*Driv*ing Innovation in Crisis Management for *E*uropean *R*esilience

D43.31 - Crisis dynamics & early warning Experimentation Report

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Document Information

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List of Acronyms

Abbreviation / acronym	Description
CM	Crisis Management
COP	Common Operational Picture
DEWS	System for Tsunami Warning
EmerT	Emergency Mobility of Rescue Forces and Regular Traffic
EMM	Europe Media Monitor
ESS	Emergency Support System
GCS	Ground Control Station
GDACS	Global Disaster Alert and Coordination System
MEGO	Floods Modelling tool
PROCEED	Situation analysis tool
RIB	Decision support database
SITRA	Tools suite for situation reasoning
SOS	System of Systems
SUMO	Simulation of urban mobility
U-FLY	Ground control station (GCS) for Remotely Piloted Aircraft (RPV)
ZKI-Portal	Center for Satellite Based Crisis Information

Project Description

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

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

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

DRIVER Step #1: Evaluation Framework

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

DRIVER Step #2: Compiling and evaluating solutions

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

DRIVER Step #3: Large scale experiments and demonstration

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

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

Executive Summary

This report summarizes the first DRIVER SP4 experimentation round (the Initial Inventory of Solutions), which took place in November 2014 in Aix-en-Provence, with a focus on the T43.3 "Crisis dynamics & early warning" task.

The crisis evolution is a specific part of the crisis lifecycle. It starts in a small temporal interval near the crisis genesis (e.g. when a tropical cyclone forms in the open sea or when an earthquake generates a tsunami wave) and lasts until the restoration process follows the emergency relief operations.

Observing the crisis in the most severe initial part and coordinating the procedures necessary to mitigate its effects require the management of a flow of information that must be integrated with an existing knowledge of the territory and the population. This information has to be redistributed to the operators and the population not only through the media.

A very specific and paramount part of this process requires the capacity to reach the population at the beginning of the crisis evolution to make it aware of the involved risks and to help taking measures to reduce the damages to people and resources.

Where possible, these solutions must be part of a system of systems and help it to produce a common space of information, where decision makers can negotiate the exchange of information and redistribute the relief effort amongst the involved actors.

A vital part of such a system are tools able to model the evolution of natural disasters. Originating from the scientific community, this kind of tools required big integration efforts in the past. Adopting standard data formats and providing common programming interfaces allowed an easier exploitation by the disaster relief community. A few examples of modelling tools were also evaluated.

The initial inventory of tools helped identifying the initial set of solutions to be involved in Experiment 45 with the working title Understanding Crisis Dynamics: An Assessment of Solutions for the Analysis of a Crisis from Early Warning to Recovery Phase, **an extensive experiment which will span from 2016 to 2017 and will benchmark many ICT solutions when applied to the described tasks, and which will also invite other solutions provided not only by DRIVER partners.**

The capabilities of the following solutions were presented during the Initial Inventory of Solutions:

- **ATOS DEWS**
- **HKV MEGO**
- **HKV SUCCESS**
- **HKV EvacuAid**
- **JRC Crisis Wall**

As well as others the evaluators considered relevant for the task:

- **SITRA**
- **ESS**
- **Dashboard App**
- **EmerT-Portal**
- **ZKI-Portal**
- **SUMO**

The deliverable also analyses the feedback received from the different evaluators and discusses the possible experiments for the second round and the synergies with other DRIVER solutions.

1 Introduction

1.1 Scope

The purpose of this document is to report on the experiment related activities conducted in SP4 and more specifically by T43.3 Crisis dynamics & early warning during the first round of experiments (before MS1). During this first round, conducted in November 2014, a specific session has taken place to present all solutions that are related to Task 43.3. Solution features have been evaluated by different project partners or end-users. This was decided to enable the validation and presentation of solution related features on the one hand, and to develop ideas and concepts between different solutions on the other hand.

As a result of this exercise, more than a superficial knowledge of the solutions available in DRIVER, the sub-project acquired a better understanding of the interactions between the different tasks, and how different solutions can participate in a system to strengthen the response capabilities of member states organizations.

From this initial inventory, a selection of tools will participate in the next experiment: this selection helped choosing other tools, which will be invited to join the experiment.

1.2 Document overview

This document contains the following chapters:

- A first chapter gives this introduction to the document,
- A second chapter discusses the topic of the task "Crisis dynamics and early warning",
- A third chapter presents the results at Task level, and
- A fourth chapter presents the conclusions that are derived from the round of experiments.

1.3 Reference Documents and Standards

This report refers to the following documents:

D41.1.1 Initial Inventory of Solutions - SP4 level report

Solution descriptions: see DRIVER Space
→ SP4 → _SP4 Solutions very short descriptions:
https://driver.atosresearch.eu/index.jsp?uuid=fb8f9121-45cd-47cc-927d-ce7f37be2881
→ SP4 → SP4 1st Initial Inventory of Solutions (Aix) → Solution Descriptions
https://driver.atosresearch.eu/index.jsp?uuid=0f36372a-56d1-4c1c-82f4-e58d26e47da7

2 Crisis dynamics and early warning

This paragraph discusses the content and relevance of Task 43.3 with regards to Crisis dynamics and early warning.

2.1 Task Description

According to the Description of Work (DOW), Task 43.3 Crisis dynamics and early warning addresses the need to predict the impact and to assess risks of approaching hazards (for preparedness and reaction) and to provide reliable early warning, in particular:

- Translation of monitoring information, results of modelling and simulation and scientific advice into actionable information for emergency management users;
- Impact estimation on people, environment, infrastructure and economy;
- Solutions for planning, authorisation and distribution of a public warning and warnings to critical infrastructure-operators and enterprises working with dangerous goods.

Planned experiments within the scope of T43.3 are:

- Hazard prediction and impact estimation within an earthquake scenario;
- Early situation awareness and early warning within a tsunami scenario.

2.2 Crisis dynamics and early warning concepts

Every crisis will evolve according to its nature, unpredictable to some extent. A prompt and complete flow of information is not always enough to manage a crisis: The Information has to be combined with a forecast of the evolution of events and the knowledge of the territory that is affected by the disaster.

Many different solutions can be combined in order to monitor the situation, to organize the response and to make all this effort visible and understandable.

Data is collected by various means (human or sensor based direct observation, aerial or satellite observation, media monitoring). This requires harmonization of the data formats, or the integration effort would be too big and time or cost ineffective.

Solutions are needed to combine this flow of information, in order to show it in a simple yet complete common operational picture. This picture needs to be exploited by different kinds of actors with different needs and interpretation of the information. On top of this, the situation, or at least some of its aspects, can be modelled and forecasted: this is a valuable complement of the real data and can be used to improve the relief effort. Its reliability has to be scientifically proven, though.

This kind of integration solutions requires also generating outputs easily consumed by the media and other systems to warn the population.

This task is not aiming at providing a set of components to be integrated in a crisis management system, but at developing a practice of solution assessment able to highlight the winning points of a solution. When a solution is tested, it has already proven its quality. The task is not interested in parading solutions together with a basic evaluation, but to provide users with a deeper knowledge of its key features in order to help them understand how fit it can be to integrate in their solution.

Such an assessment cannot be performed during a few days exercise: it requires a longer amount of time devoted to the use of the solution in real or real-like conditions.

This is the basis of Experiment 45, designed on top of this experience, that will be performed in about eight months between 2016 and 2017.

2.3 Related operational needs

This paragraph discusses the way, various projects or stakeholders have mentioned, and validated the needs addressed by Task 43.3.

The solutions related to this task should tackle the following gaps as defined by ACRIMAS project [2]:

- **Early warning capabilities;**
- **Understanding specific crisis dynamics;**
- **Demand and needs assessment;**
- **Acquisition of information from external sources.**

It is interesting to note that these needs have been also identified by other studies.

The CRISYS project (cf.[5]) has identified 8 main capabilities out of which two are particularly relevant to the Task 43.3:

- **Situational awareness: Collect and present relevant static and dynamic information about the incident;**
- **Communication: Exchange information between citizens, rescue workers and authorities.**

This also is an axis of improvement and technological evolution identified in DRIVER's D41.21 Vision **on Response 2025 (cf. [3]) and D41.22 First stage SOTA (cf. [4]).**

3 Task experiment report

All the solutions available in Sub-Project 4 (SP4, Strengthened Responders) were presented and evaluated during the Initial Inventory of Solutions in Aix-en-Provence (at Pôle Risques) from Nov. 24th – 28th, 2014.

A summary of this week and general conclusions are factored out and summarized in a common document [1].

3.1 Evaluation sheet structure[1]

The solution features related to task T43.1 are described and evaluated as following:

Task	Feature	Sub-Feature
T43.3 Crisis dynamics & early warning	Translation of info into actionable info for EM users	Monitoring information
		Modelling, simulation and scientific advice
	Distribution of warnings (public and to operators of critical infrastructure and enterprises)	preparation of warnings
		authorisation of warnings
		distribution of warnings

Table 1 Solutions' evaluated features

3.2 Solutions involved

According to the agenda, the following presented solutions are considered as relevant for T43.3 (covering features of the task):

Solution	Provider	Session	Evaluators
DEWS	ATOS	T43.3	TNO, THW, IAO, DLR, TCS
The DEWS system receives information from open distributed multi-sensor platforms, processes it and supports operators to decide whether an early warning must be issued. Being modular, it integrates with different sources, models and means of publications.			

[1] Evaluators' names are not mentioned in this public deliverable due to privacy reasons, but are known to the consortium partners.

Solution	Provider	Session	Evaluators
MEGO	HKV	T43.3	TNO, THW, IAO, DLR, TCS
MEGO creates a flood extent area based on user estimates for dike breaches, calculates maximum depth, which transport lines will be affected and where shelter can be found.			
SUCCESS	HKV	T43.3	TNO, THW, IAO, DLR, TCS
SUCCESS is a flood defence warning and information system It features structured situational data overview and early warning information on water, weather, dikes, and evacuation			
EvacuAid	HKV	T43.3	TNO, THW, IAO, DLR, TCS
EvacuAid is a decision support solution for evacuations It gives insight in effectiveness of different evacuation strategies			
CrisisWall	JRC	T43.3	TNO, THW, IAO, DLR, TCS
CrisisWall gathers live data from various sources of crisis information and stores it. The sources include GDACS, EMM, ECHOFLASH. A web client allows the user to search, filter, group and organize this data into events. This web client is tailored specifically for use on a large wall touch screen. Users can also create events directly, add analysis and populate them with items. Event reports can be generated and shared and data from the CrisisWall can also be viewed through mobile applications.			

Table 2 Selected solutions

Based on the providers' descriptions, the following solutions provided at least some of the mentioned features for Task 43.3. The reviewers rated them as well, and the results will be presented here.

Solution	Provider	Session	Evaluators
SITRA	FOI	T43.1	TNO, THW, IAO, DLR, TCS
SITRA is a tools suite for situation reasoning and risk assessment. (Risk-) models are used in combination with an ontology based reporting tool to collect relevant information in a structured way. Information gathered from the field is displayed on a map and in the form of tables. Information is also summarized per geographical area.			
ESS	GMV Sistemas	T43.4	TNO, AIT, MSB
The Emergency Support System (ESS) is a suite of real-time data-centric technologies which will provide actionable information to crisis managers during abnormal events. This information will enable improved control and management, resulting in real-time synchronization between forces			

Solution	Provider	Session	Evaluators
on the ground (police, rescue, firefighters) and out-of-theatre command and control centres (C&C).			
DASHBOARD	HKV	T43.4	TNO, AIT, MSB
DASHBOARD is an app for public warning That is transferring actual risk information to the public.			
EmerT-Portal	DLR	T43.1, T43.2, T43.3, T44.2, T44.4	MSB, THW, WWU, Pole Risque
The EmerT-Portal is a web-portal developed within the Delphi and VABENE projects of the German Aerospace Center (DLR). With EmerT it is possible to visualize the current traffic situation using different traffic sources (aerial images, inductive loops, Floating-Car-Data etc.). The traffic data can be used as basis to simulate and predict traffic and for supporting the decision process for traffic management actions in case of an incident or planning a big event.			
ZKI Portal	DLR	T43.2	MSB, THW, WWU, Pole Risque
The Center for Satellite Based Crisis Information (ZKI) presents a service at DLR. It provides a 24/7 service for the rapid provision, processing and analysis of satellite and airborne imagery during natural and environmental disasters, for humanitarian relief activities and civil security issues worldwide. The resulting satellite and airborne based information products are provided to relief organisations and public authorities and are mainly freely available on the ZKI website. According to the requirements of the user, the information products are delivered in the form of maps, GIS-ready geodata or dossiers which are then used to support disaster management operations, humanitarian relief activities or civil security issues. The ZKI is ISO 9001 certified.			
Sumo	DLR	T44.2	MSB, THW, WWU, Pole Risque
SUMO is a microscopic and open source road traffic simulation. In SUMO it is possible to simulate vehicles, pedestrians, traffic lights and multimodal mobility. In principle, SUMO requires a road network that includes road-side infrastructure, such as traffic lights, and a traffic demand for performing a simulation. Given both, the simulation SUMO moves the vehicles from the start position of their route to their end position. SUMO is a development of the Institute of Transportation Systems at the German Aerospace Center. The first concepts were developed in the year 2000 and the first public release was done in the year 2002.			

Table 3 Additional solutions

3.3 Inventory results

3.3.1 Solutions feature coverage overview

Table 4 shows all solutions covering features of task T43.3.

dark green=FULLY COVERED and DEMONSTRATED; light green=COVERED ACCORDING SOLUTION PROVIDER BUT NOT DEMONSTRATED, yellow=PARTLY COVERED, white=NOT COVERED		Task session	T43.3: Crisis dynamics & early warning					T43.1: Damage and Needs Assessment	T43.4: Interaction with citizens		T44.2 Tasking and capacity monitoring	T43.2: Airborne Sensor Processing	
		Solution supplier	ATOS	HKV	HKV	HKV	JRC	FOI	GMV Systemas	HKV	DLR	DLR	DLR
		Tool name	DEWS	MEGO	SUCCESS	EvacuAid	Crisis Wall	SITRA	ESS	Dashboard App	EmerT-Portal	ZKI-Portal	SUMO
Task	**Feature**	**Sub-feature**											
T43.3 Crisis dynamics & early warning	Translation of info into actionable info for EM users	Monitoring information	Fully	Fully	Fully	Fully	Fully	Fully	no demo	Partly	Fully	Fully	
		Modelling, simulation and scientific advice											Fully
	Distribution of warnings (public and to operators of critical infrastructure and enterprises)	preparation of warnings	Fully	Fully	Fully	Partly	Fully		Fully	Fully			
		authorisation of warnings											
		distribution of warnings											

Table 4 Solutions' feature coverage

In the next sections, each solution will be presented together with the evaluation and the comments of the evaluators.

3.3.2 DEWS

The system is capable of continuously receiving relevant information from open distributed multi-sensor platforms, processing it and supporting operators, e.g. by use of a simulation system to forecast probable tsunami wave propagation, in order to decide whether an early warning must be issued. In the event of an early warning, the system is able to integrate relevant information packages on the fly, and distribute them to a multiplicity of actors dealing with crisis management and emergency activities.

Although current implementation is focused on tsunami warning, the system can be adopted to:

- Other geological paradigms / hazards: e.g., Fires, Landslides, Floods, Volcanic eruptions, etc;
- Other areas / regions: e.g., Mediterranean and connected seas.

So to realize these aims, a modular service and events oriented architecture with standardized interfaces has been designed and implemented. This has been achieved by using open standards as well as by integrating free and open source software wherever possible which allows:

- Supporting the flexible integration of different types of sensors into the sensor integration platform by using the set of standards and concepts defined by the Sensor Web Enablement Initiative (SWE) of the Open Geospatial Consortium (OGC);
- extending the graphical user interface, the simulation systems and situation picture components can be extended with hazard specific functionality in the decide-and-act segment;
- Including information logistics functions for the customisation and dissemination of warning messages by incorporating standards of the Organization for the Advancement of Structured Information Standards (OASIS) in the downstream segment;
- Communicating warning messages by means of the Common Alerting Protocol (CAP) and the Emergency Data Exchange Language – Distribution Element (EDXL-DE) in the downstream segment.

The key operational functions of the early warning system are to support real-time monitoring, timely decision making, and customised dissemination of warnings messages. Thus the overall information flow includes three segments:

- Upstream: Acquisition of sensor data and transmission to the warning centre including processing and event detection;
- Decide-and-act: Information flows within the warning centre including situation analysis, decision support and warning dissemination planning;

- **Downstream: Preparation of customised tsunami (or other risks) messages for the dissemination via selected channels to different stakeholders (e.g., civil protection authorities, police, rescue teams, citizens, etc.).**

3.3.2.1 Explicit feedback tables

Feature	Sub-Feature	ATOS DEWS	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Translation of info into actionable info for EM users	Monitoring information	Tool can be connected to sensor networks in order to receive real-time observations using OGC SWE standard (SAS, SOS, WNS). It can also receive EDXL-DE/CAP messages from compatible warning centres. Information is displayed in form of features over a map, time series graphs and tables.	Yes	3	7	TNO Not relevant for large parts of Europe
	Modelling, simulation and scientific advice	Currently adapted for tsunami simulations (although extensible for other type of simulations such as fires, etc.). It displays current wave front and supports operator to determine expected zones of impact, ETA, wave height. Various wizards to support for decision-taking (e.g., based on tsunami simulation, NEAMWave				DLR2 Is it a model or a lookup table? The selection of nearest neighbour instance and user needs to manually enter wave heights Should be validated model

Feature	Sub-Feature	ATOS DEWS	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
		decision matrix for issuing warning) to decide whether or not to issue a warning.				
Distribution of warnings (public and to operators of critical infrastructure and enterprises)	preparation of warnings	Based on predefined message templates (in various languages) with place holders for dynamically generated information specific of current event (e.g., location, ETA, etc.)	Yes	3	7	DLR2 Good that there is an operator check
	authorisation of warnings	Distribution of warnings dependent on role of the person receiving it. Some warning messages require revision and manual acceptance before the tool issues it (again, depending on the role of the recipient).				DLR2 But is forecast operator a warning operator? Not as far as I know
	distribution of warnings	Warning messages can be distributed through several channels: email, fax, sms, ftp, social media, rss. Original warning message is issued using CAP format (including text, maps, documents,				DLR2 Who is the authority in charge of alerting?

Feature	Sub-Feature	ATOS DEWS	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
		O&M data, etc.), which depending on the dissemination channel can be embedded in the message. Alternatively it can issue standardized tsunami warnings (see NEAMWave example).				

Table 5 DEWS evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
MSB3	Impressive tool. Sensor driven, follows standard protocols.		
TNO	Useful tool for warnings in tsunami risky countries Anyway, elaborate the follow-up by MS-NCCIS!	2 ½	
DLR2	Technological level of the tool is pretty advanced Useful tool in the early warnings - usability is very dependent on the validity of the model - you could think of including performance measuring (false alarms, miss hits) - it is an expert system and it is not a problem that the GUI is complex. it is ok to need training. But make sure it is used often	2/3 I like it a lot Is this a tool to replicate?	Simulations can be used in the experiments Should be part of the forecasting suite

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
IAO	Good tool for aggregating sensor information, do simulations and to issue warnings/information to different affected regions via various channels.	3	

Table 6 DEWS remarks

3.3.2.2 Statement of the solution provider

Unfortunately no statement is available.

3.3.3 MEGO

MEGO creates a flood extent area based on user estimates for dike breaches, calculates maximum depth, which transport lines will be affected and where shelter can be found.

3.3.3.1 Explicit feedback tables

Feature	Sub-Feature	HKV MEGO	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Translation of info into actionable info for EM users	Monitoring information	Provides maps of disaster area, based on predefined (and analysed) scenarios. Actual maps (from rescue workers) may be added. Basically the maps provided are	Yes	2	8	DLR2 How can additional data be incorporated? DLR3 Very sophisticated impression.

Feature	Sub-Feature	HKV MEGO	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
		analysed and validated data.				
	Modelling, simulation and scientific advice	Provides maps based on computer simulation of the disaster which can be combined into a complex scenario (i.e. it includes flood scenarios based on a single levee breach; combining these results in complex scenario with multiple levee breaches). Actual map layers (i.e. from rescue workers) is added.	Yes	2	7	
Distribution of warnings (public and to operators of critical infrastructure and enterprises)	preparation of warnings	Compound maps of disaster are shared over the internet.	Partly	3	8	
	authorisation of warnings	Distribution of the situational awareness by passive sharing the compound maps. No active distribution of warnings.	Partly	3	8	
	distribution of warnings	Information is published and thereby available to crisis partners and public (no active warnings).	Partly	3	8	

Table 7 MEGO evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
DLR2	- Very advanced level of maturity - Display is clearly structured and easy to understand - What kind of up-to-date data is involved?		Possible contribution to training? Scenario design?
DLR3	Very mature level from what was shown. Possible online/live use is not clear to me.	3	Combination with traffic analysis systems seems to be useful, or even other data (airborne gathered etc.). Otherwise useful component for scenario analysis.
MSB3	It is in operation and focuses on early warning. Not redundant if there is a lack of Internet connection?	3	Have been developing integration with open data. They are somewhere in between the systems Dews and PROceed, if you try to group the systems in clusters.
TNO	Disadvantage: only expected flooding are precalculated. So: is it useful outside NL? Approach: OK	2 Is it validated for non-Dutch situations? Floodings in mountainous areas.	Useful for back office purposes during flooding. Aspect of warning could be improved; I miss an outcome related to warning.

Table 8 MEGO remarks

3.3.3.2 Statement of the solution provider

Unfortunately no statement is available.

3.3.4 SUCCESS

SUCCESS is a floods, flood defence warning and information system. It features structured situational data overview and early warning information on water, weather, dikes, and evacuation.

3.3.4.1 Explicit feedback tables

Feature	Sub-Feature	HKV Dashboard SUCCESS	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Translation of info into actionable info for EM users	Monitoring information	Dashboard contains 1. water level/discharge monitoring and forecasting, 2. weather information feeds (not implemented in tsunami demo version) 3. dike and flood defence: dike status, visual inspections and calculations (calculations not implemented in tsunami demo version)	Yes	3	8	DLR1 Possible additional information, like traffic / logistic information, areas to be evacuated in 1-2 hours, location of responder stuff could be integrated.

Feature	Sub-Feature	HKV Dashboard SUCCESS	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
		4. evacuation status and status update 5. potential other info: webcam, all sorts of manually entered data, text, images, twitter feed (not implemented in demo). All information feeds are preconfigured				
	Modelling, simulation and scientific advice	Provides maps based on computer simulation of the disaster which can be combined into a complex scenario (i.e. it includes flood scenarios based on a single levee breach; combining these results in complex scenario with multiple levee breaches). Actual map layers (i.e. from rescue workers) is added.				TNO Dike modelling has to be improved?
Distribution of warnings	preparation of warnings	Compound maps of disaster are shared over the internet.	Yes		8	DLR1 if you can take the current traffic and forecasted traffic

Feature	Sub-Feature	HKV Dashboard SUCCESS	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
(public and to operators of critical infrastructure and enterprises)	authorisation of warnings	Distribution of the situational awareness by passive sharing the compound maps. No active distribution of warnings.				situation, may be evacuation routs / directions could also be distributed.
	distribution of warnings	Information is published and thereby available to crisis partners and public (no active warnings).				

Table 9 SUCCESS evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
DLR1	professional tool	3	Shows potential to be combined with further functionalities from other DRIVER tools (traffic / logistic information, COP, etc.)
DLR2	Very mature tool that is already operational.	3	What else data could possibly be included in the system?
TNO		2	To be combined with IDIRA? DEWS?
MSB3	It is in operation and seems to be efficient at what it is aimed to do. It might be considered to treat the tools from HKV as a package.	3	Close to DEWS. Could possibly integrate with for example COP from Frequentis.

Table 10 SUCCESS remarks

3.3.4.2 Statement of the solution provider

Unfortunately no statement is available.

3.3.5 EvacuAid

EvacuAid is a decision support tool for evacuations. It gives insight in effectiveness of different evacuation strategies.

3.3.5.1 Explicit feedback tables

Feature	Sub-Feature	HKV EvacuAid	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Translation of info into actionable info for EM users	Monitoring information	Tool needs situation assessment from operator regarding: 1. lead time (time left for evacuation) 2. citizen compliance with decision 3. government readiness 4. infrastructural chaos/peace	Yes	3	6	DLR2 Could system support be added to the weighting of 1.-4.? DLR3 Can additional evacuation strategies be created? How are they defined? TNO Extend the decision support part.

Feature	Sub-Feature	HKV EvacuAid	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
	Modelling, simulation and scientific advice	Tool calculates expected success rate of evacuation as well as expected casualties for several evacuation strategies regarding the situation as entered by the operator. Information is to be used when taking evacuation decisions.	Yes	3	7	
Distribution of warnings (public and to operators of critical infrastructure and enterprises)	preparation of warnings					
	authorisation of warnings					
	distribution of warnings					

Table 11 EvacuAid evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
DLR2	Not clear how dependant the calculations are on the input data Sensitive data is involved	3 Tool seems usable, but the underlying model is a little bit unclear.	
DLR3	Underlying model is unclear. How are numbers calculated for such a sensitive topic like number of casualties?	3	
TNO	Good for planning purposes (risk mgmt.) wrt use in response situation, I think more analysis is required as well as usability for the decision makers should be determined. Validation from real evacuations and evacuation decisions should be done.	1-2	Support for backoffice
MSB3	It is used by professionals for making decisions about evacuations in case of flooding. It seems to be useful for decisions in different types of flooding emergencies, should you evacuate or not? And how should you evacuate? This tool can give you support. The overall impression of the tools from HKV is that there is a high level of potential to integrate with other systems and that the maturity is very high and that they are user friendly.	3	

Table 12 EvacuAid remarks

3.3.5.2 Statement of the solution provider

Unfortunately no statement is available.

3.3.6 CrisisWall

The main scope for the CrisisWall software is to exploit the large display and interaction surface of the large video wall. However, a principal design element of the software is collaboration, be it with several analysts in front of the video wall, or distributed analysts using different devices. Therefore, the CrisisWall software - or elements of it - should work on normal PCs, tablets, and smart phones, but also on surface tables and alternative devices.

The CrisisWall software is targeted to the principle emergency management tasks in a national or international crisis room, such as the European Emergency Response Centre. Driven by the outcomes of previous research and ECML experiments, the following tasks were identified as having the most potential to benefit from the CrisisWall.

- **Surveillance**
- **Activation: analytical tasks for an emergency**
- **Presentation**

Features provided by CrisisWall:

- **Real-time data gathering**
- **Sense-making: filter, search a COP**
- **Event management**
- **Consult COP (multi-platform)**
- **Collaborative analysis -> social graph**
- **Varied visualizations**

3.3.6.1 Explicit feedback tables

Feature	Sub-Feature	JRC CrisisWall	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Translation of info into actionable info for EM users	Monitoring information	Tool connects with other aggregators of information to exploit sensor readings' analysis and media monitoring	Yes	3	7	DLR3 External models are visible in item details. No own models identified.
	Modelling, simulation and scientific advice	The tool is fed by many different models, including Tsunami propagation, floods, cyclones and storm surge	Yes	3	7	DLR2 Not visible in the demonstration
Distribution of warnings (public and to operators of critical infrastructure and enterprises)	preparation of warnings					
	authorisation of warnings					
	distribution of warnings					

Table 13 CrisisWall evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
DLR2	The tool can contribute to the COP production in various ways. It is usable, but needs some time to be used by untrained user. A tutorial, or readme would be useful to understand "Crisis Wall" and to use it in an efficient way. The information view is sometimes slightly unstructured and overwhelming. To view information more dedicated to specific events could be useful. Also, to incorporate in the view information on what is important to a specific user could be could. A more structured display of information, filtered by severity or for example relevance to the user could help to see and understand information and information changes at a glance. Who is the dedicated user? End-user could probably rather be informed by a national mission manager, as the information are not always officially authorized.	3	Towards more shared understanding of CM Potential to integrate information coming from other tools (COP, SUMO, etc.)
DLR3	Nice use of Google Earth as display tool of newsfeeds. At first sight, it looks more like an informational tool for home uses. More features like forecasting and more diverse mapping/sorting should be useful for use in real crisis management. Highlighting/downgrading of single "news" could be used to build a system that displays the personal likes/needs.	2	
TNO	Monitoring at national level	2-3	Should be extend from ERCC to National Crisis

		Analysis/transcoding for own situation	Centres
MSB1	Very impressive visualisation capabilities of the information in the common operational picture. Good potential, the JRC backing can be important for the success of the tool. We look forward to a demo on site with full internet capacity and large screens.	3	This is the most obvious choice for a common operational picture tool on the highest level of aggregation in the project.
Pole Risque		2	

Table 14 CrisisWall remarks

3.3.6.2 Statement of the solution provider

After the good reception of the solution during the inventory experience in Aix, its development continued achieving the following results:

- The continued development of clients exploiting its API: web client, Android app, Windows Universal app.
- In order to improve the interoperability, new data formats and sources have been added. The procedure to add a new source was greatly simplified also thanks to a set of ready-to-use components.
- The use of standard icons from UN-OCHA has been enriched by colour coding them accordingly to the relevance of the displayed information.
- Part of the additional sources required then a refinement of the access control. The users are now classified based on their clearance to access specific information. This allows using the same system in different contexts, because sensitive information can coexist with publicly available information, not requiring the duplication of the system. Information can easily transit from one context to the other. Unauthorised users have no sensibility of the access restrictions.
- A special class of users has also been created specifically for unmanned systems: this feature is intended to auto login a client operating, for instance, in a situation room and displaying the information on a big visualization area.

All these features are presently used in our daily work and are completing the testing phase. In the near future, CAP and EDXL formats will be handled as well as the integration of other services.

There will be additional client applications for mobile devices developed during the year.

3.3.7 SITRA

SITRA is a suite of research prototypes tools which combines techniques such as adaptive situation based reporting, semantic technologies and risk modelling in order to improve situation awareness.

SITRA has three main components at current date:

- A mobile application for gathering data from the field
- A situational awareness operational picture (COP)
- A framework for risk models that can be used to predict events, get early warnings, identify information gaps, and assess risks. The content of the risk models is dependent on the users need and therefore will not be an explicit part of SITRA. However, a tool for creating risk models can be provided (Impactorium). In the experiment we use simple, layman created, risk models to show functionality.

An ontology is used as a basis for information exchange between the components. The formal definitions of terms available in the ontology are also used to generate situation based input forms in the mobile application. Data collected (by the mobile application) is feed into the operational picture. Individual data items such as incident reports as well as overlays representing risk types per geographic area are accessible from the COP. The risk values used in the overlays are calculated based on risk models. The risk models define how to calculate the probability, impact and risk for a risk event given a set of connected nodes where the nodes represent observable indicators or intermediate variables. The value/state of each indicator is based on relevant data that is available. The indicator value can either be sets manually or by a rule formulated using terms defined in the ontology. The risk model can potentially also be used to identify information gaps and prioritize information acquisition activities. The mobile app interface will reflect the current information need in terms of highlighting prioritized form fields and asking the user to report on certain matters.

SITRA can be configured to be used various crisis settings. The idea is that the risk models are developed by, or with the help of, domain expert and validated before put in use.

3.3.7.1 Explicit feedback tables

Feature	Sub-Feature	FOI SITRA	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Translation of info into actionable info for EM users	Monitoring information	The risk models will automatically be updated based on incoming information. The map, list and overlays will also be updated. The models can be used to get early warnings. The information in the system is available to support decision making and actions.	Yes	3	4	DLR1 Can be used for risk assessment in Preparedness & Planning DLR2 Aggregation and filtering to enhance the operators' situational awareness THW automatic updates can cause the loss of valuable info TNO The reasoning behind risk modelling is missing
	Modelling, simulation and scientific advice					
Distribution of warnings	preparation of warnings					

Feature	Sub-Feature	FOI SITRA	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
(public and to operators of critical infrastructure and enterprises)	authorisation of warnings					
	distribution of warnings					

Table 15 SITRA evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
DLR1	Professional research prototype.	2	Could be used to gathers online information from the field during a crises to provide input to the common operational picture.
DLR2	Very useful tool to support disaster management missions. Several features have a great potential. To cover certain cases (like power failure, multiple reports of the same incidents, etc.) further development is indicated. The map view is structured in a good way and clearly arranged.	3	Position within the DRIVER System of Systems (potential integration with..., complementary to...) Including pre-disaster information, as well as information collected by other partners could be a helpful feature

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
TNO	- End-user involvement lacks - Risk models lack any proof/validation - How to use this in an operational environment is not clear	1 ½ (see third bullet)	There is potential, e.g. wrt damage assessment based on info from the field.
IAO	Nice tool, however the model might need a validation in order to be of reliable use	2	
TCS	The tool is very promising. The usage of an ontology is a very good potential for the tool. Models have to be developed; capitalized and improved by the experiences on the field - which is not the easiest part to be organised.	3	
THW	Generally, an interesting tool, that can help to assess a crisis quicker. However: - What happens, when the infrastructure fails (Internet) - Privacy laws (pictures) - Assessment of quality of reports - Where is the info (maps) coming from?	Still relatively immature (1-2)	Could be used as an information gathering tool during a scenario based interactive experiment.

Table 16 SITRA remarks

3.3.7.2 Statement of the solution provider

SITRA is a research prototype and purpose of it has been to try out and experiment with technologies for enhanced situation awareness spanning the whole chain from information collection, processing and analysis, and presentation based on semantic technologies. The technologies used has to some extent been studied and applied in other domain such as military intelligence and port security. From a pure technological perspective, SITRA is relatively mature.

However, as the evaluators have pointed out, there are several concept aspects that are still relatively immature. For instance, the use of risk models in a crisis situation needs to be studied in greater detailed and validated before any conclusions can be made. Other areas that need more work are information quality aspects and information weighting.

SITRA is at current date generic and not tailor made for any specific scenario. In order to test and explore if concept is useful, we plan to configure the system to be used for a specific crisis scenario. We will also increase the involvement of domain experts and end-users in order to get the feedback needed to take the concept to the next level.

3.3.8 ESS

The Emergency Support System (ESS) is a suite of real-time data-centric technologies which will provide actionable information to crisis managers during abnormal events. This information will enable improved control and management, resulting in real-time synchronization between forces on the ground (police, rescue, firefighters) and out-of-theater command and control centers (C&C).

3.3.8.1 Explicit feedback tables

Feature	Sub-Feature	GMV Sistemas ESS	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Translation of info into actionable info for EM users	Monitoring information	Traffic information from road network sensors (ITIS)			6	
	Modelling, simulation and scientific advice					
Distribution of warnings	preparation of warnings	Alerting tool for SMS broadcasting through regular phone network	Yes	3	6	AIT1 The tool allows mass-sending the SMS and voice messages - even

Feature	Sub-Feature	GMV Sistemas ESS	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
(public and to operators of critical infrastructure and enterprises)		(ALCATEL) and network hijacking (IMSI Catcher)				in the situation where network is not available. AIT2 The tool allows to send mass SMS and voice messages. Unclear if they can be distributed to specific groups only. TNO Non-technical (how to communicate properly is not shown). MSB1 Towards human in the loop.
	authorisation of warnings	ESS alerts are considered authorized by the broadcasting systems.				
	distribution of warnings	Alerting tool for SMS broadcasting through regular phone network (ALCATEL) and network hijacking (IMSI Catcher)				

Table 17 ESS evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
AIT1	This tool appears to be well done and my impression is that it's either already at the "operative" level or pretty near to being operative. Main functionalities it offers are in my opinion: - middleware for gathering and sharing of information from various sources. - mass-informing functionality through several channels. Most interesting appears to be a feature which allows sending of SMSs to everyone in an area even if the network is down.	3	See "overall impression". In my opinion, the tool could be used as a part of the complete crisis management support infrastructure and provide one or more of the three main functions listed above. From AIT point of view (CrowdTasker), incorporating a map of danger areas resulting from model runs in local situation shown to

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
	- modelling sub-system which can be used to assess and predict the risk development for certain types of events (e.g. fire)		volunteers would be nice. Also the possibility to send some tasks to "everyone" - even in situation when the network is down sounds interesting.
AIT2	Appears to be a very mature tool with a lot of possible use cases in CDM and in the environmental domain.	3	Is it only for COP during the crises or also in all other phases? Could be used as a general crisis management supporting tool in DRIVER or as middleware to combine input from other tools. Depending on the use cases, this could be e.g. social media monitoring or crowd tasking.
TNO	Technically promising	2 ½	Non-technical part should be improved, e.g. in relation with SP3 (wrt communication with citizens) how to deal with N (N > 100) messages in a short period
MSB1	Under "interactions with citizens" but seem to hold many other features, not enough time to understand the tool.	3	

Table 18 ESS remarks

3.3.8.2 Statement of the solution provider

The main goal of ESS is to present crisis managers with the COP of a crisis to improve their situational awareness. As one of the evaluators mentions, ESS is well suited to act as a middleware to show information from several sources. Regarding crisis dynamics and early warning, ESS contribution is limited to the distribution of warnings, broadcasting SMSs through phone network (requires involvement of ALCATEL Lucent) or network hijacking (requires the use of an IMSI catcher, which is legally troublesome). Given the high number of solutions available for this task, it is proposed to consider ESS as a backup option (focusing ESS in Situation Awareness).

3.3.9 DASHBOARD

DASHBOARD is an app for public warning that transfers actual risk information to the public.

3.3.9.1 Explicit feedback tables

Feature	Sub-Feature	HKV "Safe Trip" Dashboard	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Translation of info into actionable info for EM users	Monitoring information	app is monitoring information on European websites and presenting only the information relevant to the user. Types of information include: weather, flood warning, forest fire risk. Extra information to be added later would be: storm, volcano, avalanche, pollen	Yes	3	6	AIT1 it would be interesting to make this information available to third party tools. MSB1 GPS-weather, no common way of publishing info and warnings in Europe
	Modelling, simulation and scientific advice	no added evaluations by the app, because of the single voice principle	No	1		
Distribution of warnings (public and to operators of	preparation of warnings	single voice principle: all warnings are provided by national authorities	No	1	6	AIT1 Local warning systems? multi-linguality support? Messages according to users profile?

Feature	Sub-Feature	HKV "Safe Trip" Dashboard	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
critical infrastructure and enterprises)						MSB1 Other national info needed.
	authorisation of warnings	only published information is republished	No	1		MSB1 Incorporate a map.
	distribution of warnings	app is essentially a location based service that looks up the information for the current location of the user	Yes	3		MSB1 If national agency issue warnings the tool will relay those warnings.

Table 19 DASHBOARD evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
AIT1	A simple app which could improve the outreach of information distribution to citizens.	3 application does what it should - present local situation to people who aren't familiar with the area.	The app could be used as a part of alerting/informing infrastructure. In my opinion, it would be much more interesting to use the application backend as a middleware which would make this information available to other tools (avoid duplication of efforts).

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
MSB1	Possibly a tool better suited for SP3	3 for the crisis aware individual 1 from a first responders point of view	Possibly more useful in SP3

Table 20 DASHBOARD remarks

3.3.9.2 Statement of the solution provider

Unfortunately no statement is available.

3.3.10 EmerT-Portal

The EmerT-Portal is a web-portal developed within the Delphi and VABENE projects of the German Aerospace Center (DLR). With EmerT it is possible to visualize the current traffic situation using different traffic sources (aerial images, inductive loops, Floating-Car-Data etc.). The traffic data can be used as basis to simulate and predict traffic and for supporting the decision process for traffic management actions in case of an incident or planning a big event.

3.3.10.1 Explicit feedback tables

Feature	Sub-Feature	DLR EmerT	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Translation of info into actionable info for EM users	Monitoring information	- Aerial images and traffic data, provides information as input for other tools. Aerial images (orthoprojected and mosaiked) give general overview about the disaster situation.	Yes	3	6	MSB2 It would be very useful to be able to use information from EmerT in other situation assessment tools, rescue services own operational tools.

Feature	Sub-Feature	DLR EmerT	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
		- merged traffic situation und prediction give also an overview, shows bottlenecks, and are input for maintain supplies				
	Modelling, simulation and scientific advice	no added evaluations by the app, because of the single voice principle	Yes	3	7	
Distribution of warnings (public and to operators of critical infrastructure and enterprises)	preparation of warnings					
	authorisation of warnings					
	distribution of warnings					

Table 21 EmerT portal evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
MSB2	This tool seems very mature and rich in functionality.	3	I think it will be very central in Driver especially if its information content can be shared with other tools. All "other common operational picture" / "situation assessment" type of tools would benefit from integrating data from EmerT.
WWU	Very promising, useful and mature tool that could be used for various transportation planning tasks in the logistics domain, the set up time has to be considered	3	The output is of high interest for all logistics related tasks, many other tools can benefit from EmerT results.
THW	- interesting tool primarily for planning events. Difficult to use in a ad hoc crisis, as people will behave in a unpredictable/less predictable manner. - also good for evacuation.		

Table 22 EmerT portal remarks

3.3.10.2 Statement of the solution provider

The evaluators rated the EmerT-portal as a mature and useful solution for DRIVER. The output is of high interest for all traffic and logistic related tasks. A limitation within an ad-hoc crisis is of course the set up time for gathering all relevant traffic data and the problem that people might behave in an unpredictable way. These issues will be considered in the DRIVER project and research will be done to overcome these problems.

3.3.11 ZKI-Portal

The Centre for Satellite Based Crisis Information (ZKI) presents a service at DLR. It provides a 24/7 service for the rapid provision, processing and analysis of satellite and airborne imagery during natural and environmental disasters, for humanitarian relief activities and civil security issues worldwide. The resulting satellite and airborne based information products are provided to relief organisations and public authorities and are mainly freely available on the ZKI website. According to the requirements of the user, the information products are delivered in the form of maps, GIS-ready geodata or dossiers which are then used to support disaster management operations, humanitarian relief activities or civil security issues. The ZKI is ISO 9001 certified.

3.3.11.1 Explicit feedback tables

Feature	Sub-Feature	DLR ZKI portal	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Translation of info into actionable info for EM users	Monitoring information	Terms, items, symbols and layout used in map products are adjusted to users' needs and standardized facilitating map interpretation /usage	Yes	3	9	
	Modelling, simulation and scientific advice					
Distribution of warnings	preparation of warnings					

Feature	Sub-Feature	DLR ZKI portal	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
(public and to operators of critical infrastructure and enterprises)	authorisation of warnings					
	distribution of warnings					

Table 23 ZKI portal evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
MSB2	My limited experience is that maps with processed satellite data are from Copernicus activations. It takes a very long time from satellite image requested and taken until the product is finally delivered. As a user I may want a less "prepared" format such as a vector file instead of a map product if that data may be available quicker than the final product.	3 Maps and presented product seem very usable	The tool can provide imagery and geodata for emergency management and disaster assessment for the Driver experiments. Information should be integrated into the common operational picture tools.
WWU	ZKI is a very useful and established tool to fulfil the mentioned features.	3	Relevant to the most other tools as the provided information have a very high bandwidth and quality.
THW		2	

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
		Satellite imagery is a useful tool, if: - satellite is available - costs are reasonable - time between request and fulfillment is not too large	

Table 24 ZKI portal remarks

3.3.11.2 Statement of the solution provider

The evaluation of ZKI reflects the usability and maturity of the service. Most features have been assessed with TLR 8 or 9, which corresponds to the TLR given by DLR, as this service is already operational. Furthermore, most features have been marked as fully usable by the evaluators. The possibility to create different map formats has been positively perceived with an emphasis on the importance of vector formats which ensure reusability by other solution providers. The use of satellite imagery is very much appreciated, but it is also outlined that the acquisition of such images may take a long time. The evaluators point out the importance of the data and maps provided by ZKI, and it was highlighted that the information should be integrated in the common operational picture.

When working with satellite data, time is indeed the imitating factor. The analysis and preparation of maps play minor roles. The time consuming part is the satellite acquisition and satellite delivery to the ZKI. For this reason vector data derived by satellite imagery is not faster than delivering the map product. The time frames can be discussed to decide on a case by case basis which information product would suit. The advantage of airborne imagery like demonstrated in DRIVER is the faster availability of the images.

3.3.12 SUMO

SUMO is a microscopic and open source road traffic simulation. In SUMO it is possible to simulate vehicles, pedestrians, traffic lights and multimodal mobility. In principle, SUMO requires a road network that includes road-side infrastructure, such as traffic lights, and a traffic demand for performing a simulation. Given both, the simulation SUMO moves the vehicles from the start position of their journey to their end position. SUMO is a development of the Institute of Transportation Systems at the German Aerospace Center. The first concepts were developed in the year 2000 and the first public release was done in the year 2002.

3.3.12.1 Explicit feedback tables

Feature	Sub-Feature	DLR SUMO	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Translation of info into actionable info for EM users	Monitoring information					
	Modelling, simulation and scientific advice	Simulation based prediction of the traffic situation incorporating demand and infrastructure predictions	Yes	3	7	
Distribution of warnings (public and to operators of critical	preparation of warnings					
	authorisation of warnings					

Feature	Sub-Feature	DLR SUMO	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
infrastructure and enterprises)	distribution of warnings					

Table 25 SUMO evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
MSB2	Seems very useful to most cases where traffic simulation is needed.	3	Useful as a service to other tools that need to complement with traffic simulation.
WWU	As mentioned also by the audience SUMO seems to have a high maturity level (the estimation of the evaluators is based on the information of the tool provider in the evaluation sheet, i.e. 7, although some features seem higher than this) but especially a very high relevance for many other tools. Both network planning and operational tools can benefit from SUMO outputs.	2-3 The only limitation to be considered is the required setup time in terms of new data (esp. transportation network).	As mentioned above SUMO can be understood as a tool that can both process data/results from (e.g. EvacuAid) and to other DRIVER tools (e.g. anylogic).
THW	Very useful tool. - If you can obtain info on the change in, for instance, the stability/load capacity of bridges, it could be very beneficial. Ex: Normally a bridge can handle 8t.		

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
	After 5 hours of flood exposure it can handle 3t. - if you can get info on the status of gas stations (do they still have gas, do the pumps function, are they flooded, etc.) that could help.		

Table 26 SUMO remarks

3.3.12.2 Statement of the solution provider

The evaluation stated that SUMO seems like a very useful solution for DRIVER when traffic simulation is needed. It was mentioned that its setup time for gathering required data is a limitation. This is a well-known problem in general for traffic simulations. To overcome this problem, actions in two different directions are planned be done:

1. Improving the setup time and
2. Generating typical traffic data.

Another issue is that SUMO should be seen as a service for other tools. Therefore, effort is put on concepts for coupling SUMO with other solutions (e.g. Anylogic). One reviewer stated that it would be nice to have information about bridge load and gas stations included. Currently this information cannot be given by SUMO but it will be checked whether it is possible to include this feature within DRIVER.

4 Conclusion

Task 43.3 Crisis dynamics & early warning addresses the need to predict the impact and to assess risks of approaching hazards (for preparedness and reaction) and to provide reliable early warning.

This deliverable covers all solutions which were declared to have relevance for this task, and not only the two presented specifically for it.

The overall quality level of the solutions is very high: they are quite all mature and several already operative.

The relationship with T43.1 is quite obvious, being the topics strictly related.

It is also very interesting that some minor overlaps were not evident in the evaluators' response: solutions which ranked well in Task 43.3 "**Translation of info into actionable info for EM users**" are not rated the same for Task 43.1 "Decision support". This different evaluation of the same sol**ution could stem from the different context, meaning that if the purpose changes the expectations and evaluation metrics also change.**

This interesting evidence must be taken into account designing further experiments, calibrating solutions metrics and evaluation criteria on the basis of the type of task that the solution is supposed to perform. If this aspect will not be accounting a biased evaluation could be performed.

The analyzed solutions cover several aspects of crisis dynamics and early warning answering to some of them, in particular:

- Translation of monitoring information, results of modelling and simulation and scientific advice into **actionable;**
- Impact estimation on people, environment, infrastructure and economy**;**
- Planning, authorization and **distribution of a public warning and warnings to critical Infrastructure operators and enterprises working with dangerous goods;**
- Hazard prediction and impact estimation within a flood scenario and pandemics scenario**;**
- Early situation awareness and earl**y warning within a tsunami scenario.**

Whereas the solutions were providing the workflow to prepare the warnings, only a few coped with the distribution of those warnings. This is interesting, suggesting that only where there was a specific interest in addressing the citizens, this topic was taken into account. Where the solutions aimed at a professional audience, the distribution was to be demanded to other solutions. One of the reasons is the final confirmation of communications aimed at the population that must come from authorized officers, often not working in the same service as the analysts. This led to a loose integration between the different systems until now. However, it is also true that this integration would require different expertise, that only a few single companies are provided with.

On the other hand, the evaluators expressed interest in the capacity of the solutions to interoperate with other systems. This prepared the focus of future experiments, e.g. Joint experiments need to interoperate solutions and their functionalities.

From the experimental point of view, the work of the evaluators is very difficult to analyse. As the solution providers only had 15 minutes to present, in such a short presentation, it was difficult to explain the more complex functionalities. The better the presenter the more effective the solution seemed. Some features, like the models' integration, were penalized by the time needed to show **them in details.**

However, a better understanding of each solution has been acquired. Some of the solutions need to be revised and updated according to the technical and functional lacks. Some indication and suggestions for solutions improvement has been reported above within the evaluation tables (Table 5 to Table 26).

The following has been identified as indications for next round of experiment:

- **Concerning the maturity level, it can be assessed that a high level of maturity is not a minimum requirement to use a solution within a structured experiment which focused on interoperability, as a Common Information Space is required to exchange data and information among platforms and decision makers dealing with a defined crisis. Only the solutions that show and make data available to end users should own an advanced Graphic User Interface and well defined use procedures. However, a TRL of at least 7 is recommended.**
- **Simulation/modelling tools and generally tools that provide basic information (SUMO, EmerT-Portal) should be used to integrate them with COP or information management tools.**
- **The solutions with a high TRL value (ZKI-Portal, DEWS, SUCCESS, and MEGO) have to be considered ready to use, also through standalone deploying, within joint experiments and complex experiments.**
- **The solutions with a low TRL value (DASHBOARD, ESS, EmerT, SITRA, and EvacuAid) should be considered as optional solutions. They should be used to integrate the outcomes of others solutions and in particular when a customized solution is required.**
- **Solutions that display data and information as a Common Operational Picture (DEWS, SITRA, CrisisWall, and MEGO) should be considered as crucial solutions to be used in joint experiments to collect and show information to decision makers.**

In order to deeper analyse the proposed solutions, an integrated use of them have to be performed. The experiments planned within SP4 will return enough information on which a more accurate and comprehensive analysis can be performed.

The activities related to WP43 concerning solutions benchmarking will be re-played through several planned experiments. The analysed solutions cover some of the gaps described in D41.22 [6], however a deeper analysis is required to better assess the features of solutions in a crisis management operational environment.

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