scenario outline

The scenario of Trial 4 dealt with an extreme high tide at the coast, coinciding with an expected storm. On top of that a moderate probability of technical failure of the shipping lock at Scheveningen was given. The initial scenario reads as follows: A potential breach of the coastal defences at Scheveningen may result in the flooding of large areas of The Hague (with water depths up to 2 meters). Especially the area of The Hague city centre is threatened. In case the event occurs, thousands of people are at risk of being trapped, including expected loss of life. Thus, the predicted flood requires decisions on evacuation needs for inhabitants of the threatened area. The water inflow will further affect the vital infrastructure and result in loss of power, drinking water and heating (the event occurs in the winter) in the area. Traffic, whether it be cars, buses or trains, struggles with difficulties due to flooded roads, debris and disappeared manhole covers. In order to keep the number of casualties at a minimum, one should pay attention to the emergency supply for an efficient evacuation process of the population before, during and after the disaster.

Trial 4 was prepared and executed as a table-top (in-door) event based on a scenario run in a simulated environment created in the TTI. Actions were taken by the participants in a realistic information environment, based on currently available legacy tools and means, Crisis Management plans, rescue procedures and good practices of the Trial practitioners. In Trial 4 the focus was on coordinating the flood (threat) by SRH only.

[11] DRIVER+ Project. D922.11 List of CM gaps. March 2018 (https://www.driver-project.eu/wp-content/uploads/2018/08/DRIVERPLUS_D922.11_List-of-CM-gaps.pdf)



Visualisation of the flood in baseline scenario[12]

The Trial 4 scenario was divided in two phases:

- Threat phase: there is a serious threat of flooding due to the severe meteorological circumstances;
- Impact phase: the flooding occurs and an appeal is made for additional (international) emergency response.

Each of the phases consisted of two blocks (see Table below).

Trial setup

Day	Phase	Block	Trial time at start of the block	Focus	Objective
1	Threat	1	31 hours before the expected dike breach	Situational awareness and determining the cascading effects of possible flooding	Assessment of The Hague city centre
		2	28 hours before the expected dike breach	Formulate mitigating measures, with focus on evacuation	Formulate two evacuation strategies, define actions/measures to mitigate effects of possible flooding
2	Impact	3	16 hours after the dike has breached	Damage assessment	Assessment of damage in the flooded area (The Hague city centre) and mitigation measures

[12] https://basisinformatie-overstromingen.nl

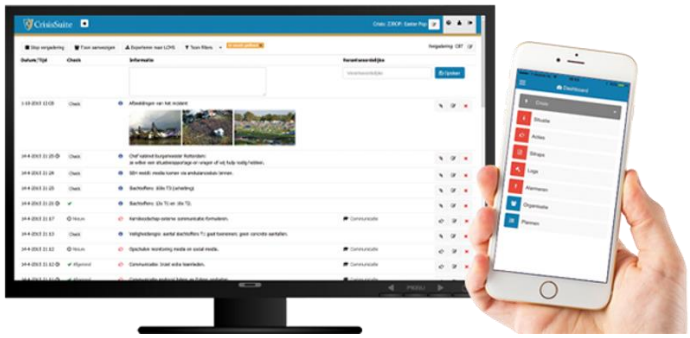
Day	Phase	Block	Trial time at start of the block	Focus	Objective
		4	16 hours after the dike breach	Damage control and recovery	Answering questions of International Organisations, planning police personnel, mitigating measures

3. Solutions

After passing the Call for Application and the selection process, the Dry Run 1 and Dry Run 2, the following five solutions were implemented in Trial 4. Three of them (CrisisSuite, 3Di and SIM-CI) were provided by non-DRIVER+ partner companies while the other two (Airborne and Terrestrial Situational Awareness and HumLogSim) were from project partners.

CrisisSuite (provided by Merlin Software B.V., the Netherlands), performing the following main functions:

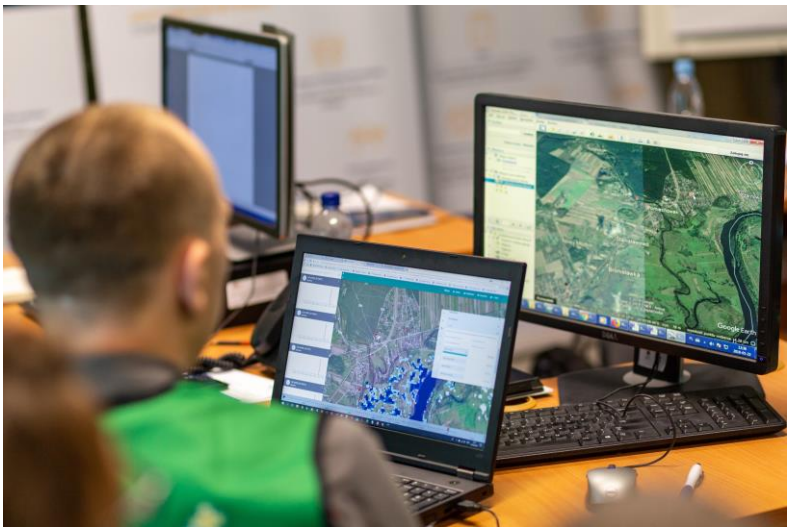
- Establish information exchange to provide a Common Operational Picture to supporting crisis teams without access to the legacy system of Crisis Management professionals.
- Log sitreps, decision and actions.



CrisisSuite

3Di (provided by Nelen & Schuurmans, the Netherlands), performing the following main functions:

- Provision of a flood prediction in the threat phase and update of this prediction based on actual water level in the impact phase.
- Calculate effects of mitigation measures (pumps, barriers).



3Di

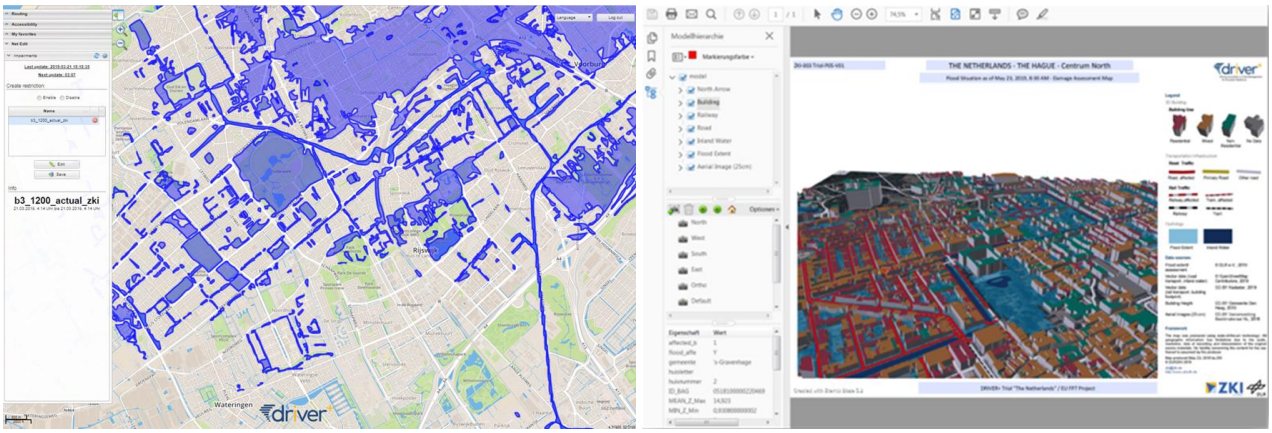
SIM-CI (provided by SIM-CI, the Netherlands), performing the following main function:

- Prediction of cascading effects on critical infrastructure (power, telecommunication and public transport).

SIM-CI

Airborne and Terrestrial Situational Awareness (ATSA; components *KeepOperational* and *ZKI*, provided by DLR, Germany), performing the following main functions:

- Overview of actual flood state based on aerial images.
- Route calculations that avoid the flooded area.
- Provision of damage assessment maps in 2D and 3D based on the derived inundated area.



Airborne and Terrestrial Situational Awareness comprised of modules KeepOperational (left) and ZKI (right)

HumLog (provided by WWU, Germany), performing the following main functions:

- Create an evacuation plan for neighbourhoods, hospitals, etc.
- Calculate organisational logistics (esp. planning of personnel).

HumLog

(1: control buttons; 2: general overview; 3: map; 4: key values of an agent; 5: legend; 6: map options)

4. Results

The results are structured along three dimensions: the Trial dimension, the solution dimension and the Crisis Management dimension. The **Trial dimension** relates to the Trial organisation: everything that has to do with the Trial run in very "hands-on" manner is part of this dimension. The **solution dimension** tackles all functionalities as well as the usability of each solution that is trialled. The most important dimension is the **Crisis Management dimension**, because this is looking at the potential impact a solution has on the selected CM gaps.

4.1 Trial Dimension

The major outcomes related to the Trial dimension confirm that the participants' number, background and commitment supported the Trial adequately. The scenario and the simulated environment were deemed

realistic enough for the practitioners' immersion. Attendees of Trial 4 agreed that they were satisfied with its organisation and would recommend participating in DRIVER+ Trials to others. However the results also show room for improvement with respect to the technical set-up, the training and the scenario building. The complete Test-bed Technical Infrastructure was running without any problems throughout the complete Trial run.

4.2 Solution dimension

The objective of this evaluation in the solution dimension is, for each innovative solution, to provide a detailed answer to the question "Does the selected solution fulfil the expected functions during the Trial?" In order to focus strictly on the gaps selected for Trial 4, not all of the solutions' functionalities were evaluated.

3Di was primary used in the threat phase and significantly facilitated the situational awareness of the practitioners. The flood prediction gave detailed information on the extent and depth of the flooding. 3Di provided quick simulations of the possible flood extent, based on the actual information available. It supported decision making especially through the calculated effects of proposed mitigating measures.

ATSA, module KeepOperational was useful to substantiate traffic circulations plans made by the action centre of Police and was able to cope with blockages. It provided useful input to HumLog. **ATSA, module ZKI** is only for the impact phase, but provided an objective and accepted (by the practitioners) flood extent for dealing with the flood. The practitioners lacked however, information on the water depth. The interactive damage assessment maps provided in the last scenario block were hardly used, mainly because handling of the PDF's was considered difficult by the practitioners in order to complete given task.

CrisisSuite fully covered the gap associated with information exchange between action centres and supporting organizations. Practitioners considered the solution as a valuable support in multi-agency communication.

HumLog has provided objective quantification of the effects of an evacuation strategy, improving decision making, closing to a large extent the gap in planning and management of large scale evacuation. The solution was helpful for resource management, regarding evacuation, herewith partly closing the gap on long-term resource management.

SIM-CI added to the situational awareness of the practitioners, especially since it objectively quantified possible cascade-effects of flooding. Effective handling of SIM-CI takes more training, but is a valuable addition to assessing the flood threat.

Overall, the innovative solutions provided the expected functions. All five trialled solutions significantly improved situational awareness of the practitioners, supported decision making, information exchange and the resource management processes. Additionally, the Trial provided useful and practical feedback to solution providers to further improve their solutions, especially to enhance maturity levels for being fully implemented operationally.

4.3 Crisis Management dimension

The main outcomes in the Crisis Management dimension are that the trialled solutions contributed to closing Gap 1 '*Limitations in the planning of resources for response during large scale and long-term crisis*' and partially closing Gap 2 '*Shortcomings in the ability to exchange crisis-related information among agencies and organisations*' and Gap 3 '*Shortcomings in planning and managing the side effects of large-scale evacuation of population in urban areas*'. These observations are limited to the Trial specific conditions.

In a crisis situation where the Safety Region involves external organisations, **information sharing** is an important aspect. Internally, the Safety Region uses the legacy system LCMS which is fine for their needs, but is – for non-technical reasons – a closed and restricted information system. Closing the Gap 2 on (net-

centric) information sharing proved to be feasible with usage of CrisisSuite during Trial 4. The experiences in the Trial even led to initiatives to formally connect both solutions (LCMS and CrisisSuite).

The other solutions added significantly to the **situational awareness**, providing the practitioners with a more accurate and more detailed insight in the (potential) consequences of flooding. 3Di provided accurate predictions on flooding for the threat phase, while ATSA, module ZKI provided objective flood information in the impact phase. ATSA, module KeepOperational facilitated the traffic circulation plan, and HumLog provided insights into the feasibility of proposed evacuation strategies. Particularly SIM-CI provided new **insights in the cascade-effects of flooding** enabling the Safety Region to quantify these effects.

The gap concerning **long-term resources planning** (Gap 1) was only partly closed in Trial 4: the focus on overall resource management was redirected to resource planning in respect to support evacuation execution, using HumLog.

The gap regarding **evacuation planning** (Gap 3) was closed using ATSA, module KeepOperational to determine effective evacuation routes together with HumLog, substantiating the proposed evacuation strategies.

5. Answers to the research questions

I. How can simulation tools improve resource planning activities in large scale and long-term disaster operations?

By monitoring available resources and in parallel illustrating how the threat (e.g. a flood) evolves, solutions in the Trial could report the need for specialized equipment better than without solution support. Solutions also facilitated the organisation of action logistics, e.g. the commander of action knows his assets and resources, proved potential to provide detailed information on the flood forecast and substantiation of the effects of mitigating measures (like emergency dikes or pumps), and proved the possibility to support in decision making about the deployment of human resources and equipment.

Furthermore, solutions proved potential of providing a traffic management plan on best routes available in case of a crisis, optimizing these routes with respect to the protective measures, and demonstrated possibilities such as determining the roads to reach the destination as quickly as possible, or information on closed roads.

Deriving the flood extent from aerial imagery of the flooded area demonstrated the support potential of remote sensing in decision making on the deployment of human resources and equipment.

II. How can net-centric data exchange improve information sharing between relevant parties and thus improve the shared understanding of the current situation?

The use of solutions resulted in more detailed information, based on the best (actual) data available in an objective manner. Netcentric information exchange provides a shared situational assessment, due to use of more detailed data, e.g. flood maps, cascade-effects and quantified traffic routes. The advantages of netcentric information exchange in the Innovation Line during the Trial were the following:

- Information is shared instantaneous and continuous; all organisations use the same information.
- Faster information exchange between Safety Region (using solely the legacy system) and external organisations (using solution): Information is digitally available, including maps (in contrast to phone or mail communications, followed by importing this information into the systems).
- No errors are made in distribution of information and all information is up-to-date because all organisations use the same data.
- Unambiguous information, since the organisations share their information. There is no person in between that may distort the information.
- Higher efficiency for the external organisations, since their information was available for all action centres and crisis teams, in contrast to every action centre to individually contact the organisation by mail/phone (or relaying information request via the information manager).

III. How can simulation tools support the planning and management of a large-scale evacuation under consideration of real-time traffic information?

The solutions trialled during Trial 4 were useful for indicating collection points for the evacuees, locating evacuation assembly points, avoiding evacuation assembly points in areas flooded or areas threatened by cascade-effects (areas without power), designating routes for transport of evacuees, informing about the current state (who is evacuated, who still needs evacuation), or assessment of necessary resources. As demonstrated during Trial 4, practitioners using solutions made decisions based on available simulations. Advantages of the Innovation line were detailed information on the forecast flood and substantiation of the effects of protective measures (like emergency dikes or pumps), the provision of a traffic management plan on best routes available in case of a crisis, and optimization of these routes with respect to the protective measures. Furthermore, dynamic information on cascade-effects (power failure) in case of flooding and effects of protective measures were made available.

6. Conclusions and policy recommendations

Trial 4 has met its objectives by active involvement of Crisis Management practitioners in the searching for the innovation that meets their expectations. Trialling five promising solutions in the context of a flood forecast and an actual flood response allowed the practitioners to test the solutions in the close to real environment of a table-top Trial. The Test-bed proved a useful environment to plan and execute the Trial in line with the TGM. The Trial has led to collecting data which enabled answering a set of research questions and through that proved the solutions' innovative functionalities which revealed to cover the identified gaps to certain extent. Answering the research questions was the key challenge of the Trial 4. The answers for three main research questions were formulated on basis of the collected and analysed data and observations during Trial 4. They are valid for the context of Trial 4 and in respect to the tasks given to the practitioners in this simulated Test-bed environment during the Trial.

The following set of EU policies and regulations are relevant to the findings of Trial 4. The answers to the research questions asked show that there is potential for the trialled technological solutions to contribute to the Crisis Management processes. Recommendations were formulated accordingly.

***POLICY:** CIVIL PROTECTION*

- **REGULATION:** Decision No 1313/2013/EU of the European Parliament and of the Council of 17 December 2013 on a Union Civil Protection Mechanism

RECOMMENDATION:

The forest fires in Sweden in 2018 revealed a need for continuous up-date on the roads patency in order to shorten time for reconnaissance activities and deployment of resources. The same problem concerns also other major disasters like flood which impacts broad geographical areas and transport infrastructure making them not operational any longer (e.g. roads or railways). Having software (ATSA - KeepOperational) which provides a close to real time update on the possibility of roads could have an impact on civil protection modules management. Such solution could facilitate the work of national coordinating cells as well as Union Civil Protection Teams (UCPT) and civil protection team leaders.

Secondly, 3Di and ATSA - ZKI could contribute to the European Flood Awareness System (EFAS) by providing new software which potentially provides added value (e.g. new algorithm for flood spread calculations) to the system utilized on the EU level.

CrisisSuite adds to efficient information sharing among different stakeholders in the response phase. Since UCPM missions by definition include many stakeholders, CrisisSuite has the potential to facilitate vertical and horizontal communication between the ERCC, UCPT and civil protection modules working under the UCPM umbrella.

The shared communication environment of CrisisSuite could also be extended to other partners from outside the UCPM (e.g. UN agencies). It would facilitate the work of all these actors in different phases of

CP missions (pre-mission, on-mission and mission-end[13]). Since CrisisSuite has the technical ability to be connected to other COP legacy solutions (like in Trial 4 to LCMS), it is worth to consider whether CrisisSuite could also be a module of the Common Emergency Communication and Information System (CECIS).

***POLICY:** ENVIRONMENT*

- **REGULATION:** Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks

RECOMMENDATION:

The Regulation primarily is in place to:

- Increase public awareness.
- Support the process of prioritising, justifying and targeting investments and developing sustainable policies and strategies.
- Support flood risk management plans, spatial planning and emergency plans.

Solutions 3Di, SIM-CI, ATSA are crucial for flood development prognoses and adequate information sharing on the flood risk, and as such, could positively influence the quality of flood risk planning processes. They could facilitate the work of water authorities from local up to national level.

- **REGULATION:** Directive 2007/2/EC establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) Improves the provision of information and good quality data across EU Member States

RECOMMENDATION:

Since the set of the trialled solutions provides records on the interagency communication as well as the decisions taken during the disaster response, spatial data recorded in the solutions could be used for post-disaster analyses. These records could facilitate the process of lesson-identification from the past emergencies in order to share it among the EU Member States.

***POLICY:** SOLIDARITY FUND*

- **REGULATION:** COM(2013) 522 Proposal to amend Council Regulation (EC) 2012/2002 establishing the European Union Solidarity Fund

RECOMMENDATION:

CrisisSuite has a potential to facilitate Integrated Political Crisis Response (IPCR) arrangements, especially before and during informal roundtable meetings as well as in drafting Integrated Situational Awareness and Analyses (ISAA) reports. It is worth to consider the added value the solution could bring into communication process among the Member States in case of IPCR activation.

***POLICY:** INDUSTRY AND INFRASTRUCTURE*

- **REGULATION:** SWD(2013) 318 New approach to the European Programme for Critical Infrastructure Protection Making European Critical Infrastructures more secure

RECOMMENDATION:

Cascading effects are one of the key phenomena which are recognized in the late 20th century. Increasing significance of networks forces deeper understanding of these phenomena in order to mitigate its negative

[13] United Nations Disaster Assessment and Coordination (UNDAC) Field Handbook, Office for the Coordination of Humanitarian Affairs, 7th Edition (2018), p. 48

consequences. *SIM-CI* should be considered as a valuable asset in this respect. Therefore solutions as *SIM-CI* should be used for simulation exercises to facilitate critical infrastructure contingency planning.

- **REGULATION:**
  - SWD(2013) 318 New approach to the European Programme for Critical Infrastructure Protection Making European Critical Infrastructures more secure
  - Regulation 347/2013/EU of the European Parliament and of the Council on guidelines for trans-European energy infrastructure; COM (2011)0650 Proposal for a Regulation on Union guidelines for the development of the trans-European transport network

RECOMMENDATION:

Planning localization of critical infrastructure (1) as well as trans-European energy and transport (2) objects requires simulation exercises on potential flood impact on investment areas. This could be supported by *3Di* and *ATSA-ZKI* solutions in order to minimalize the risk of building the objects in current flood prone areas as well as the areas which could be flood prone in longer time perspective (taking into consideration the climate change effect).

POLICY: *INSURANCE*

- **REGULATION:** COM (2013) 213 Green paper on the insurance of natural and man-made disasters

RECOMMENDATION:

Since flood is the highest risk natural disaster in Europe, involvement of the insurance sector is critical in order to decrease its impact. *3Di* and *ATSA-ZKI* solutions could be valuable in facilitating the consultations among stakeholders on the flood risk calculations. The solutions could support identification and prediction of the (potential) flood impact, also cross-border, for different scenarios. These measures could support the consultation processes between the stakeholders such as policy makers, insurance companies and potential clients of these companies. Such type of discussions, supported with the results of the analysis and simulations, could also broadly promote insurance as a way to decrease flood risks.

Annex 10.5 Final Demonstration

1. Background

The last Trial concluding a series of DRIVER+ Trials, called **the Final Demo,** took place from **25 to 29 November 2019** in two cities and in three different locations: Warsaw, Poland, at the Main School of Fire Service (SGSP) and at the Space Research Centre of the Polish Academy of Sciences (SRC PAS), and in The Hague, the Netherlands, at the Safety Region Haaglanden (SRH). The organisation was a shared responsibility between the Trial Owner (SRC PAS) and the Trial Host (SGSP). The event has been tailored to the needs of the main end-user, being the **Emergency Response Coordination Centre (ERCC).**

The Final Demo involved 155 persons from 17 countries: 145 of them were located in Warsaw and 10 participants in The Hague. Of this group, 113 participants were directly involved in the Final Demo preparation and execution, and 42 persons were observing and documenting the event. Since the scenario was addressing information exchanges among **Union Civil Protection Mechanism (UCPM)** entities (including **ERCC, expert based coordination teams (EUCPT)**[14] and certified **Response Capacities** of **the European Civil Protection Pool**), only participants and observers with adequate experience were selected.

The **general purpose** of the Final Demo was to improve cooperation and coordination among agencies and organisations, using innovative solutions, and providing a Common Operational Picture to support handling large scale crises outside the EU.

Two out of seven simulated command posts of Final Demo

2. Context

This section presents the practitioners' needs (gaps) which the selected solutions aimed to address, the research questions guiding the Final Demo overall process, as well as the scenario on which the Final Demo realisation is based.

2.1 Crisis Management Gaps

In DRIVER+, a capability gap is understood to be "the difference between a current capability and the capability considered necessary for the adequate performance of one or more disaster management

[14] European Union Civil Protection (coordination) Team, supported by the Technical Assistance and Support Team (TAST). The TAST capacity was role-played by a team consisting of geoinformation specialists and solution operators tasked for helping practitioners to efficiently use the innovative solutions.

tasks."[15] The list of three Crisis Management capability gaps proposed by Final Demo practitioners is presented below, with the first as highest priority:

Gap 1: Shortcomings in interoperability in the ability to exchange crisis-related information among agencies and organisations.

Gap 2: Lack of a "Common Operational Picture" to integrate data sources and calculation results from different models crucial for the decision-making process.

Gap 3: Limitations in the ability to merge and synthesise disparate data sources and models (e.g. historic events, spreading models, tactical situation, critical assets map) in (near to) real time to support decision making.

All these gaps have been discussed and validated during the DRIVER+ gaps assessment workshop[16] in January 2018 and subsequently confirmed during two thematic workshops with the ERCC.

2.2 Main Research Questions

The main research questions driving the FD process are the following:

RQ 1.1: How to combine information from different operating actors to increase the EUCPT and the EUCP Modules' situational awareness?

RQ 1.2: How to optimize communication between descending and ascending (taking over) EUCP Teams?

RQ 2: How to optimise the EUCPT to ERCC situation reporting?

RQ 3: How can access to recent geoinformation data and related analytical products affect the decision-making processes of the EUCPM Response Capacities?

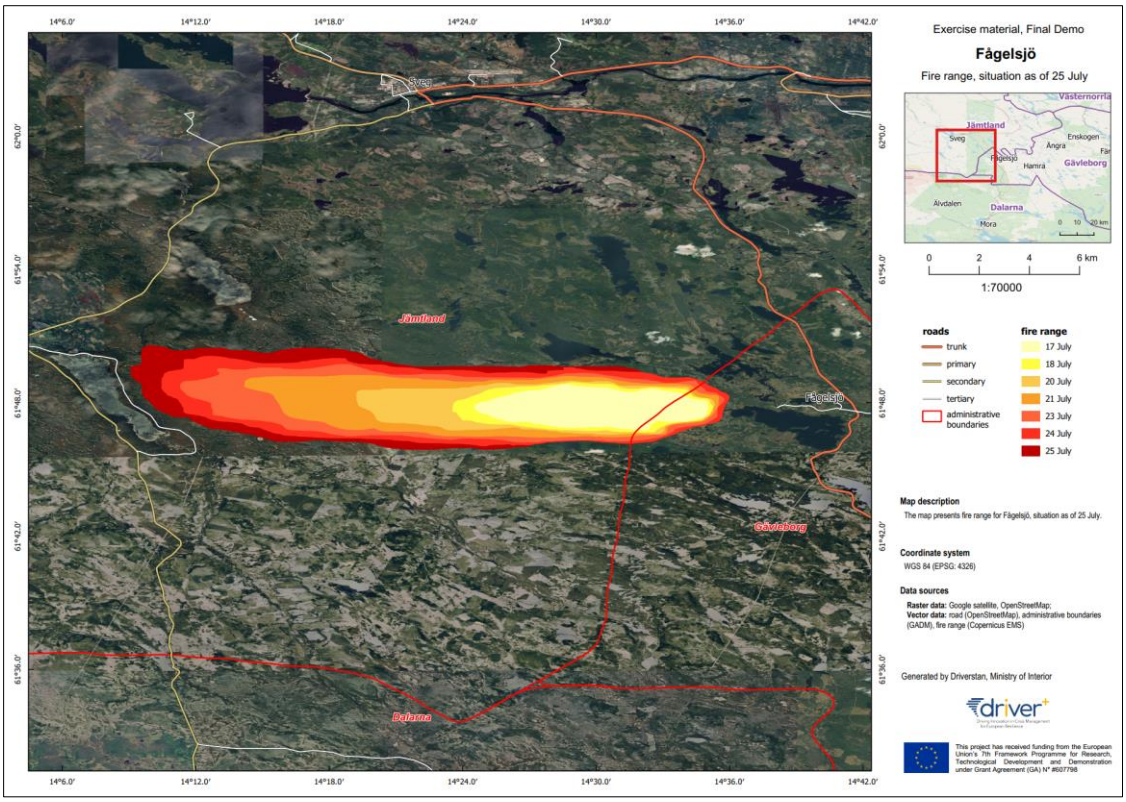
2.3 Scenario outline

The Final Demo was executed as a command-post (in-door) event run in parallel in three physically distant locations. It was focused on information exchanges between UCPM entities, therefore all activities below the Response Capacity commander level were simulated by the FD simulation team. The scenario was created in the TTI and was administered semi-automatically via the Trial Management Tool (TMT). Actions were taken by the participants in a realistic information environment, based on currently available legacy tools and means, rescue procedures and good practices of the FD practitioners. Scenario realism (and participants immersion) was facilitated by including as many as feasible realistic elements, such us reports from the field, ambient communication to support authenticity, the fire progress and crises development visualised on a map describing the whole fictional country Driverstan.

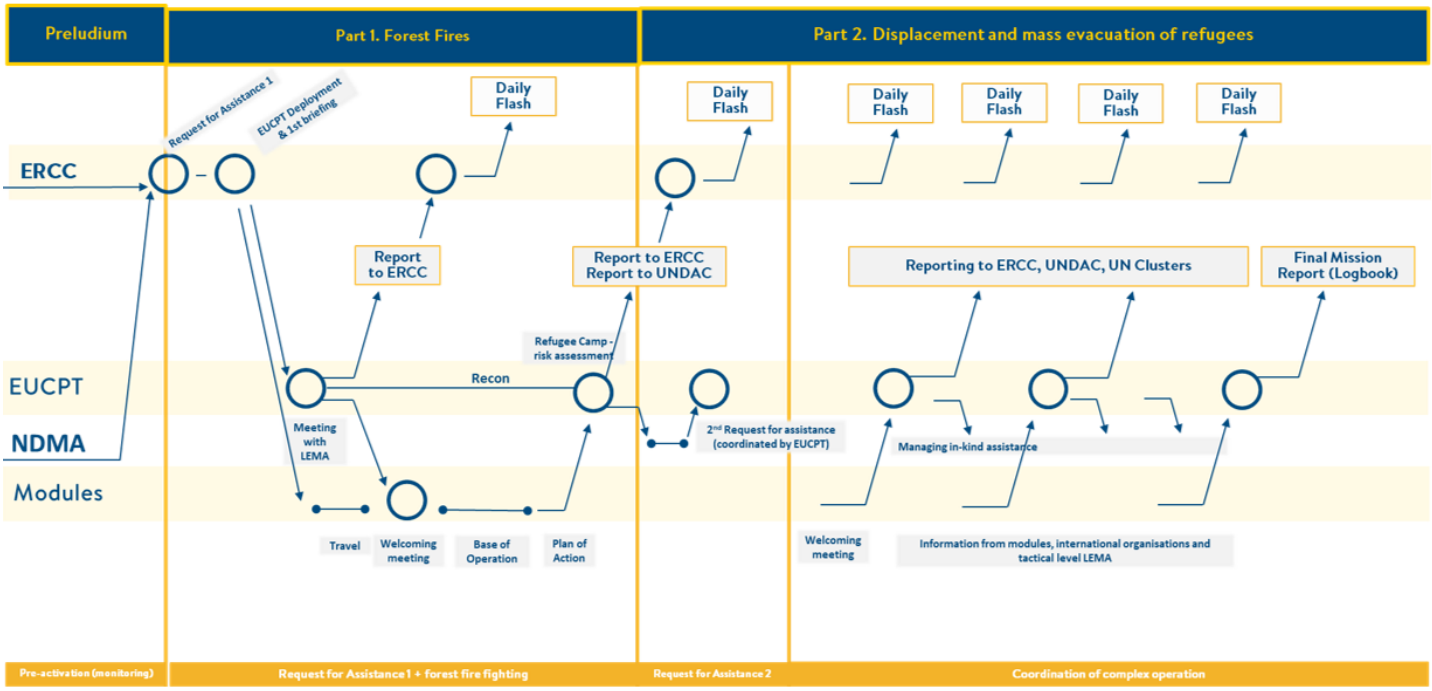
Based on the objectives described above, the scenario initially revolved around a forest fire spanning across a neighbouring EU country. In the second part it was broadened by the discovery of an endangered illegal refugee camp and the resulting cascading effects like the coordination of medical evacuation by aircraft. Some activities not directly related to the assessment of trialled innovations were included to increase the realism, as those activities are typical distractions during in-situ UCPM coordination (such as organising a briefing for VIPs, negotiating with local authorities, making press releases and attending press conferences).

[15] ECORYS and TNO for European Commission DG HOME. First Responders - Identifying capability gaps and corresponding technology requirements in the EU. January 2016.

[16] DRIVER+ Project. D922.11 List of CM gaps. March 2018



Visualisation (a print-ready map) of the fire extent[17]



Final Demo scenario workflow

[17] This fire extent depicts the fire progression in Fågelsjö area, based on data from Copernicus EMS activations in Sweden, 2018. For the FD some data was altered or added, and artificial fires were created.

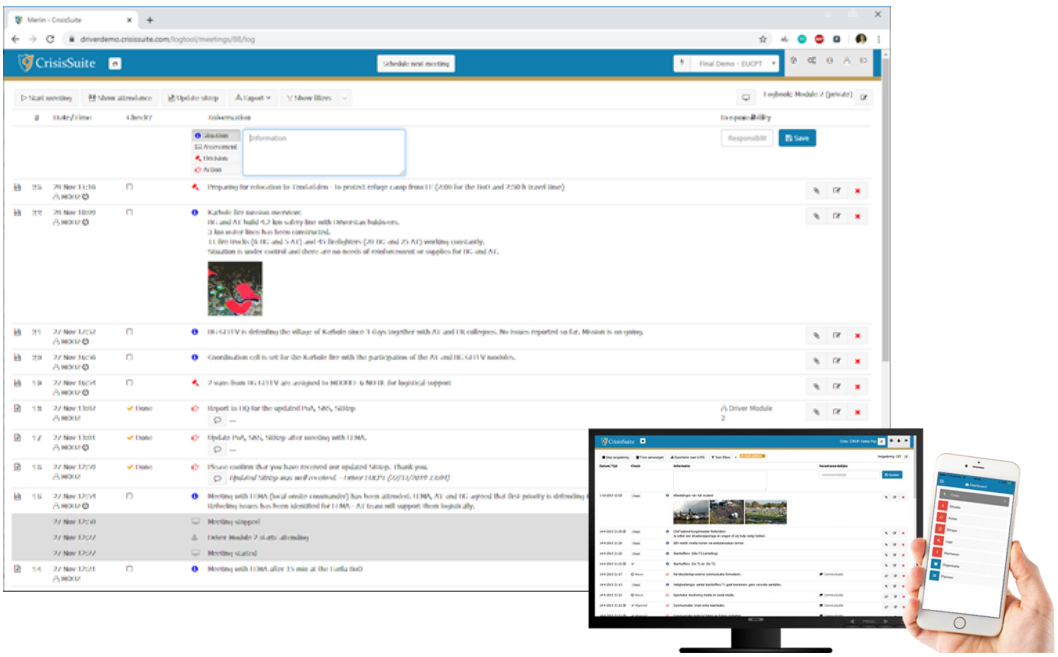
From an organisational point of view, both scenario phases were divided into smaller blocks, called sessions. The sessions were further divided in episodes to structure the data collection processes and allowing better scenario control and facilitation. In total, five episodes were realised within four sessions. The first session was a semi-realistic warm up session, during which the participants could acknowledge and adjust operational procedures when using innovative solutions. It was also used to present and explain the differences between a Trial and a CPX MODEX exercise (which participants are used to).

3. Solutions

After passing the selection process, the Dry Run 1 and Dry Run 2, five solutions were implemented in the Final Demo. Three of them (CrisisSuite, Drone Rapid Mapping and vieWTerra Evolution) were provided by non-DRIVER+ partner companies, while the other two (Socrates OC and Field Reporting Tool) were from project partners.

CrisisSuite (provided by Merlin Software B.V., the Netherlands), served as main platform for logging actions and decisions and requesting and exchanging standardised reports, performing the following main functions:

- Host CM plans and documents.
- Support the logbook(s) for sharing of vertical and horizontal information.
- Support the resource pooling information (related with CECIS).
- Display the Situation map.
- Help generating Situation Reports and other standard forms



ERCC logbook during Final Demo and mobile interface of CrisisSuite

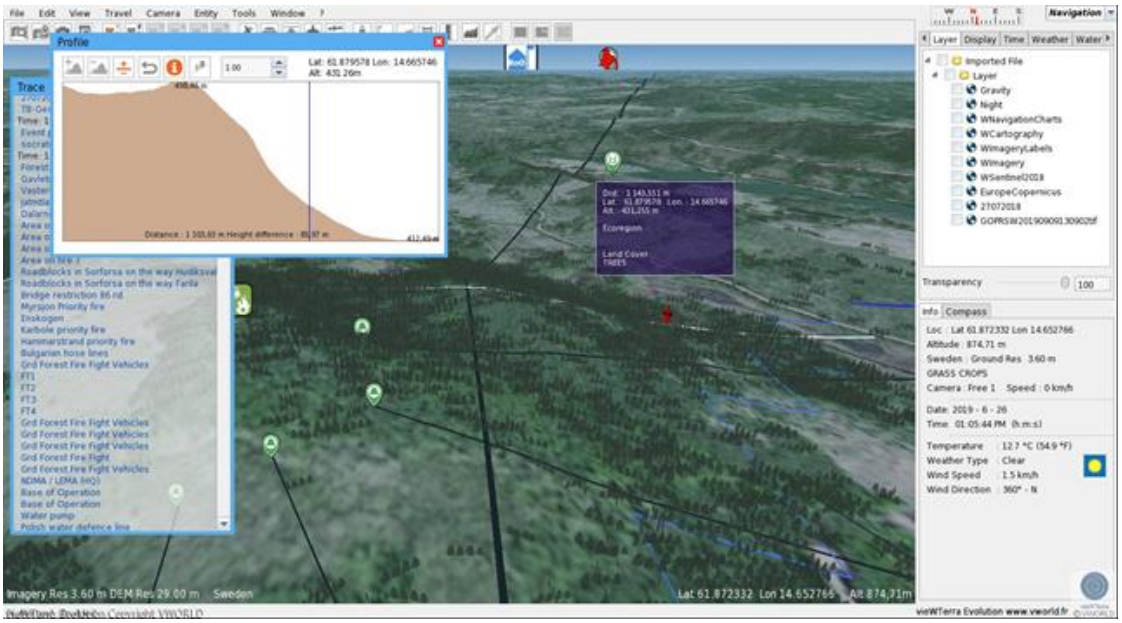
Socrates OC (provided by GMV, Spain), serving as primary COP, performing the following main functions:

- COP tool with geographical focus.
- Enable map-based situation management related to hazards, infrastructure and resources.
- Share its COP with other solutions (CrisisSuite, vieWTerra Evolution).

View on Final Demo Socrates OC map situation

vieWTerra Evolution (provided by VWORLD, France), performing the following main functions:

- Display 3D model of area.
- Display Socrates OC map situation in 3D view.
- Enable terrain analysis.



vieWTerra Evolution 3D map of the Final Demo situation

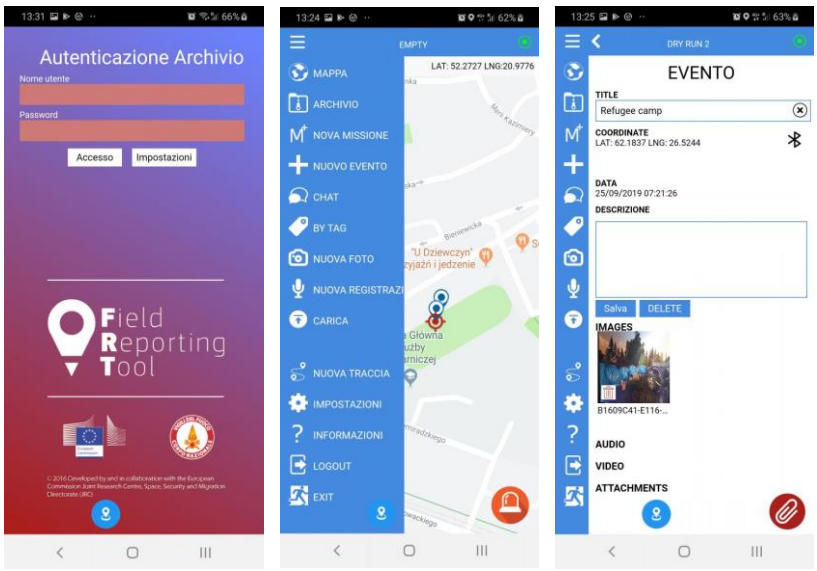
Drone Rapid Mapping (provided by Creotech Instruments; Poland), performing the following main functions:

- Process drone data for generation of high resolution orthophoto maps as images of WMS layers.
- Process drone data for generation of high-resolution 3D terrain models (photogrammetry).

3D visualisation generated by DRM from drone images *(left)* **and DRM processing unit** (right)

Field Reporting Tool (provided by Joint Research Centre; European Commission), performing the following main function:

- Send geo-located pictures, voice messages and text reports from the field.



Field Reporting Tool solution used by simulation team to generate field reports
(1: logging screen; 2: general map view; 3: report creation view)

4. Results

The results are structured along three dimensions: the Trial dimension, the solution dimension and the Crisis Management dimension. The **Trial dimension** relates to the Trial organisation: everything that has to do with the Trial run in very "hands-on" manner is part of this dimension. The **solution dimension** tackles all functionalities as well as the usability of each solution that is trialled. The most important dimension is the **Crisis Management dimension**, because this is looking at the potential impact a solution has on the selected CM gaps.

4.1 Trial Dimension

The data were collected with questionnaires, which were filled in by the practitioners (ERCC, EUCPT and CP Modules) and the observers. The major outcomes related to the Trial dimension confirm that the

participants' number, background and commitment supported the FD adequately. The main organisational challenge was the practitioners' time they can devote to the execution of the scenario. Furthermore, the Test-bed Technical Infrastructure and its components worked well without major issues.

4.2 Solution dimension

The objective of this evaluation in the solution dimension is, for each innovative solution, to provide a detailed answer to the question "Does the selected solution fulfil the expected functions during the Trial?" In order to focus strictly on the gaps selected for the Final Demo, not all of the solutions' functionalities were evaluated.

***CrisisSuite*:** The solution was primarily used for logging actions and decisions, sharing information (logbooks) vertically and horizontally within the chain of command, and generating reports. It also replicated the situation map. Practitioners rated CrisisSuite as having a great potential, and it was highly appreciated for its ease of use. The ability of CrisisSuite to log decisions and support sharing of information was positively perceived by the practitioners.

***Socrates OC*:** The solution was primarily used for the map-based management of the situation and the resources. Socrates OC was recognized as a promising solution and easy to use. Its map view provided useful detailed information to the practitioners.

***vieWTerra Evolution*:** The solution was primarily used for its capability of 3D visualisation of the terrain and situation, and the corresponding 3D analysis. VieWTerra Evolution was perceived as a promising solution and much appreciated for the support it provided to the very specific task it was used for (positioning of Base of Operations and planning the water supply lines).

Drone Rapid Mapping: The mobile processing unit enabled acquiring 3D maps and 2D hi-resolution shareable layers of areas of interest from imagery acquired by a light drone. Its products allowed a better understanding of a terrain even before the Module arrived in the area. The solution received strong positive feedback on its ability to provide information faster, more reliably and in more detail than currently possible. Overall, the solution was praised for its potential and innovativeness.

Field Reporting Tool: The solution's main role was to share reports (georeferenced photographs with commentary) from the refugee camp to vieWTerra Evolution and CrisisSuite solutions. As the Final Demo was an indoor event, the actual use of FRT was limited to the use of the outcomes of this solution by the practitioners.

Overall, the solutions provided the expected functions. Additionally, the Final Demo provided useful and practical feedback to solution providers for specific task oriented adaptations enabling their solutions to be implemented fully operationally.

The whole set of solutions and their interoperability was perceived as a rather positive support to the overall tasks to be accomplished, especially in terms of speed. Although information was spread or duplicated among several solutions, practitioners got a clear picture of how information was shared. Generally, the high maturity of the individual solutions was probably a success factor.

4.3 Crisis Management dimension

The main outcomes in the Crisis Management dimension are that the trialled solutions demonstrated their potential to facilitate closing Gap 1 'Shortcomings in interoperability in the ability to exchange crisis-related information among agencies and organisations' and contributed to closing Gap 2 'Lack of a Common Operational Picture to integrate data sources and calculation results from different models crucial for the decision-making process' and Gap 3 'Limitations in the ability to merge and synthesise disparate data sources and models in (near to) real time to support decision making'. These observations are limited to the Trial specific conditions.

For the **information exchange between the ERCC and the EUCPT** there is some added value observed on the EUCPT site. The innovative solutions demonstrated to bring some extra potential in the formatting criterion in case of reusing briefing materials received before deployment from the ERCC. This improvement costs a bit more effort of the ERCC, however, this extra effort is most likely to be reduced when the ERCC would have been able to better familiarize with the new solution.

In the **communication flow** from the EUCPT to the ERCC being realized in a form of Situational Report, the innovative solutions show some extra potential regarding usability and structure. The ERCC regarded the innovative solutions more usable than the current legacy tool; however, at the same time the EUCPT has to dedicate more effort to use the solutions in order to produce the SitRep. This could be caused by a potential lack of sufficient training and familiarisation.

As it comes to the effort dedicated by the EUCPT on **structuring the SitRep**, the new solutions provide added value by reducing this effort, and at the same time the SitRep is perceived by the ERCC as better structured compared to using the legacy tool. These conclusions mainly cover the use of CrisisSuite. It is worth to underline that the SitRep produced by the current legacy tool is still meeting the expectations from the ERCC. The main room for improvement seems to be on reducing the EUCPT effort needed to generate and share the SitRep.

When looking at the **information exchange between the EUCPT and the Modules**, it can be stated that the information flow to the Modules is perceived as very beneficial. It requires lower efforts by the EUCPT and leads to a higher result for the Modules. It demonstrates high potential of the innovative solutions during briefings for the Modules which is currently not always fully clear and structured. The information flow from Modules to the EUCPT is perceived less beneficial. However, the feedback of the practitioners suggests that the innovative solutions for the status updates from the Modules to the EUCPT have a high potential.

5. Answers to the main Research Questions

RQ 1.1: How to combine information from different operating actors to increase EUCPT and EUCP Modules situational awareness?

During the Final Demo the common information environment was created by the solutions CrisisSuite, Socrates OC, vieWTerra Evolution and the Field Reporting Tool. For the purpose of assessing the potential of the trialled solutions, taking into account that information varies considerably in form, the information flow was validated according to the following criteria: usability, editability, formatting, searchability, structure, visualisation, and relevance of produced and received information.

For the preparation and sharing of the initial briefing documents, the efforts appeared to be higher compared to the use of legacy systems. At the same time, the benefits were perceived as rather low when using the innovative solutions. The main reasons seem to be: (1) the variety and flexibility of the legacy systems (technical, organisational), (2) the fact that the innovative solutions were not fully adjusted to the needs, and (3) the lack of (training) time to familiarise with the solutions. This reinforces a strong natural habit of using the legacy tools which are commonly utilised in working routine.

The innovative solutions were recognized as having an added value by making the information easier to edit for own purposes. The *editability* showed decreasing effort on producing and giving the briefings. Furthermore, the briefing materials were assessed as better by those who receive it (in the sense that these were easier to be further edited). Moreover, almost all of the surveyed criteria indicated a high potential of the innovative solutions to be used in communication. Even though, the *effort* dedicated to produce information and the *effort* to digest briefing information are in all cases (besides above mentioned *editability*) higher. The result, understood in terms of how the information facilitates an action, is perceived as much better. This indicates a high potential of the innovative solutions for improving the quality and efficiency of briefings organized at operational level.

RQ 1.2: How to optimise communication between descending and ascending (taking over) EUCP Teams?

The innovative solutions facilitated an adequate and efficient transfer of information to the upcoming teams before a new EUCPT deployment. It provided the opportunity to be better prepared for the mission as well as decreased time pressure and potential stress when preparing for the mission. The results show that the innovative solutions did lead, in most cases, to a higher increase of the perceived *results* (benefits) with only a slight increase of the required *efforts*. This suggests that if the practitioners would use the innovative solutions during a longer period, gaining more experience in operating them, the effort could be comparable (or even less) to producing information in a legacy system, while the final product could bring higher added value on the side of the receiver.

RQ 2: How to optimize EUCPT to ERCC situation reporting?

Situational reports are a form of regular information exchange. Optimising the reporting process should be based on efficient preparation of a set of data which could be transferred between EUCPT and ERCC. This could be realised by the systematic collection of all data during the entire mission cycle, analysing them (e.g. in order to filter the important ones), processing them into more adequate information (e.g. by producing informational synergies better matching the receiver's requirements) and presenting them in the best possible way in a structured form. Using CrisisSuite appeared very promising in this respect.

The main findings suggest that the SitRep needs from the ERCC are met by both the legacy system and the innovative solutions. However, the perceived *efforts* for the EUCPT working with the innovative solutions have increased significantly, although the data suggest that a learning effect lowers this increase.

RQ 3: How can access to recent geoinformation data and related analytical products affect the decision-making processes of EUCP Modules team leaders?

The exchange of the status updates with a possibility to use geoinformation, seems to offer only limited added value. In most cases the efforts to generate the messages are perceived lower, while the perceived benefits have decreased. However, the practitioners recognised that the trialled solutions bring some added value in *structuring* the information prepared as a status update. This is based on the observation that there was less effort dedicated by the EUCPT in using the innovative solutions to structure the information product, which actually brought better results to the Modules when they arrived on the scene. Moreover, the innovative solutions provided added value by making the process of searching for specific data easier, while the needed effort remained the same.

6. Conclusions and policy recommendations

The FD has met its objectives by the active involvement of Crisis Management practitioners at the EC-level in searching for the innovation that meets their expectations. Trialling five promising solutions in the context of a cross-border crisis allowed the practitioners to test the solutions in a close to real environment. The Test-bed proved a useful environment to plan and execute the FD in line with the TGM. The FD has led to collecting data which enabled answering a set of research questions and through that proved the solutions' innovative functionalities which revealed to cover the identified gaps to certain extent.

The results clearly indicate the potential of the innovative solutions to improve communication between EUCPT and CP Modules. The improvement in quality of communicated information and efficiency of information exchange would be relevant to the provision of an initial set of information, regular briefings for Modules, and a rapid provision of situational updates. The appropriate developments should in particular focus on adoption of common interoperability standards for information exchange. They should also aim at optimisation of user interfaces and information processing methods to decrease effort required from the operator. Using new solutions in information management could also optimise the time spent by the EUCPT and/or CP Modules while travelling to the disaster stricken country. Having a common information space shared by multi-stakeholders will work out for a better situational awareness through a common operational picture shared by all involved actors.

The Trial Guidance Methodology may be applicable for the evaluation of the civil protection exercises and training courses, as it helps to make the evaluation results more objective. Furthermore, such systematic evaluation process could support the planning of upcoming UCPM exercises and training courses, especially in respect to following up on lessons identified. Elements of the TGM and its systemic approach may also be used for the purpose of conducting evaluations of real civil protection and humanitarian aid missions, facilitating the conduct of lessons learnt sessions.

The Final Demo findings address mainly two EU policies the UCPM is involved in:

- **Civil protection:** the Commission coordinates the response to disasters worldwide by pooling civil protection resources from countries in the EU Civil Protection Mechanism.
- **Humanitarian aid:** aid is delivered to victims of humanitarian crises and disasters based on the needs of affected populations by funding humanitarian projects carried out by non-governmental humanitarian organisations, UN agencies and the Red Cross.

Within this scope it is possible to formulate recommendations related to optimisation of information exchange among different UCPM elements.

a) Establishment of a dedicated IT system aimed at facilitating information exchange between EUCPT and UCPM Modules should be considered as an element of establishing the rescEU capacities in line with the relevant Commission Implementing Decisions. To ensure maximum efficiency of such a system, the appropriate technical interoperability standards should be defined and operational procedures for its use should be developed.
b) The EUCPT–ERCC information exchange may benefit from the establishment of such a Common Information Space. The effectiveness of communication between these entities is already very high and the expected improvement would be mainly related to decreasing effort on information processing and report preparation in the EUCPT. The appropriate requirements should in particular emphasise optimisation of user interfaces and information processing methods.

Improvement of the information management processes by more effective preparation and exchange of information products on both operational and strategic levels will have a direct positive influence on the efficiency of UCPM response as a whole.