Project Deliverable

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COORDINATION AND SUPPORT ACTION	H2020 SECURITY

Title

D3.3 - Results of the Request for Ideas: mapping RTOs and Industry potential, response and trends related to Fire-IN CCC/ FCCCs #2

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RE	Restricted to a group defined by the consortium (including the Commission)	
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Abstract:

This document describes the second cycle results of the implementation of the "Request for Ideas" procedure which has been defined in T3.1. The particularities and the issues raised during the initial cycle of interaction with the Industry, RTOs and standardization bodies as well as the necessary adaptation of the actions and communication methods for the maximization of the results of T3.2 are presented also in this deliverable.

Keywords:

Communication, Industry, Request for Ideas

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Executive Summary

The FIRE-IN project is an initiative funded by the European Commission that has been launched on the 1st of May 2017. FIRE-IN has been designed to raise the security level of EU citizens by improving the national and European Fire & Rescue (F&R) capability development process. FIRE-IN addresses the concern that capability-driven research and innovation in this area need much stronger guidance from practitioners and better exploitation of the technology potentially available for the discipline.

The purpose of this report is to describe the steps and procedures followed for establishing cooperation schemes with Research and Technology Organizations (RTOs) and industry suppliers in an attempt to collect "responses" to the identified Common Capabilities Challenges (CCCs) and Future Common Capabilities Challenges (FCCCs) and implement the "**Request for Ideas**" (**RfI**), based on the methodology described in D3.1.

The actions described in this report are based on the work carried out so far in WP1 (the identification of the CCCs) and in WP2 (the screening of existing solutions). This document refers to the second cycle of the three cycles of the implementation of T3.2. The deliverable includes the results of the interactions with the Industry, RTOs and standardization bodies during the second cycle of implementation of "RfI" process. During the second cycle of Task 3.2 implementation, the FIRE-IN e-platform which is the basic tool of interaction with the stakeholders, has almost been operational.

Particularities, difficulties and limitations of the interaction with the WP3 stakeholders, which raised during the second cycle of T3.2, are discussed in detail in this report since these are essential outcomes for the continuation and appropriate adaptation of RfI process, and for the maximization of results of the first (1st) and also of the next (3rd) cycle.

This report encompasses the interaction with the stakeholders, the description of the submitted solutions in the e-platform, from the industry, standardisation bodies and research institutes until June 2020 and their analysis with the traffic light system.

During the first cycle, a more traditional, though often less effective, way of interaction with RTOs, industries and standardisation bodies was adopted in order to collect the first solutions and ideas. During the second cycle given the availability of the FIRE-IN e-platform, as well as the maturity gained from the first cycle, in terms of the peculiarities of interaction with the different categories of stakeholders, both the contacted stakeholders and the interaction ways were more targeted. The operational e-platform, in this 2nd cycle, was an essential tool for the organized registration of ideas and solutions providing a professional dimension to the communication with the stakeholders.

Finally, significant conclusions drawn from this process are also presented.

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1. Introduction

The project FIRE-IN has been designed to identify capability gaps from the point of view of practitioners in the field of fire and rescue, and to fill these gaps by implementing a structured mechanism to identify existing solutions or define RDI capability challenges that should be addressed in future calls for projects.

Based on the identification of the capability gaps in work package WP1 involving practitioners gathered in 5 thematic working groups (TWG) and the screening for solutions carried out in work package WP2, the work package ***WP3 "Collaboration with research, industry and standardization bodies and recommendations"*** aims at developing the interactions with research, industry and standardization bodies to validate the identified gaps, fill these gaps with solutions not yet identified in WP2 (during the 2nd screening cycle) and help expressing the needs for future research, development and innovation.

The second Task of WP3, **T3.2 "Request for RDI ideas addressing CCCs and FCCCs and capitalization of the feedback"** concerns the implementation of the communication strategy with the industry, standardization bodies and RTOs aiming at the "Request for Ideas" implementation.

The deliverable D3.3 presented herein, describes the procedures and actions for interacting with industry, standardization bodies and RTOs, considering the profile of the stakeholders, the Common Capability Challenges (CCCs) and the results of interaction with them, for the achievement of the **Request for Ideas** (RfI) procedure during the second cycle.

The work described in this deliverable is closely related and based on:

- The background work carried out in T3.1 and described in D3.1.
- The interactions with the WP1 and WP2, in particular the CCC and FCCC definition and the screening of possible solutions.
- The solutions submitted in the FIRE-IN e-platform during the 2nd cycle of RfI of the project.

Deliverable D3.3 is organised in the following parts.

- Chapter 1 is an introductory section.
- Chapter 2 briefly describes the background of the "Request for Ideas" procedure which is analysed in detail in D3.1. In this chapter the Common Capability Challenges (CCCs) both of the 1st and 2nd cycle are presented, as well as the Traffic Light System.
- Chapter 3 discusses the issues that have arisen from the CCCs of the 2nd cycle, the connection between the CCCs of the 1st and 2nd cycle, the interaction and feedback gathered during this 2nd cycle RfI, as well as the methodology of the analysis of the solutions during the 2nd cycle.
- Chapter 4 presents the solutions submitted in the FIRE-IN e-platform during the 2nd cycle and their analysis.
- Chapter 5 discusses the conclusions drawn from the 2nd cycle of RfI and the extent that the CCCs of both cycles are covered. Future Ideas are presented as well as recommendations for the future challenges and the e-platform operation.
- Finally, an appendix has also been included.

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2. Background information of RfI procedure

The present chapter is devoted to a brief description of the Common Capability Challenges of the 1st and 2nd cycle, as well as a description of the traffic light system that has been used for the analysis of the submitted solutions in the e-platform.

The intention of this section is far from an exhaustive repetition of the CCCs of the 1st and 2nd cycle and the traffic light system; it aims at their brief presentation in order to point out certain issues that have been raised and at the same time to facilitate the understanding of the analysis of CCCs by potential stakeholders. An extended description of the CCCs and the traffic light system can be found in deliverables D1.2[1], D1.3[2] and D3.1[3], respectively.

Yet, a brief repetition is necessary in order to track the links of evolution between the various deliverables of the project, to recall basic definitions and outcomes of the previous steps of the project that will also be used for the methodological approach of the "Request for Ideas" procedure and finally, to provide external readers with an idea of what has been done so far in the project so that they can capture the full picture of the project.

[1] Lahaye, S. et al. (2018). D1.2 Report on current and future common capability challenges (CCCs and FCCCs) #1 (Fire-In consortium, September 2018).
[2] Gallardo, G. et al. (2019). D1.3 Report on current and future common capability challenges (CCCs and FCCCs) #2 (Fire-In consortium, October 2019).
[3] Salvi, O. and Frecenon, P. E. (2018). D3.1 FIRE-In context for interaction with industry and Research (Fire-In consortium, December 2018).

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2.1. Common Capability Challenges (CCCs, 1st and 2nd cycle)

A brief description of the 1st and 2nd cycle CCCs, as well as a discussion on the issues that have been raised during the RfI procedure are presented in the following.

2.1.1. CCCs of the 1st cycle

Common Capability Challenges (CCCs) have been identified by associated experts and practitioners in the five thematic working groups of the project. In the 1st cycle twenty-seven (27) CCCs are identified and expressed in a combination of seven (7) capabilities and four (4) main common challenges in a matrix format.

The seven (7) capabilities are the following:

- Incident Command Organization
- Pre-planning
- Guidance instruments
- Knowledge Cycle
- Information management
- Community Involvement
- Technology

The four (4) challenges are the following:

- High Flow of effort in hostile environment
- Low frequency, high impact events
- Multi-agency/multi-leadership environment
- High level of uncertainty

Capabilities and challenges are crossed in a matrix format having the capabilities in the horizontal and the challenges in the vertical axis in order to present the twenty-seven (27) identified gaps (27 CCCs). The CCCs are presented in the Appendix A1 (D1.2[1]) and are also accessible in the FIRE-IN e-platform (https://fire-in.eu/challenges-resources). In addition, the majority of the identified CCCs in the 1st cycle is in accordance with the Sendai framework[4] and the International Forum to Advance First Responder Innovation (IFAFRI) challenges.

2.1.2. CCCs of the 2nd cycle

During the 2nd cycle, CCCs were revised in terms of description and prioritization. Work Package 1 provided a better description of the 27 CCCs in the seven (7) capabilities and four (4) challenges. In addition, during the 2nd cycle, two (2) more capabilities were examined, the capabilities of "Communication" and "Human Factor". Nevertheless, these last capabilities and the respective CCCs are relevant with only a couple of Thematic Working Groups of FIRE-IN, so they are not included in the final list of outcomes of the 2nd cycle. The detailed description is provided under deliverable D1.3[2],

[4] UNISDR (United Nations International Strategy for Disaster Reduction), 'Sendai Framework for Disaster Risk Reduction 2015–2030.'

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which, as an outcome of several workshops, supports a prioritization of the CCCs. The outcome was a prioritized list of twelve (12) common capability challenges that are presented in the Appendix 2 -2nd cycle prioritized CCCs (Table 19), on which the description of the prioritized CCCs is presented along with the capability addressed and the magnitude of importance. The capability addressed is marked as the column "topic", while the column "magnitude of importance" depicts the number of votes that the CCC gathered in the analysis of the deliverable D1.3[2].

2.2. Traffic Light System

The traffic light system is a tool developed in the FIRE-IN project, under Work Package 3 and Task 3.1 in order to be used to demonstrate/understand the level of coverage of each CCC using explicit criteria. The traffic light system can be applied in three sectors:

a) publications and projects,
b) standards and
c) technologies.

In the following tables (Table 1, Table 2 and Table 3), the criteria that characterize the level of coverage of the CCCs are presented. More details can be found in Deliverable D3.1[3].

Table 1. Criteria to characterize the level of coverage of the CCCs for the "publications and projects" screening field.

Criteria	Green	Yellow	Red
Operational value	Many projects on the topic, that are already completed and delivered available knowledge in articles and guidance documents.	Few projects completed on the topic, sometimes only at national level. 1 or 2 on-going projects.	Further research and development needed.
Access to Knowledge	Peer reviewed international guidance document or standard available. Training courses available.	A few papers available sometimes only at national level.	Only papers or communication pointing the need to address the topic.

Table 2. Criteria to characterize the level of coverage of the CCCs for the "standard" screening field.

Criteria	Green	Yellow	Red
Operational value	Peer reviewed international guidance document or standard available.	Standard or guidance document in preparation or mentioned as future work of some technical committees.	The need to address the topic has been expressed by the community.

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Table 3. Criteria to characterize the level of coverage of the CCCs for the "technologies" screening field.

Criteria	Green	Yellow	Red
Operational value of existing solution	Already available and operational.	Available as pilot solution / demonstration.	Further research and development needed.
Solution maturity (TRL) and industrialization level (time to market, TTM)	TRL>9 Already available on the market.	6<TRL<9 Already developed as prototype and being tested / validated.	TRL<6 Still need some research and development.
Interoperability and standardization	Availability of the standards describing to solutions and interoperability issues.	Awareness of need for standard.	Standard not yet addressed.

2.3. Solutions in the context of Work Package 3

The term "solution" is a generalized term that is used in FIRE-IN project and may refer to a product that is already available on the market, a research paper, a publication, a guideline, a standard, a white paper, a standard operating procedure or a simple idea for the development of a future product.

The term "solution", in the context of WP3, refers to the products that are submitted in the FIRE-IN e-platform by potential stakeholders who act as "suppliers" such as the Industry, Research organizations and Standardisation bodies. Solutions should consider the demands identified by experts, practitioners, policy makers, etc., and be addressed to the FIRE-IN CCCs.
As also stated, in Deliverable D3.2[5], and with a few additions, the solutions under consideration in T3.2 during all the cycles are the following:

1) Products (hardware or software) of RTOs, industry and private companies with a high level of maturity (e.g. TRL ≥ 6)
2) Existing standards and procedures already adopted in the fire and rescue procedure relevant to software, hardware and equipment.
3) The results of EU Projects that have a high level of maturity and support of a specific organization or association, in order to be considered as products for operational use. These results concern:
   - Clearly defined and described methods, procedures and tools supported by manuals and informative reports on scientific and technical background;
   - Platforms that have been developed in the framework of past projects and are sufficiently supported after the end of the projects;

[5] Varela, V. et al. (2019). D3.2 Results of the Request for Ideas: mapping RTOS and Industry potential, response and trends related to Fire-IN CCC/FCCCs #1 (Fire-In consortium, June 2019).

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- Platforms, currently under development in the frame of a project that are sufficiently reported and a business plan for their support exists, after the end of the project;
- Databases with a high quality and sufficient amount of data entries;
- Software systems and tools that have been developed in the frame of a project, validated and supported by manuals and experts for updates.

4) Ideas or projects or standards that are under development and are innovative, responding to the needs of an existing gap, providing insights to the future of industry.
5) Services that are provided by FIRE-IN stakeholders and are based on mature products or studies.
6) Publications that refer directly to the development and use of a technological solution such as a software or a hardware, e.g. drones or robots or special PCs.

Due to the fact that publications, best practices, doctrines, lessons learnt, and standards are an important part of the solutions that FIRE-IN aims to gather, these solutions are also considered and analysed with the traffic light system. This type of knowledge can have an informative and educational character to the "suppliers" and "innovation developers" and can highlight the trends of research and the standards and procedures that practitioners take into account during their daily work.
Focus is given to technological solutions or guidance that address more explicitly the needs that have been identified as CCCs from the FIRE-IN consortium and associated experts invited during the WP1 TWG workshops.

As a reminder, exchanges between fire and rescue practitioners and RTD solution providers during FIRE-IN annual dissemination event in Barcelona, May 2019, issued some guidelines for solutions. Those were listed in Deliverable D3.2[5]:

- Need for adaptation of common symbology for civil protection at European level.
- Existing and future software, platforms and decision support tools should be governed by interoperability.
- Public procurement procedures can raise and necessitate the issue of interoperability.
- Communication issues to be considered.
- Communication Risk to be considered.
- The existence of various decision support software, tools and platforms may complicate significantly operational decisions.
- Regulatory issues to be considered.

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3. RfI Implementation and Methodology

3.1. RfI and connection to the CCCs

The 2nd cycle of the project provides prioritized CCCs between the 27 CCCs of the 1st cycle and more detailed description of the prioritized CCCs. In addition, the presentation of the prioritized CCCs is in a list and not in a matrix format and is simpler, especially for stakeholders less familiar with the project, allowing for their familiarization with the needs defined from the FIRE-IN. Two main concerns have arisen during the "Request for Ideas" procedure of both cycles.

The first one is that this prioritization may lead to an initial confusion that the original twenty-seven (27) CCCs of the project have been reduced to twelve (12). A closer look of D1.3[2] reveals that the "list of concerns" of the 2nd cycle is targeted and therefore includes a better and more analytical description of certain CCCs of the original twenty-seven (27) CCCs. The fact that some of the CCCs are prioritized does not modify the original ones. The CCCs are still twenty-seven (27) with some of them being with a higher interest for experts and practitioners involved in the process.

The second concern is related to the capability categories of "*Guidance instruments*" and "*Technology*" found within both cycles. These two categories are extremely difficult to be limited as horizontal aspects as presented in the matrix of the 1st cycle CCCs (Table 19 – Appendix A1) and are actually more generic categories that practically enclose all CCCs. This means that these two categories cover transversally all dimensions of the matrix. In particular, "*Technology*" and "*Guidance instruments*" are capabilities that exist in all CCCs independently of the capability category. For example, technologies and standards exist not only in the four (4) CCCs "*Use technology to assess risks and minimize responder's engagement*", "*Simulate complex scenarios*", "*Technological tools to support data sharing*" and "*Get a clear picture of the risk evolution*", but also in the rest of the CCCs.

The fact that "*Technology*" and "*Guidance instruments*" are more generic classifications of capabilities that could cover all the Common Capability Challenges is verified from a brief market research. Deliverable 2.3[6] (Work Package 2) deals with the screening of solutions for the 12 prioritized CCCs (appendix – chapter 6.2). In this report, 2nd cycle CCCs Nr #2 "Technology" and Nr #10 "Standards" could not be handled as discrete PCCCs as the rest of the twelve, due to their intrinsic generic description. Indeed, a closer look to these two prioritized CCCs provides general description and specification of a system rather than a true and specific challenge. It is also characteristic that solutions that were submitted in the FIRE-IN e-platform during this second cycle RfI procedure by the users and classified as "lessons learnt, doctrine and best practices" were guidelines and lessons learnt matched with CCCs outside of the "Standardisation" capability.

In order to resolve in some extent these two issues the following approach was followed:

a) Before the launch of "Request for Ideas" for the 2nd cycle, a discussion with the Work Package leaders and especially with Work Package 4 leader took place and concluded to the necessity to somehow embed the prioritized CCCs in the CCCs matrix (Appendix A1), thus making evident that the CCCs are in total 27 and the link between the two cycles exists. As most of the prioritized CCCs are an explanation/detailed description of the original CCCs, it was decided to integrate the phrase "TOP CHALLENGE" in the CCCs matrix in the online platform. This action covers both the role of

[6] Walter, G. et al. (2020). D2.3 RDI and standardization screening report #2 (February, 2020).

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linking the two cycles and the role of pinpointing the CCCs that are most important according to the experts. This change is already implemented in the e-platform and can be found in the "Challenges and Resources" section of the e-platform (https://fire-in.eu/en/challenges-resources).

b) The most important issue for the "*Technology*" and "*Standards*" was overcomed in the following way. All CCCs are considered as unique elements and potentially have a match with at least one technology or standard, if applicable. This approach ensures that our methodology is not biased against certain CCCs and all CCCs are treated equally, with equal weights (mathematically speaking). It's worth noticing indeed that a methodological approach (not an arbitrary decision) is used to assess if a challenge (CCC) is already covered or not by the market or the research community. In chapter 3.3, where methodological approach is discussed, this is further analysed. A similar approach, addressing the CCCs of technological solutions irrespective of their capability classification, has also been followed in the 1st cycle.

Before proceeding to the next step, it is important to show the connection between the CCCs of the two cycles, in a direct relationship (Table 4).

Table 4. Matching of the 2nd cycle prioritized CCCs with the 1st cycle CCCs.

Nr	2nd cycle prioritized CCCs	Topic	1st cycle CCCs
1	Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …	Community involvement	Develop public self-protection to minimize responders exposures
2	Technologies used in interventions should be: • Useful. • Simple, intuitive, and easy to use. • Easy to integrate and interoperable. • Easy to transport, deployable on field, light, with high autonomy. • Robust, resistant, long duration, able to tolerate severe/harsh conditions. • Open access. • Usable by people with disabilities.	Technology	Use technology to assess risks and minimize responder's engagement
3	Change of paradigm. From 'We, authorities, will protect you' to 'You, citizen, should be actively involved'. These affirmations mean that you should be prepared to be self-sufficient concerning to your own protection and your community protection always inside the framework of the emergency. Be used to this sort of situations normalizing them.	Community involvement	Involve communities in preparing population for the worst scenario before it happens
4	Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises.	Community involvement	Involve communities in preparing population for the worst scenario before it happens

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Nr	2nd cycle prioritized CCCs	Topic	1st cycle CCCs
5	Once the standard roles of different actors have been trained and drilled inside each agency, organize multiagency joint trainings and exercises with the focus on decision-making, coordination and interactions between agents. Train in overlapped competences and limits of competences. Train the trainers of the different agencies. Share on-line training and exercises.	Knowledge cycle	Build a shared understanding of emergency and train interagency scenarios
6	Identify points of coordination in the different zones: from local (hot zone, warm zone ...) to regional and to national. Establish different levels of liaison officers, translators; communication; entrance points; and infrastructures as needed.	Incident Command Organization	Distribute decision-making
7	Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points…	Incident Command Organization	Anticipate vulnerability, and communicate to the public
8	Base the prediction of scenarios on historical events and on statistics (baseline), including the modelling of the actual conditions (at local level) and human factors.	Pre-planning	Negotiate solutions with stakeholders for anticipated scenarios
9	Maintain situation awareness. Avoid the loss of information with shifts' changes.	Incident Command Organization	Focus on sustainability of safe operations
10	Adapt the legal framework and requirements on prevention and self-protection of infrastructures and activities to first responders' needs, lessons learned from past events... Plan the implementation of laws and plans. Adapt the regulations to emergency situations.	Guidance instruments and standards	Standardize capabilities in front of pre-established scenarios
11	Towards a complete cycle of knowledge. Adjust Standard Operational Procedures (SOPs), doctrine and pre-plans using the feedback from real incidents and from exercises testing them (evaluators, assessors, statistics…) and identify the main gaps to focus efforts in training, procedures, personnel and equipment. Evidence based on fire scenarios. The process learning of an organization goes through the identification of own 'best practices' and the external ones: • to collect experiences and convert them into guides, • to collect 'lessons learned' and transform the best points into protocols, • to share experiences with the aim of generating standards.	Knowledge cycle	Organizational learning focusing efforts in key risks and opportunities
12	Be prepared to provide massive alerts to population	Community involvement	Involve communities in preparing population for the

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Nr	2nd cycle prioritized CCCs	Topic	1st cycle CCCs
			worst scenario before it happens

A comparison between the two cycles reveals that out of the twelve (12) prioritized CCCs, four (4) of them engage the general public and the community and three (3) of them are related with the "*Incident Command Organization*". The capability of "*Knowledge cycle*" is related to two (2) prioritised CCCs while, "Pre-planning", "*Technology*" and "*Guidance instruments and standards*" only with one (1) of them. Nevertheless, technologies and standards exist or may exist in the future for all the prioritised CCCs of the 2nd cycle as well as of the CCCs of the 1st cycle irrespective of their classification/position in the matrix.

The most important outcome is that "*Community Involvement*" and "*Incident command Organisation*" is of high importance for the practitioners.

3.2. Communication, interaction with potential stakeholders and Methodology adopted

3.2.1. Communication with stakeholders

The 2nd cycle RfI coincided with the time period that Europe was hit by the COViD-19 pandemic. The general lockdown and the interruption of normal life limited the means of communicating the RfI to potential stakeholders. Face to face meetings as well as other physical meetings were cancelled. The optimal way to communicate the RfI procedure was based on digital means, that are the e-mails, teleconferences, webinars and in some cases phone calls.

Center for Security Studies (KEMEA), as Work Package 3 leader and Task 3.2 leader invited more than 300 persons from various organizations across Europe. Based on our experience in the 1st cycle, the emails were sent to contacts from the extended network of KEMEA that are past or current collaborators. The invitations sent were formatted in a personalized letter and often direct informal contacts were also used. This ensured that the invitation would not be disregarded by the recipient and increased the probability of getting a response, feedback and ultimately achieve registration to the network and submission of a solution to the e-platform. Additionally, some teleconferences were held with persons that expressed their interest in the FIRE-IN project and the RfI procedure.

The relevant invitations were written in a simple language and provided detailed but not exhaustive guidance on how to enter, register and submit a solution on the FIRE-IN e-platform. They were also accompanied by two attachments, an invitation for becoming a possible solution provider of the project and the FIRE-IN leaflet. The invitation to stakeholders was based on the one proposed in Deliverable D3.1 but it was modified, and it was slightly different than the one of the 1st cycle since the e-platform was completed and running. The e-mail body text and the invitation are presented in the appendix (Appendix A3). The overall goal has been to facilitate the process for the potential stakeholders and minimize the time and effort required from them.

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In this aspect, the consortium was requested to assist the RfI process following a similar path, by sending invitations to contacts they have collaborated with and have some kind of professional relation.

In addition, other means were also used such as social media (LinkedIn) and dissemination of FIRE-IN objectives and RfI process during participation of KEMEA collaborators to online EUvsVirus Hackathon.

Special reference is made to the latter as FIRE-IN was communicated among a number of innovators dealing with COVID-19 crisis but not only. Between the 24th and 26th April 2020, a pan-European hackathon was hosted by the European Commission, with the aim to support the development of innovative technological, but not only, solutions for coronavirus-related challenges. There were more than 20,000 participants with 2,150 solutions submitted. A large European community of innovators, investors, researchers, civil society representatives was created and highly connected during a week, as the results were announced on the 30th of April 2020. KEMEA, within networking and innovative technology exploitation actions has participated voluntarily in the organization committee and got the opportunity to communicate to the different channels of Hackathon communication platform the Request for Ideas of FIRE-IN project. The invitation uploaded to EUvsVirus challenge is presented in Figure 1. **The EUvsVirus platform allowed access to a variety of innovators** who, despite their targeted activity for the time of Hackathon, are developing tools and ideas applicable in the emergencies of FIRE-IN thematic fields. A number of interested researchers and startup technology providers responded, have registered to the platform and an exchange has initiated.

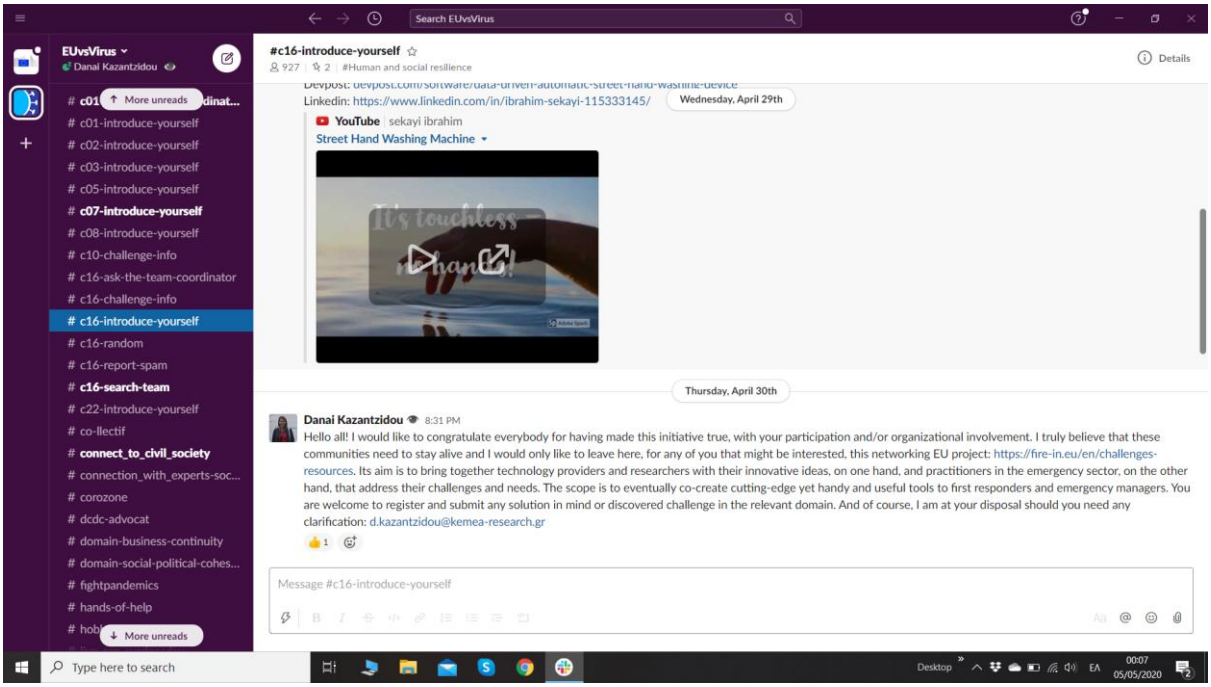

Figure 1. Screenshot of FIRE-IN communication among the slack channels of EUvsVirus Hackathon.

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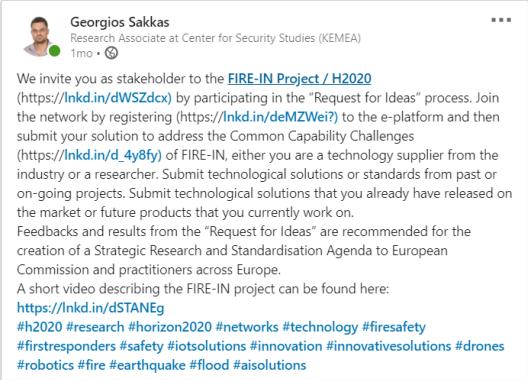

Additionally, we used social media and especially LinkedIn for the promotion of "Request for Ideas" procedure and the invitation of possible stakeholders and suppliers to FIRE-IN with 220 views. A screenshot of the promotion is presented in Figure 2.

Figure 2. Screenshot of the promotion of "request for Ideas" to LinkedIn.

SAFE cluster, the coordinator of the project, contacted the members of its network (450 members, around 800 invitations) and organized, together with **The French School of Fire officers (ENSOSP)**, a webinar for the presentation of FIRE-IN and the e-platform. This initiative also helped boosting FIRE-IN visibility. 53 persons attended the webinar. From SAFE cluster statistics, at least 24 persons registered to the network, among 10 private companies. An example of the invitation for the webinar in LinkedIn is provided in Figure 3. The First Responders community of firefighters was also contacted through ENSOSP.

Figure 3. Screenshot example of the webinar hosted by SAFE and ENSOSP.

INEDEV also used the invitation provided to targeted contacts to various certification and standardization bodies, research brokers, associations and companies across Europe (approximately 35 key persons) contacted. A special teleconference was organized to present and discuss further the FIRE-IN concept and "Request for Ideas" and a step to further collaboration was established with TIC Council. Similar interactions have been engaged with ETPIS and PESI, and with the Chairperson of the CEN TC 391.

Fraunhofer established contacts mainly with research institutes from Germany and Australia as well as practitioners and SMEs (around 10 organizations).

CNBOP-PIB was also highly engaged in the "Request for Ideas" procedure during the 2nd cycle as one of the FIRE-IN partners dealing with many private companies. Approximately 1,400 electronic invitations (approximately 1330 by emails and 80 calls) were sent to various Polish and International entities. Nevertheless, often emails were returned as inactive.

Finally, around 20 persons from various organizations were also contacted by other partners of FIRE-IN such as **THW** and **CNVVF**.

The following categories of stakeholders were included in the contacts:

- Academic and Research institutes highly engaged in the topics of FIRE-IN,
- Public Organisations such as First Responders, Civil Protection Offices (various levels of administrations),

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- Private companies and firms highly engaged with the topics of FIRE-IN and the creation of software, hardware, robotic equipment, UAVs and drone manufacturers, distributors and training centers,
- Standardisation bodies,
- Non-Governmental Organisations and Associations relevant to the FIRE-IN topics.

In total, it is estimated that around 2,000 to 2,500 persons were invited to join the FIRE-IN network and "Request for Ideas" procedure by e-mail or skype and telephone calls with the contribution of all WP3 partners and some other partners of the consortium. Unfortunately, a percentage of these invitations either were declined or never responded, which is an expected drawback of communication via e-mail. For that reason, additional dissemination efforts were made via social media and the promotion of "Request for Ideas" concept reached around 500 additional persons.

Overall, we estimate that over 2,000 persons were truly notified on the "Request for Ideas" procedure. There was also feedback from International or European Associations that they were informed for the "Request for Ideas" and did forward the relevant invitations to their members.

3.2.2. Interaction and feedback

The first presentation of the e-platform was made on the DRIVER+ conference in February 2020 in Brussels**. The first comments were very encouraging**. In general, **the operation of the FIRE-IN e-platform during the 2nd cycle made easier the explanation of FIRE-IN and the challenges identified so far and also the creation of the Pan-European network of practitioners, researchers, industries, standardization bodies and experts. The platform is a significant tool for networking and solutions documentation through which gaps in the existing and future challenges may revealed.**

Up to June 2020, the time of delivery of the current report, the platform has been operational for approximately 4 months and apart from the solutions submission, there has also been opportunity for recommendations from the platform users (solutions providers, stakeholders, etc.) during the RfI procedure for the improvement of the e-platform functionality.

In Figure 4, the number of registered persons to FIRE-IN e-platform per country are presented, while in Figure 5, the number of registered persons, up to June 2020, to FIRE-IN e-platform per type of organization is presented. The three countries with the highest contribution to the FIRE-IN network are France (43 people), Greece (33 people) and Poland (21 people).
Based on the type of organization (e.g. private company, public body, research/academic institutes, NGOs and Associations), 85 people are from private companies representing 47% of the FIRE-IN network so far. Public bodies are 30 in total (17% of the network) out of which 19 are public bodies in regional and local level while 11 in national level. It is worth noticing that the FIRE-IN network of practitioners is far wider as it also includes about 350 "associated experts" registered on a first list, previously to the implementation of the current website. Those ones will be reached in the coming months to transfer their registration on the current tool.
The submitted solutions per country are also presented in Figure 6.

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Figure 4. Total number of registered to FIRE-IN e-platform per country (as of mid June 2020)

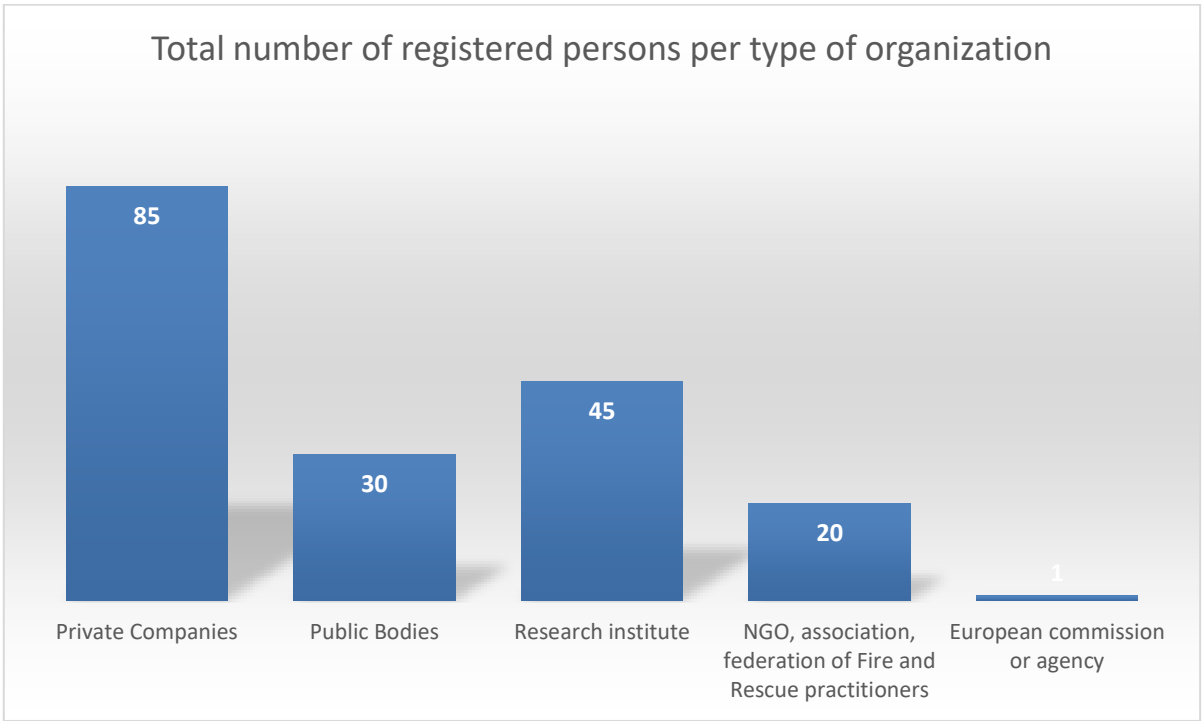

Figure 5. Total number of registered to FIRE-IN e-platform per organization type (as of mid June 2020)

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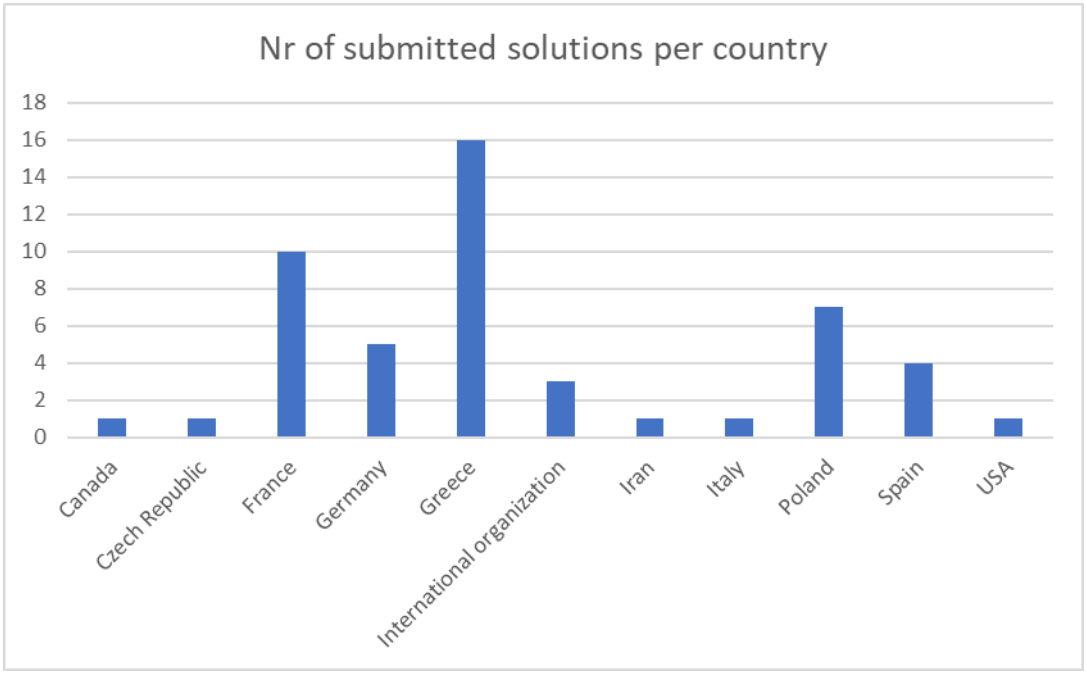

Figure 6. Distribution of submitted, to the e-platform, solutions per country.

Until June 2020, 50 solutions were submitted: twelve (12) of them are "Best practices, doctrines, lessons learnt", eight (8) are publications that are not directly engaged to a technological solution and thirty (30) are technological solutions.

During this 2nd cycle of **RfI** procedure the interaction with the potential stakeholders was more active compared with the 1st cycle despite the fact that this procedure run during the COVID-19 pandemic in Europe, thanks also to the functional e-platform.

Due to the COVID-19 pandemic outbreak, questions were answered by emails and in some cases, skype and telephone calls were organized to discuss further the FIRE-IN project, its goal and the RfI procedure.

Briefly, the outcomes of the feedback can be summarized as follows:

- The concept of FIRE-IN and the CCCs was easier to explain to potential solution providers, compared to the 1st cycle, due to the existence of the e-platform.
- **The operation of the e-platform made FIRE-IN more appealing to the potential stakeholders**.
- **FIRE-IN still remains more appealing to SMEs with low accessibility in the market compared to large companies**. Of course, this is somehow accepted and expected since large companies have invaded the market and already gained the proper recognition from the market, research, practitioners and policy makers.
- Large enterprises have difficulties in proceeding with the submission of solutions. This implies more complicated internal procedures compared to smaller companies, meaning employees of **large enterprises should take the approval of administration boards**, which can be easily translated to more time between the invitation and the submission of solution.
- Another **significant** issue both for large enterprises and SMEs is **the issue of confidentiality**. It is extremely difficult for some private companies, irrespective of their size, to reveal projects

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and products on which they currently work and will be on the market in the near or far future mainly for reasons of industrial espionage.

- **The time that stakeholders want to devote is minimum**. To this end it is important to minimize the time required for registration and solution submission (*e.g.* keeping the minimum necessary fields to be filled in).
- The **validation of registration** procedure is a significant issue for the submission of solutions. Recommendations for automatic validation e-mails within were proposed by the e-platform end users. The fact that the validation is a procedure checked by a human and not a machine, can lead to the conclusion, from the end user side, that the system delays their registration which consequently may lead them to put off from the procedure of engaging with the FIRE-IN.
- Similarly, in several cases, confusion upon the selection of CCC within which the solution lies, led to delays and finally users are discouraged from submitting the solution although they have successfully registered.
- The issue of funding was raised by some small enterprises for becoming stakeholders as well as the issue of time they have to devote.
- Stakeholders expressed their **interest in participating in physical meetings**, which they tend to find more efficient for networking and promoting their products rather than submitting the solution in the platform.
- WP3 stakeholders, in many cases, despite their interest to the FIRE-IN project and network, tend to delay the upload of solution to the platform.
- The number of solutions submitted and especially of technological solutions is relatively low compared to the number of people contacted. Compared to the number of registered people the number is satisfying. Also, the fact that mainly electronic dissemination for the RfI was undertaken, should be considered in the overall comparison between solutions and registered persons.
- Users provide information regarding future improvements of their products in few cases.
- **Language is a barrier** to some extent, although this is an issue that is already being processed by the consortium but somehow also affected the 2nd RfI procedure.

The feedback and the interaction with stakeholders was a great opportunity to thoroughly test the FIRE-IN e-platform and has demonstrated its relevance and usefulness. Based on the previously mentioned comments from the community some recommendations for the improvement of the FIRE-IN e-platform are provided:

- Registration is simple and fast but the selection of the Thematic Working Group has one disadvantage, *i.e.* text on how to select multiple TWGs needs to be added.
- The validation of registration should be automatic and the "validation e-mail" should be shortly after a person's registration (max within a couple of minutes).
- In the "Login" section a "Forgot password" should be added.
- The FIRE-IN concept is not easily perceived when navigating in the e-platform "Home page".
- Even though FAQs exist, how to "Submit a solution" is not an easy task for someone to find it.
- Solutions, of any kind, should be accessible by a dedicated section. The existing pathway through the "Challenges and Resources" and then through each challenge is difficult to find.
- In the "Submit a solution" form, a descriptive text on how to select more than one challenge should be entered.
- It is not clear to the users that the matching of the solutions with the challenges of FIRE-IN is extremely important for the project. Somehow this has to be pointed out in the "Submit a solution".

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- The url of the solution, although entered by the user, does not appear in the solution unless the user fills in the additional, not mandatory, text box.
- When submitting a solution, the system could provide the user with a report in *.pdf format of the solution that has been submitted and how it will appear on the web. This can be done exactly after the submission online or to be sent to the user by e-mail, e.g. after the solution is validated.
- Language barriers. Many people find it difficult to read only in English. This is a barrier that is already under progress. It should be noted that FIRE-IN e-platform is translated in various languages, a unique characteristic of networking platforms.
- Finally, a proposition was to transform or to create a dedicated portal in the e-platform in the form of online marketplace. This proposition could be extremely appealing to private companies, especially SMEs. For example, to increase the number of solutions submitted, a rule of minimum two solutions by each user (by a domain organization check) should be submitted, in order its organization to gain a spot on the marketplace. Despite, any future decision on the evolution of the FIRE-IN e-platform, its public character and openness should be kept.

3.3. Methodological approach of submitted solutions in the RfI procedure

After the presentation of the communication and feedback with the stakeholders as well as the connection of CCCs to the RfI procedure, the basic steps of the analysis of each solution submitted to the platform are described below:

a) The first step is the application of the "traffic light system" in the solutions screened in WP2. This work is carried out mainly for all the technological solutions of WP2 but also for publications, guidelines and standards that are also presented in Deliverable D2.3[6]. Also, important findings from Deliverable D3.5[7] are also taken into account for the application of traffic light system on the solutions screened in WP2 for the 2nd cycle. This a basic step in order to better understand and gain a clear overview of where the market stands. This information will provide input for the following steps. This analysis is presented in chapter 4 which follows.

b) The second step of the analysis is the discretisation of solutions submitted to the FIRE-IN e-platform. According to the on-line form, the user (technology supplier, stakeholder, etc.) can submit three types of solutions:

- Publication
- Best practices, doctrine, lessons learned
- Technological innovation

c) The third step is the check and analysis of each solution submitted in the FIRE-IN e-platform. The matching of the 1st cycle CCCs with the Prioritised CCCs of the 2nd cycle is also carried out. Also, for the cases that the platform user (technology supplier, stakeholder, etc.) has not completed the CCCs field of the form, the CCCs are added by WP3 leader. Following, the information provided by

[7] Lahaye, S. et al. (2019). D3.5 Final Strategic Research and Standardisation Agenda #1 (Fire-In consortium, July 2019).

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the user in the submission form is checked, in order to classify the solution based on the "traffic light system". All types of solutions are checked. Individual publications are excluded from the "traffic light system". The way that "traffic light system" is built for publications and projects demands that this kind of solutions has to be checked in total and not one by one. Especially, for technological solutions, another important factor is checked: if the solution submitted is already in use by various organisations. This element is an additional feature that can provide significant input whether the solution is truly being implemented by possible end-users or not. This is a further step after the "traffic light" system which is not depicted in it. This further analysis as well as additional comments are provided only for technological solutions, which are the core of WP3 and this deliverable.

d) The final step is the application of the "traffic light system" to the prioritised CCCs taking into account the results of the analysis of the solutions performed in the previous steps. The overall analysis of each CCC according to the traffic light system is applied based on both the solutions of WP2 and WP3.

For the submitted solutions various statistics are provided as well as the way CCCs are covered. All solutions, irrespective of their type, are presented one by one in table format.
Publications and best practices, doctrines and lessons learnt are presented in an overall table, while for technological solutions, as the core element of this deliverable, a separate table is provided for each of the solutions. For technological solutions the following fields are provided:

- Solution name
- Solution provider
- Solution Short description (as submitted by the user)
- Solution type
- Relevant Thematic Working Group (as submitted by the user)
- TRL (as submitted by the user)
- 1st cycle CCCs addressed (as submitted by the solution provider of the e-platform)
- 2nd cycle CCCs addressed (added by WP3 leader)
- Scope/Rational context (as submitted by the user)
- E-FIRE-IN link (direct link to the FIRE-IN platform)
- Expected/future developments (from the side of the provider as submitted by the solution provider)
- Comments from the analysis (added by WP3 leader)

The results of the abovementioned steps are presented in a table format for each solution in chapter 4. The table has the following format:

Table 5. Example of the format for the results for each solution submitted in the e-platform of FIRE-IN.

Solution Name	Solution Type
Solution provider	
Solution short description	
Scope / Rational context	
Relevant Thematic Working Group	TRL
Link in the FIRE-IN platform	
1st cycle CCCs addressed	
2nd cycle CCCCs addressed (added by WP3 leader)	

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Ideas and future developments (from the side of the solution provider)
Comments from the analysis (added by WP3 leader)

At this point, it should be noted that the main focus of the present deliverable is the analysis of technological solutions. As mentioned in chapter 2.3 the fact that solutions in terms of publications and best practices have been submitted in the e-platform lead us to also provide some basic analysis according to the traffic light system for them too. The latter could not be ignored, as publications and best practices provide significant information and technological innovators are expected to consider research and lessons learnt during the development of new tools.

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4. Analysis and Results

4.1. "Traffic light system" for the solutions screened in WP2

In WP2 during the 2nd cycle, 168 technological solutions, 267 research items, 40 guidelines and 7 standards were screened and matched with the prioritized CCCs. The screened technological solutions matched at least one CCC, with that meaning that solutions were repeating between the ten (10) prioritized CCCs. Prioritized CCCs of "Technology" and "Standards" were not treated as separate category of capability-challenge due to their generic intrinsic character.

4.1.1. Technological solutions

The first step for the analysis of the RfI procedure is the application of the traffic light system, mainly to the technological solutions screened during the second cycle of the project in WP2. This is extremely important in order to gain more knowledge and a more concrete view over the status of the market. The solutions submitted to the FIRE-IN e-platform are examined in the next step. The basis of the traffic light system is briefly presented in chapter 2.2 and in detail in Deliverable D3.1[3].

General comments that arise from the traffic light system analysis:

- The vast majority of the solutions is of TRL=9, because of the technological solutions screened in WP2. The fact that more than 160 solutions with TRL>7 exist provides evidence that in the market many solutions exist that can cover the Common Capability Challenges to a significant extent. Also, the fact that purely technological solutions that could not exactly match the ten prioritized CCCs during the 2nd cycle and refer specifically only to some special hardware equipment like drones or robots, that potentially can cover the majority of the CCCs, means that technological solutions of all kinds exist, from hardware, software and even materials.
- Another issue is that of operational value, especially for the technologies that are targeted to the general public. These applications, besides the ones that are related to alerts, are educational technologies in the form of text or games. The operational value for them is dealt in the form of being easy to use and understand and provide adequate information to the end user.
- Information on potential standards addressed by and the level of the interoperability was not provided clearly in many cases in the general description. In order to assess the issue of standards we took into account the extent that general guidelines from official sources are being considered and the comparison between existing standards and the capabilities of each technology as they are described from the supplier. In general, this means that technological solutions that address "*Incident Command Organization*" do have some standardized technologies, meaning TCP/IP, 3G, 4G, standard file formats, etc., and some extent of interoperability and have also been manufactured based on some standards. On the contrary, the technologies that can be matched with the "*Community Involvement*" may lack in interoperability and standards. Some technologies do not seem to follow certain standards or have a certain degree of interoperability. Some are based on independent programmers meaning that their credibility could be posed under question. Nevertheless, it is important to note that the majority of technologies seem to follow the need for standards and interoperability.
- Finally, from WP2 the capability of "*Incident Command Organization*" seems to be fully covered by technologies, while the same occurs with the capability of "*Knowledge Cycle*". On the contrary, in

"C*ommunity involvement*" research is ahead of technology. Many research items exist regarding community involvement that is not fully covered by technological solutions. We do know that everyday new technological solutions regarding community involvement, such as early warning systems, appear on the market. The lack of standards is apparent but this is balanced because of the existence of guidelines. Guidelines are not that easy to be integrated as an assistance into software or other technologies, as in most cases there is no obligation to do so.

In Table 6 the number of solutions screened from WP2, to which a traffic light characterization was allocated, is enlisted per each criterion studied and for all ten prioritized CCCs. The reasons that CCC #2 and CCC #10 of Table 2 are not analysed is described in detail in Deliverable D2.3[6]. Also, the overall level of coverage, in terms of the traffic light system, of each prioritized CCC is presented on Table 6 based on the technological solutions of WP2. The color denotes the coverage level of the respective CCC. The final color has been given based on the assessment of the traffic light system and the overall impression on the extent that the CCC is covered without the application of mathematical weighting. Practically, "Incident Command Organization" can be characterized as green, "Community Involvement" as yellow, "Pre-planning" as green and "Knowledge cycle" as yellow in terms of technology.

During this step of analysis, for the prioritized CCCs, specific comments follow:

- **CCC1 – Community Involvement**: 34 technological solutions were evaluated and considered. Various applications exist both from well-established organizations and independent programmers. The majority of technologies follow specific guidelines while, for others, the extent of validity is not certain. The majority have some interoperability characteristics. The operational value is mainly from the point-of-view of its end users, meaning the general public and not first responders. Worldwide applications.
- **CCC3 – Community Involvement**: 32 technological solutions were evaluated and considered. Similar comments as in CCC1.
- **CCC4 – Community Involvement**: 35 technological solutions were evaluated and considered. In this CCC, besides software applications from credible institutions that directly target the general public are also taken into account, giving credibility to interoperability and standards. The majority of the applications have significant operational value.
- **CCC5 – Knowledge Cycle**: 48 technological solutions were evaluated and considered. Special software and applications with proven operational value. The majority supports interoperability while standardization has raised for more of them. Minor applications without clear information on their interoperability, standards and operational value.
- **CCC6 – Incident Command Organization**: 44 technological solutions were evaluated and considered. Incident Command Organization is the capability with the green operational value, interoperability and standards. The majority, if not all, are already in the market interoperable equipment and used by first responders. Applications from worldwide. This is also depicted in CCC7 and CCC9.
- **CCC7 – Incident Command Organization**: 80 technological solutions were evaluated and considered. Similar comments as in CCC6.
- **CCC8 – Pre-planning**: 50 technological solutions were evaluated and considered
- **CCC9 – Incident Command Organization**: 74 technological solutions were evaluated and considered. Similar comments as in CCC6.

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- **CCC11 – Knowledge Cycle**: 21 technological solutions were evaluated and considered. Practically, a green level is addressed for all criteria of traffic light system. Nevertheless, for some technologies the extent of their standardization is not very clear.
- **CCC12 – Community Involvement**: 35 technological solutions were evaluated and considered. Similar comments as to CCC1. Alert functionality is included in solutions provided mainly by well-established organizations. Also, applications from independent or private companies are retrieved through the same well-established organizations.

Table 6. Traffic Light System for the prioritised CCCs based on technological solutions screened in the 2nd cycle of WP2. In addition, the level of coverage for the respective is also presented.

Nr	Description	Criteria	Green	Yellow	Red
1	Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits … (Community involvement)	Operational Value	**24 solutions** Already available and operation	**10 solutions** Available as pilot solution/demonstration	Further research and development needed
		Solution maturity (TRL)	**32 solutions** Already available in the market (TRL ≥ 9)	**2 solutions** Already developed as prototype and being tested / validated (6 ≤ TRL < 9)	Still need some research and development (TRL < 6)
		Interoperability & standardization	**14 solutions** Availability of the standards describing to solutions and interoperability issues	**13 solutions** Awareness of need for standard	**7 solutions** Standards not yet addressed
3	Change of paradigm. From 'We, authorities, will protect you' to 'You, citizen, should be actively involved'. These affirmations mean that you should be prepared to be self-sufficient concerning to your own protection and your community protection always inside the framework of the emergency. Be used to this sort of situations normalizing them. (Community involvement)	Operational Value	**22 solutions** Already available and operation	**10 solutions** Available as pilot solution/demonstration	Further research and development needed
		Solution maturity (TRL)	**30 solutions** Already available in the market (TRL ≥ 9)	**2 solutions** Already developed as prototype and being tested / validated (6 ≤ TRL < 9)	Still need some research and development (TRL < 6)
		Interoperability & standardization	**11 solutions** Availability of the standards describing to solutions and interoperability issues	**13 solutions** Awareness of need for standard	**8 solutions** Standards not yet addressed

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Nr	Description	Criteria	Green	Yellow	Red
4	Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises. (Community involvement)	Operational Value	**28 solutions** Already available and operation	**7 solutions** Available as pilot solution/demonstration	Further research and development needed
		Solution maturity (TRL)	**33 solutions** Already available in the market (TRL ≥ 9)	**2 solutions** Already developed as prototype and being tested / validated (6 ≤ TRL < 9)	Still need some research and development (TRL < 6)
		Interoperability & standardization	**21 solutions** Availability of the standards describing to solutions and interoperability issues	**13 solutions** Awareness of need for standard	**1 solution** Standards not yet addressed
5	Once the standard roles of different actors have been trained and drilled inside each agency, organize multiagency joint trainings and exercises with the focus on decision-making, coordination and interactions between agents. Train in overlapped competences and limits of competences. Train the trainers of the different agencies. Share on-line training and exercises. (Knowledge cycle)	Operational Value	**39 solutions** Already available and operation	**9 solutions** Available as pilot solution/demonstration	Further research and development needed
		Solution maturity (TRL)	**44 solutions** Already available in the market (TRL ≥ 9)	**4 solutions** Already developed as prototype and being tested / validated (6 ≤ TRL < 9)	Still need some research and development (TRL < 6)
		Interoperability & standardization	**24 solutions** Availability of the standards describing to solutions and interoperability issues	**22 solutions** Awareness of need for standard	**2 solution** Standards not yet addressed
6	Identify points of coordination in the different zones: from local (hot zone, warm zone ...) to regional and to national. Establish different levels of liaison officers, translators; communication; entrance points; and infrastructures as needed.	Operational Value	**43 solutions** Already available and operation	**1 solution** Available as pilot solution/demonstration	Further research and development needed
		Solution maturity (TRL)	**43 solutions** Already available in the market (TRL ≥ 9)	**1 solution** Already developed as prototype and being tested / validated (6 ≤ TRL < 9)	Still need some research and development (TRL < 6)

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Nr	Description	Criteria	Green	Yellow	Red
	(Incident Command Organization)	Interoperability & standardization	**43 solutions** Availability of the standards describing to solutions and interoperability issues	**1 solution** Awareness of need for standard	Standards not yet addressed
7	Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points… (Incident Command Organization)	Operational Value	**74 solutions** Already available and operation	**6 solutions** Available as pilot solution/demonstration	Further research and development needed
		Solution maturity (TRL)	**74 solutions** Already available in the market (TRL ≥ 9)	**6 solutions** Already developed as prototype and being tested / validated (6 ≤ TRL < 9)	Still need some research and development (TRL < 6)
		Interoperability & standardization	**71 solutions** Availability of the standards describing to solutions and interoperability issues	**9 solutions** Awareness of need for standard	Standards not yet addressed
8	Base the prediction of scenarios on historical events and on statistics (baseline), including the modelling of the actual conditions (at local level) and human factors. (Pre-planning)	Operational Value	**44 solutions** Already available and operation	**6 solutions** Available as pilot solution/demonstration	Further research and development needed
		Solution maturity (TRL)	**46 solutions** Already available in the market (TRL ≥ 9)	**4 solutions** Already developed as prototype and being tested / validated (6 ≤ TRL < 9)	Still need some research and development (TRL < 6)
		Interoperability & standardization	**32 solutions** Availability of the standards describing to solutions and interoperability issues	**18 solutions** Awareness of need for standard	Standards not yet addressed
9	Maintain situation awareness. Avoid the loss	Operational Value	**71 solutions** Already available and operation	**3 solutions** Available as pilot solution/demonstration	Further research and

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Nr	Description	Criteria	Green	Yellow	Red
	of information with shifts' changes. (Incident Command Organization)				development needed
		Solution maturity (TRL)	**71 solutions** Already available in the market (TRL ≥ 9)	**3 solutions** Already developed as prototype and being tested / validated (6 ≤ TRL < 9)	Still need some research and development (TRL < 6)
		Interoperability & standardization	**69 solutions** Availability of the standards describing to solutions and interoperability issues	**5 solutions** Awareness of need for standard	Standards not yet addressed
11	Towards a complete cycle of knowledge. Adjust Standard Operational Procedures (SOPs), doctrine and pre-plans using the feedback from real incidents and from exercises testing them (evaluators, assessors, statistics…) and identify the main gaps to focus efforts in training, procedures, personnel and equipment. Evidence based on fire scenarios. The process learning of an organization goes through the identification of own 'best practices' and the external ones: • to collect experiences and convert them into guides, • to collect 'lessons learned' and transform the best points into protocols, • to share experiences with the aim of generating standards. (Knowledge Cycle)	Operational Value	**17 solutions** Already available and operation	**4 solutions** Available as pilot solution/demonstration	Further research and development needed
		Solution maturity (TRL)	**21 solutions** Already available in the market (TRL ≥ 9)	Already developed as prototype and being tested / validated (6 ≤ TRL < 9)	Still need some research and development (TRL < 6)
		Interoperability & standardization	**12 solutions** Availability of the standards describing to solutions and interoperability issues	**9 solutions** Awareness of need for standard	Standards not yet addressed

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Nr	Description	Criteria	Green	Yellow	Red
12	Be prepared to provide massive alerts to population (Community involvement)	Operational Value	**35 solutions** Already available and operation	Available as pilot solution/demonstration	Further research and development needed
		Solution maturity (TRL)	**35 solutions** Already available in the market (TRL ≥ 9)	Already developed as prototype and being tested / validated (6 ≤ TRL < 9)	Still need some research and development (TRL < 6)
		Interoperability & standardization	**17 solutions** Availability of the standards describing to solutions and interoperability issues	**14 solutions** Awareness of need for standard	**4 solutions** Standards not yet addressed

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4.1.2. Publications, best practices and lessons learnt

Continuing with the technological solutions a brief review regarding some of the solutions already presented in WP2 and Deliverable D2.3[6]. According to the results of WP2, academic research is quite productive with numerous papers while guidelines and especially standards are limited. This is even more apparent in universal guidelines which could be adopted by practitioners around the world.

Publications - Research

Regarding research items, we analyzed 54 papers, as these were presented in the Deliverable D2.3, representing a sample of 20% of the research solutions of WP2. Research exist for all prioritized CCCs. The sample is small to apply the traffic light system and get reliable results. Traffic light system, in the publications and projects domain (Table 3) examines the CCC based on the number of available projects and publications. From Deliverable D3.5[7], traffic light system has been applied on research items of the 1st cycle CCCs. As the 2nd cycle is a prioritization of the CCCs of the 1st cycle by combining the results from the 1st cycle with the transformation matrix between the two cycles (Table 6) the coverage level for the prioritized CCCs of the 2nd cycle is presented in Table 7.

A brief application of the traffic light system to the solutions (publications) published in Deliverable D2.3 reveals that the majority of the prioritized CCCs of the 2nd cycle is on a green level regarding publications. Only CCC3 and CCC4 (Community Involvement) can be characterized as yellow. The "Access to Knowledge" of all publications is in green level as well as the "Operational value" of the majority of the publications studied from the information provided from WP2. The majority of the operational value of publications in CCC3 and CCC4 are yellow or red.

Table 7. Analysis of WP2 solutions referring to research. The level of coverage is based on the results of Deliverable D3.5[7]

Prioritized CCC	Level of coverage
CCC1: Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …	**Yellow: A lot of articles but few projects on the following "community" related topics: Resilience, communication, collaboration**
CCC3: Change of paradigm. From 'We, authorities, will protect you' to 'You, citizen, should be actively involved'. These affirmations mean that you should be prepared to be self-sufficient concerning to your own protection and your community protection always inside the framework of the emergency. Be used to this sort of situations normalizing them.	
CCC4: Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises.	
CCC5: Once the standard roles of different actors have been trained and drilled inside each agency, organize multiagency joint trainings and exercises with the focus on decision-making, coordination and interactions between agents. Train in overlapped competences and limits of competences. Train the trainers of the different agencies. Share on-line training and exercises.	**Green: many projects and articles on interoperability and information systems**

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CCC6: Identify points of coordination in the different zones: from local (hot zone, warm zone ...) to regional and to national. Establish different levels of liaison officers, translators; communication; entrance points; and infrastructures as needed.	**Green; Many projects and articles on crisis management, coordination, networks and collaboration**
CCC7: Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points…	**Yellow: Some projects and articles on mainly social media and ICT tools**
CCC8: Base the prediction of scenarios on historical events and on statistics (baseline), including the modelling of the actual conditions (at local level) and human factors.	**Red: Few projects and articles on mostly on 9/11.**
CCC9: Maintain situation awareness. Avoid the loss of information with shifts' changes.	**Green: large variety of projects and articles on technological and non-technological solutions**
CCC11: Towards a complete cycle of knowledge. Adjust Standard Operational Procedures (SOPs), doctrine and pre-plans using the feedback from real incidents and from exercises testing them (evaluators, assessors, statistics…) and identify the main gaps to focus efforts in training, procedures, personnel and equipment. Evidence based on fire scenarios. The process learning of an organization goes through the identification of own 'best practices' and the external ones: • to collect experiences and convert them into guides, • to collect 'lessons learned' and transform the best points into protocols, • to share experiences with the aim of generating standards.	**Yellow: Some projects and articles on a variety of large scale incidents like large fires, nuclear emergencies**
CCC12: Be prepared to provide massive alerts to population	**Yellow: A lot of articles but few projects on the following "community" related topics: Resilience, communication, collaboration**

Guidelines and Standards

For the purposes of WP3 and the application of the traffic light system, guidelines are considered in the category of standards. Out of the 47 guidelines and standards checked in WP2, 41 of them were presented in the Deliverable. These ones were analyzed in terms of the traffic light system.

This analysis reveals that prioritized CCC3 and CCC5 can be characterized as yellow while the rest of the CCCs could be characterized as green with the exception of CCC9 for which no guideline or standard could be matched in WP2 (Table 8). A contradiction between CCC9 and CCC6 and CCC7 appears as the three CCCs represent the capability of Incident command Organizations. In our opinion CCC9 is also green in terms of guidelines as it belongs in the *Incident Command Organization* capability and from the analysis of the technologies it has been shown that CCC9 is on equal level with CCC6 and CCC7, which also belong to the capability of *Incident Command Organization*. **The level of coverage of Table 20 represents at a much greater extent guidelines and professional standards, and not formal standards.** The distinction between professional and formal standards is described in Deliverable D3.5[7]. **The number of standards identified so far in WP2 is small and does not provide good coverage of the CCCs. In our opinion, standards, especially in the form of formal standards, are in red to yellow coverage for all prioritized CCCs.**

At this point the following comment should be noted. The fact that the majority of CCCs seems to be in a green level needs extreme attention as it provides an image that the majority of the prioritized CCCs are in green level. First of all, although the 87% is a very good sample due to the fact that the

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cumulative number is not significantly high, changes may occur in the overall level of the traffic light system. Especially, existing standards is a small number globally.

Another issue that needs attention is the fact that many of the guidelines are issued by associations that are either local/regional or international. Although the internationality is a criterion of the traffic light system, guidelines from some international organizations did not provide adequate information if these guidelines are widely accepted by many nations and if are in use in the operational environment and require further analysis.

The existence of various guidelines worldwide and in several languages is a fact. **The extent of internationalization, homogenization of these guidelines is unknown, and this reveals the need of the transformation and harmonization of guidelines and best practices to standards.**

Table 8. Analysis of WP2 solutions referring to guidelines and standards with the traffic light system. Guidelines have been treated as standards.

Prioritized CCC	Green	Yellow	Red
CCC1: Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …	**8 solutions** (for one solution it is not clear if it is valid for other countries outside the USA)	**4 solutions**	
CCC3: Change of paradigm. From 'We, authorities, will protect you' to 'You, citizen, should be actively involved'. These affirmations mean that you should be prepared to be self-sufficient concerning to your own protection and your community protection always inside the framework of the emergency. Be used to this sort of situations normalizing them.	**2 solutions** (for one solution it is not clear if it is valid for other countries outside the USA)	**2 solutions**	**1 solution**
CCC4: Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises.	**6 solutions** (for at least 1 is not clear if it is used)		
CCC5: Once the standard roles of different actors have been trained and drilled inside each agency, organize multiagency joint trainings and exercises with the focus on decision-making, coordination and interactions between agents. Train in overlapped competences and limits of competences. Train the trainers of the different agencies. Share on-line training and exercises.		**2 solutions**	
CCC6: Identify points of coordination in the different zones: from local (hot zone, warm zone ...) to regional and to national. Establish different levels of liaison officers, translators; communication; entrance points; and infrastructures as needed.	**4 solutions**	**1 solution**	
CCC7: Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points…	**1 solution**		
CCC8: Base the prediction of scenarios on historical events and on statistics (baseline), including the modelling of the actual conditions (at local level) and human factors.	**3 solutions**		
CCC9: Maintain situation awareness. Avoid the loss of information with shifts' changes.	**0 solutions**	**0 solutions**	**0 solutions**
CCC11: Towards a complete cycle of knowledge. Adjust Standard Operational Procedures (SOPs), doctrine and pre-plans using the feedback from real incidents and from exercises testing them (evaluators, assessors, statistics…) and identify the main gaps to focus efforts in training, procedures, personnel and equipment. Evidence based on fire scenarios. The process learning of an	**3 solutions**		

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organization goes through the identification of own 'best practices' and the external ones: • to collect experiences and convert them into guides, • to collect 'lessons learned' and transform the best points into protocols, • to share experiences with the aim of generating standards.			
CCC12: Be prepared to provide massive alerts to population	**2 solutions**	**1 solution**	

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4.2. Solutions submitted in the FIRE-IN e-platform

This chapter is devoted to the presentation and analysis of the solutions (technological innovations, publications, best practices, lessons learnt, guidelines) as submitted by the FIRE-IN network solution providers to the e-platform. It corresponds to the second, third and the fourth step of our analysis as described in the methodology section. Chapter 4.2.2 is devoted to publications, best practices, doctrines and lessons learnt. Chapter 4.2.3 is devoted to the technological solutions.

4.2.1. First screening and filtering

During the 2nd cycle of "Request for Ideas" 50 solutions, in total, were submitted in the FIRE-IN e-platform. As stated in previous chapters, the term "solutions" refers to technological innovations, publications and best practices-doctrines-lessons learnt. This classification in terms of figures is presented in Table 9. Best practices include also guidelines. In Table 10, the distribution according to the Thematic Working Groups (TWGs) is also presented. At this point, it should be noted that certain solutions were matched by the users with all TWGs of the project.

Table 9. Distribution, per type, of the submitted solutions in the FIRE-IN e-platform during the 2nd cycle.

Solution type	Number	Percentage
Technological Innovation	30	60%
Best practices/doctrines/lessons learnt/guidelines	12	24%
Publications	8	16%

Table 10. Distribution, per TWG and type, of the submitted solutions in the FIRE-IN e-platform during the 2nd cycle of "Request for Ideas". The sum of overall exceeds the numbers of submitted solutions because some solutions were addressed to all TWGs.

Thematic Working Groups	Technological innovation	Best practices/doctrines /lessons learnt	Publications	Overall
TWG A	17	5	2	24
TWG B	8	3	1	12
TWG C	12	4	4	20
TWG D	16	7	6	29
TWG E	8	5	2	15

Regarding technological innovations, a further distinction is imperative. Thus, technologies are separated in three categories:

- Software (computer programmes and models)
- Hardware (technological equipment, such as AI, drones, cameras, sensors, motes e.t.c.)
- Other tools (services, materials, etc)

Software represent 50% (15 solutions) of technological innovations. Moreover, thirteen (13) technological solutions are related to hardware and two (2) are related to a form of services. It should be mentioned that some of the technological innovations include both hardware and software, for instance Artificial Intelligence (AI) or Unmanned Aerial Vehicles (UAVs – drones) (Figure 7).

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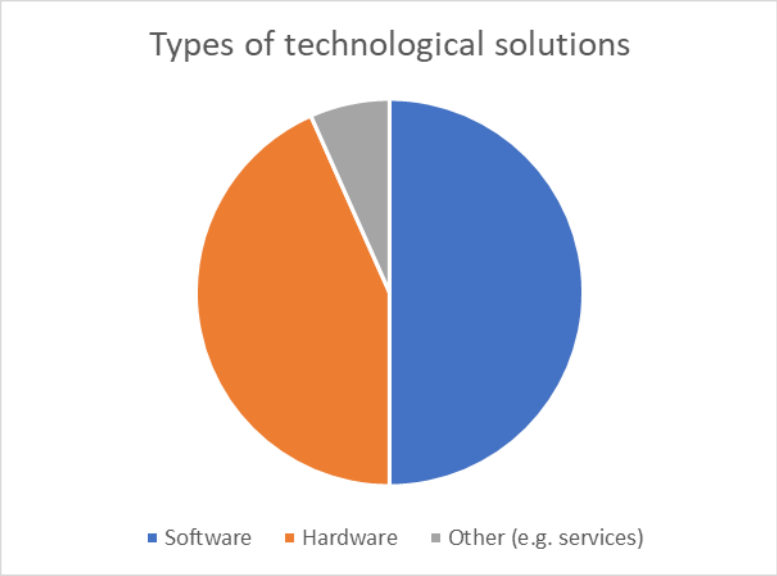

Figure 7. Types of technological solutions

Regarding the distribution of solutions according to the Common Capability Challenges, Table 11 presents the number of solutions per CCC of the 1st cycle while in Table 12 of the 2nd cycle CCC. At this point, all solutions, regardless of their type, are presented.

Table 11. Distribution of solutions per 1st cycle CCCs.

1st cycle CCCs	Nr of solutions	Capability
Focus on sustainability of safe operations	19	Incident Command Organisation
Anticipate vulnerability and communicate to the public	16	
Distribute decision making	11	
Strategies choosing safe, resilient scenarios, and maintaining credibility	5	
Train specific roles and risks	0	Knowledge Cycle
Organizational learning focusing efforts in key risks and opportunities	7	
Build a shared understanding of emergency and train interagency scenarios	9	
Focus on capacity building towards more resilient societies	4	
Develop public self-protection	14	Community Involvement
Prepare communities for the worst scenario before it happens	10	
Cultural changes in risk tolerance and resilience	7	
Pre-plan a time efficient, safe response, minimizing responder's engagement	10	Pre-planning
Negotiate solutions with stakeholders for anticipated scenarios	9	
Pre-Plan interoperability and enhance synergies	6	
Focus on governance and integral risk management	6	
Establish procedures and guides	5	Guidance Instruments and Standards
Standardize capabilities in front of pre-established scenarios	7	
Establish an interagency framework	3	
Build doctrine for resilience in emergency services and societies	2	
Information cycle	6	Information Management
Manage key information on decision-making	4	
Define common information management processes between agencies	1	
Provide an efficient, flexible flow of information for a shared understanding	7	

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Use technology to assess risks and minimize responder's engagement	29	Technology
Forecast and simulate complex scenarios	9	
Technological tools to support data sharing	9	
Get a clear picture of the risk evolution	11	

Table 12. Distribution of CCCs per 2nd cycle prioritized CCCs.

Description	Capability	Nr of solutions
Identify points of coordination in the different zones: from local (hot zone, warm zone ...) to regional and to national. Establish different levels of liaison officers, translators; communication; entrance points; and infrastructures as needed.	Incident Command Organisation	11
Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points…		16
Maintain situation awareness. Avoid the loss of information with shifts' changes.		19
Once the standard roles of different actors have been trained and drilled inside each agency, organize multiagency joint trainings and exercises with the focus on decision-making, coordination and interactions between agents. Train in overlapped competences and limits of competences. Train the trainers of the different agencies. Share on-line training and exercises.	Knowledge cycle	9
Towards a complete cycle of knowledge. Adjust Standard Operational Procedures (SOPs), doctrine and pre-plans using the feedback from real incidents and from exercises testing them (evaluators, assessors, statistics…) and identify the main gaps to focus efforts in training, procedures, personnel and equipment. Evidence based on fire scenarios. The process learning of an organization goes through the identification of own 'best practices' and the external ones: • to collect experiences and convert them into guides, • to collect 'lessons learned' and transform the best points into protocols, • to share experiences with the aim of generating standards.		7
Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …	Community involvement	14
Change of paradigm. From 'We, authorities, will protect you' to 'You, citizen, should be actively involved'. These affirmations mean that you should be prepared to be self-sufficient concerning to your own protection and your community protection always inside the framework of the emergency. Be used to this sort of situations normalizing them.		8
Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises.		10

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Be prepared to provide massive alerts to population.		7
Base the prediction of scenarios on historical events and on statistics (baseline), including the modelling of the actual conditions (at local level) and human factors.	Pre-planning	9
Adapt the legal framework and requirements on prevention and self-protection of infrastructures and activities to first responders' needs, lessons learned from past events... Plan the implementation of laws and plans. Adapt the regulations to emergency situations.	Guidance instruments and standards	17
Technologies used in interventions should be: • Useful. • Simple, intuitive and easy to use. • Easy to integrate and interoperable. • Easy to transport, deployable on field, light, with high autonomy. • Robust, resistant, long duration, able to tolerate severe/harsh conditions. • Open access. • Usable by people with disabilities.	Technology	29

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4.2.2. Publications, best practices, doctrines submitted in the FIRE-IN e-platform

This section is devoted to the presentation of solutions submitted in the FIRE-IN e-platform and characterized as "publications and best practices/doctrines/lessons learnt". As stated in Table 10, eight (8) solutions are related to publications and 12 to best practices/lessons learnt/doctrines. In Table 13 the matching of publications with the CCCs from the 1st cycle as well as the prioritized CCCs of the 2nd cycle is presented, while in Table 14 this matching is presented for the best practices. The analysis of Publications and Best Practices submitted in the FIRE-IN e-platform are presented one by one in the following pages.

Publications

Table 13. Matching of the submitted publications CCCs between the 2 cycles of FIRE-IN.

1st cycle CCCs matching for Publications	Nr of solutions	2nd cycle prioritized CCCs matching for Publications	Capability
Cultural changes in risk tolerance and resilience.	3		Community Involvement
Involve communities in preparing population for the worst scenario before it happens (TOP CHALLENGE)	2	✓ Change of paradigm. From 'We, authorities, will protect you' to 'You, citizen, should be actively involved'. These affirmations mean that you should be prepared to be self-sufficient concerning to your own protection and your community protection always inside the framework of the emergency. Be used to this sort of situations normalizing them. ✓ Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises. ✓ Be prepared to provide massive alerts to population.	Community Involvement
Develop public self-protection to minimize responders exposures (TOP CHALLENGE)	5	Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …	Community Involvement
Information cycle	2		Information Management
Focus on governance and capacity building towards more resilient societies	2		Pre-planning
Build a shared understanding of emergency and train interagency scenarios (TOP CHALLENGE)	1	Once the standard roles of different actors have been trained and drilled inside each agency, organize multiagency joint trainings and exercises with the focus on decision-making, coordination and interactions between agents. Train in overlapped competences and limits of competences. Train the trainers of the different agencies. Share on-line training and exercises.	Knowledge cycle
Strategies choosing safe, resilient scenarios, and maintaining credibility	1		Incident Command Organization

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Focus on sustainability of safe operations (TOP CHALLENGE).	1	Maintain situation awareness. Avoid the loss of information with shifts' changes.	Incident Command Organization
Anticipate vulnerability, and communicate to the public (TOP CHALLENGE).	1	Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points…	
Provide an efficient, flexible flow of information for a shared understanding	1		Information Management
Organizational learning focusing efforts in key risks and opportunities (TOP CHALLENGE)	1	Towards a complete cycle of knowledge. Adjust Standard Operational Procedures (SOPs), doctrine and pre-plans using the feedback from real incidents and from exercises testing them (evaluators, assessors, statistics…) and identify the main gaps to focus efforts in training, procedures, personnel and equipment. Evidence based on fire scenarios. The process learning of an organization goes through the identification of own 'best practices' and the external ones: • to collect experiences and convert them into guides, • to collect 'lessons learned' and transform the best points into protocols, • to share experiences with the aim of generating standards.	Knowledge cycle
Negotiate solutions with stakeholders for anticipated scenarios (TOP CHALLENGE)	2	Base the prediction of scenarios on historical events and on statistics (baseline), including the modelling of the actual conditions (at local level) and human factors.	Pre-planning
Pre-plan interoperability and enhance synergies	2		Pre-planning
Build doctrine for resilience in emergency services and societies	1		Standardization

Although the number of publications so far in the FIRE-IN e-platform is small, the focus on the capability of "Community Involvement" is clear. All publications submitted match at least with one CCC of Community Involvement. This finding is extremely important and comes in accordance with the results of WP2 (D2.3[6]) where many papers have been found to be related with the "Community Involvement Capability". It is clearly seen that research is extremely active on topics that are characterized as a priority from the first responders and practitioners. The traffic light system regarding publications and projects cannot be applied to each solution/publication separately, but it has to be examined as an overall aspect. **Based on the results of D3.5[7] and the matching between the two cycles, Table 7 still seems to be valid. However, for the "Community Involvement" capability, some of the prioritized CCCs marginally moved between "Green" and "Yellow" level.**

P1 to P8 below detail the publications posted on FIRE-IN e-platform and analysed in the present deliverable.

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P1- Integrated flood management tools series management of flash floods

Solution Name:	**Solution provider:**
Integrated flood management tools series management of flash floods	**Associated Programme on flood management (Meteorological Organisation and the Global Water Partnership)**
Solution Type: Publication/Project	
Solution short description This publication is part of the "Flood Management Tools Series" being compiled by the Associated Programme on Flood Management. The "Management of Flash Floods" Tool is based on available literature and draws findings from relevant works wherever possible. This Tool addresses the needs of practitioners and allows them to easily access relevant guidance materials. The Tool is considered as a resource guide/material for practitioners and not an academic paper.	
Website of the solution: https://www.floodmanagement.info/	
Relevant Thematic Working Group Natural Hazard Mitigation	**TRL**: 1-2: Basic Technology Research
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/integrated-flood-management-tools-series-management-of-flash-floods	

1st cycle CCCs addressed *(added by the stakeholder)*

- ✓ Cultural changes in risk tolerance and resilience.
- ✓ Involve communities in preparing population for the worst scenario before it happens (TOP CHALLENGE).
- ✓ Develop public self-protection to minimize responders exposures (TOP CHALLENGE).
- ✓ Information cycle.
- ✓ Focus on governance and capacity building towards more resilient societies.

2nd cycle CCCCs addressed *(added by WP3 leader)*

- ✓ Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …
- ✓ Change of paradigm. From 'We, authorities, will protect you' to 'You, citizen, should be actively involved'. These affirmations mean that you should be prepared to be self-sufficient concerning to your own protection and your community protection always inside the framework of the emergency. Be used to this sort of situations normalizing them.
- ✓ Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises.
- ✓ Towards a complete cycle of knowledge. Adjust Standard Operational Procedures (SOPs), doctrine and pre-plans using the feedback from real incidents and from exercises testing them (evaluators, assessors, statistics…) and identify the main gaps to focus efforts in training, procedures, personnel and equipment. Evidence based on fire scenarios. The process learning of an organization goes through the identification of own 'best practices' and the external ones:
  - to collect experiences and convert them into guides,
  - to collect 'lessons learned' and transform the best points into protocols,
  - to share experiences with the aim of generating standards.

Comments from the analysis *(added by WP3 leader)*

A project/initiative, currently running in PHASE 4, with a main focus into policy and practice to support countries and provide guidance and update relevant publications. An initiative running by the World Meteorological Organisation and the Global Water Partnership.

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P2 - Rôle et missions des conseillers techniques zonaux dans l'organisation des entraînements pour faire face aux menaces NRBCE (FR content)

Solution Name:	**Solution provider:**
Rôle et missions des conseillers techniques zonaux dans l'organisation des entraînements pour faire face aux menaces NRBCE	**CERISC - ENSOSP**

Solution Type: Publication

Solution short description

Le Livre blanc de la défense et de la sécurité de 2008 a identifié la nécessité de créer un centre national de formation et d'entraînement NRBC. En 2014, un service à compétence nationale a été créé en ce sens, il s'agit du Centre national civil et militaire de formation et d'entraînement aux événements de nature nucléaire, radiologique, biologique, chimique et explosive (CNCMFE-NRBCe), dont la mission est d'améliorer les capacités d'intervention face aux menaces et aux risques de nature NRBCe. Des entraînements interministériels sont organisés dans chaque zone de défense et de sécurité pour améliorer cette réponse interservices. Notre travail s'intéresse à la place du conseiller technique zonal dans ce dispositif. Il est l'un des référents techniques en la matière et doit contribuer à la diffusion des savoirs. Dans un premier temps, nous sommes intéressés à l'articulation CNCMFE-NRBCe / Zone de défense et de sécurité / Centre d'entraînement Zonal. Puis nous avons réalisé un sondage auprès des conseillers techniques zonaux afin de qualifier leurs implications dans ce dispositif. Ce sondage a été complété par des entretiens avec des personnalités qualifiées dans le domaine NRBCe. Enfin, nous proposons quelques pistes d'améliorations pour davantage clarifier le rôle et les missions des conseillers techniques zonaux.

Website of the solution: http://crd.ensosp.fr/doc_num.php?explnum_id=18201

Relevant Thematic Working Group: CBRNe

Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/role-et-missions-des-conseillers-techniques-zonaux-dans-l-organisation-des-entrainements-pour-faire-face-aux-menaces-nrbce

1st cycle CCCs addressed *(added by the stakeholder)*

✓ Build a shared understanding of emergency and train interagency scenarios (TOP CHALLENGE)

2nd cycle CCCCs addressed *(added by WP3 leader)*

✓ Once the standard roles of different actors have been trained and drilled inside each agency, organize multiagency joint trainings and exercises with the focus on decision-making, coordination and interactions between agents. Train in overlapped competences and limits of competences. Train the trainers of the different agencies. Share on-line training and exercises.

✓ Towards a complete cycle of knowledge. Adjust Standard Operational Procedures (SOPs), doctrine and pre-plans using the feedback from real incidents and from exercises testing them (evaluators, assessors, statistics…) and identify the main gaps to focus efforts in training, procedures, personnel and equipment. Evidence based on fire scenarios. The process learning of an organization goes through the identification of own 'best practices' and the external ones:

- to collect experiences and convert them into guides,
- to collect 'lessons learned' and transform the best points into protocols,
- to share experiences with the aim of generating standards.

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P3. Research - Building local level engagement in disaster risk reduction. A Portuguese case study

Solution Name:	**Solution provider:**
Research - Building local level engagement in disaster risk reduction. A Portuguese case study	**Fraunhofer INT**
Solution Type: Publication	
Solution short description Contributing to the global dialogue on disaster risk reduction (DRR), the purpose of this paper is to address a key priority for the Post-2015 Framework for DRR (HFA2) by analysing initiatives used by one local government to increase local-level engagement in DRR. Design/methodology/approach A review of literature from the multidisciplinary areas of communication, social and political theory examines the role that communication theory and practice can play in facilitating public participation to build community resilience. Burnside-Lawry, Judy; Carvalho, Luis (2015): Building local level engagement in disaster risk reduction. A Portugese case study. In: Disaster Prevention and Management 24 (1), S. 80–99. DOI: 10.1108/DPM-07- 2014-0129.	
Website of the solution: https://www.emerald.com/insight/content/doi/10.1108/DPM-07-2014-0129/full/html	
Relevant Thematic Working Group: SAR, Landscape Fires, Natural Hazard Mitigation	
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/research-building-local-level-engagement-in-disaster-risk-reduction.-a-portugese-case-study	
1st cycle CCCs addressed *(added by the stakeholder)* ✓ Develop public self-protection to minimize responders' exposures (TOP CHALLENGE)	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …	

P4. Renforçons notre résilience (FR content)

Solution Name:	**Solution provider:**
Renforcons notre resilience	**CERISC - ENSOSP**
Solution Type: Publication	
Solution short description La résilience c'est la capacité à s'adapter et à rebondir en période d'adversité. Et donc à traverser une épreuve avec le plus d'adaptabilité possible. Les études montrent que la résilience est corrélée à la souplesse (émotionnelle et cognitive), un brin de positivisme réaliste et une capacité à faire face aux événements douloureux de façon calme, mais proactive. Centre National de Ressources et de Résilience, France.	
Website of the solution: http://cn2r.fr/wp-content/uploads/2020/03/Renforcons-notre-resilience.pdf	
Relevant Thematic Working Group: All TWGs	
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/renforcons-notre-resilience	
1st cycle CCCs addressed *(added by the stakeholder)*	

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

✓Cultural changes in risk tolerance and resilience
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises.

P5. Community-Based Disaster Coalition training

Solution Name: **Community-Based Disaster Coalition training**	**Solution provider:** **Fraunhofer INT**
Solution Type: Publication	
Solution short description One key activity of the University of South Florida Preparedness and Emergency Response Learning Center is designing, developing, and delivering community preparedness, response, and recovery system training. Coalitions are vital for addressing emergencies or disaster situations within communities. The University of South Florida Community-Based Disaster Coalition was designed to address the challenges of building and sustaining coalitions, emphasize methods to enhance their sustainability and effectiveness, and strengthen their purpose and community impact during disasters. Teams of participants were offered 2 years of training to support coalition-building efforts. In year 1, participants engaged in 3 days of facilitator-led instruction, hands-on activities, tabletop exercises, and breakout groups to learn techniques to strengthen their coalition, which are the focus of this study. In year 2, participants engaged in additional training through course refreshers, distance learning opportunities, and webinars. Participants were grouped by county or region and comprised 6 to 9 people from a range of backgrounds and professions. During the 2012 (year 1) trainings, 184 people attended the program, representing nearly half (31; 46%) of Florida counties. Performance data indicated that participants significantly improved their knowledge scores, and course evaluations indicated that they were satisfied with the course overall. The Community-Based Disaster Coalition trainings focused on community capacity of disaster response in 31 counties, which represents close to 13 million people or nearly three-fourths of Florida residents. Training evaluations supported previous findings regarding critical coalition elements for development and sustainment, such as clear coalition purpose and goals. Several lessons were evident and inform future Community-Based Disaster Coalition efforts including adapting training to meet coalition needs; supporting the process of coalition building; following up with extended training opportunities and resources; continuing to provide trainings to counties that have not yet participated; and expanding training in other states, regions, territories, and internationally. Reference: Frahm, Kathryn A.; Gardner, Patrick J.; Brown, Lisa M.; Rogoff, David P.; Troutman, Adewale (2014): Center for Leadership in Public Health Practice, University of South Florida, Tampa, USA. Community Based Disaster Coalition Training. In: Journal of Public Health Management and Practice 20, S111- S117.	
Website of the solution: https://europepmc.org/article/MED/25072482?singleResult=true	
Relevant Thematic Working Group: Natural Hazard Mitigation	
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/community-based-disaster-coalition-training	
1st cycle CCCs addressed *(added by the stakeholder)* ✓Develop public self-protection to minimize responders' exposures (TOP CHALLENGE)	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …	

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

P6. The Eight Step Training Model: Improving Disaster Management Leadership

Solution Name:	**Solution provider:**
The Eight Step Training Model: Improving Disaster Management Leadership	**Fraunhofer INT**

Solution Type: Publication

Solution short description

In the aftermath of public tragedies such as the terrorist attacks of 9/11 and Hurricane Katrina, intense scrutiny was placed upon the emergency management community throughout all levels of government. Clearly, it is imperative that emergency managers understand the scope and scale of these events and subsequently the depth of planning required to execute coordinated preparedness, response and relief efforts. However, plans are merely a step in the overarching requirement of coordinating disaster response and delivering relief. One method for emergency managers to achieve success may be through the implementation of a disciplined training methodology, developed in the United States Army, known as the "Eight Step Training Model." At its essence, the eight step training model provides a logical, structured and repeatable framework for developing and executing training that is designed to build confident and competent emergency managers and improve the individual and collective training proficiency of primary and secondary responders (training participants). A time investment in this planning and training methodology will increase preparedness, response and recovery efforts and desired outcomes immeasurably. The model can focus upon local, State or Federal levels, incorporating Private Volunteer Organizations (PVOs), Non-Government Organizations (NGOs) or commercial industry whether local, regional or national. The steps are as follows: 1. Study/Teach the Literature / Doctrine (Certify Leaders); 2. Survey the Training Site; 3. Develop the Training Plan; 4. Issue the Plan; 5. Rehearse the Plan (Tabletop Exercise); 6. Execute the Training; 7. Evaluate the Training; and 8. Retrain as Needed to Meet Goals. At a minimum, the model acquaints participants with divergent organizational roles and missions and at its best instills confidence in participating organizations' ability to work together in a simulated setting before they are forced to collaborate during emergency response. The article seeks to describe the steps in detail and provide the reader with a fundamental understanding of the model as it may relate to their future training needs.

Reference: Slattery, Cole; Syvertson, Robert; Krill, Stephen, JR. (2009): The Eight Step Training Model. Improving Disaster Management Leadership. In: Journal of Homeland Security and Emergency Management 6 (1).

Website of the solution:
https://www.degruyter.com/view/j/jhsem.2009.6.1/jhsem.2009.6.1.1403/jhsem.2009.6.1.1403.xml?lang=en

Relevant Thematic Working Group: Landscape Fires, Natural Hazard Mitigation

Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/the-eight-step-training-model-improving-disaster-management-leadership

1st cycle CCCs addressed *(added by the stakeholder)*

✓ Develop public self-protection to minimize responders' exposures (TOP CHALLENGE).

2nd cycle CCCCs addressed *(added by WP3 leader)*

✓ Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …

Comments from the analysis *(added by WP3 leader)*

Very high operational value and interoperability, this publication is not only meant to be a training session, but also encourages different levels of stakeholders to participate and cooperate, from volunteer organisations to the local or even national industries.

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P7. Earthquake induced crises: game tree approached risk communication and lessons learnt

Solution Name:	**Solution provider:**
Earthquake induced crises game: game tree approached risk communication and lessons learnt	**National and Kapodistrian University of Athens**

Solution Type: Publication

Solution short description

Earthquake risk communication, which was extremely poor in historical times, has improved in an extraordinary way during the last decade. EEW and TW systems are, or are in the process of being, established, and platforms operated by seismological centres provide real-time earthquake information, aided by the social media and the electronic press. The platforms developed by geoscientists are extremely useful tools for emergency managers to collect in situ information on an earthquake's effects within a few minutes of its occurrence, a time critical for evaluation of effects and decision-making.

The need to deaggregate earthquake effects, associated economic loss and preparedness level due to the earthquake itself and its secondary and tertiary phenomena is nowadays apparent. Fatalities and economic losses due to secondary phenomena have been reported in past earthquakes, when the level of preparedness was low, or practically inexistent. However, in recent earthquakes, their percentage seems to follow an increasing trend. There is, therefore, a need for improved models for associated effects of recent earthquakes.

Key words: Earthquake induced disasters, disaggregation, risk communication, geoethics, game theory, attacker, defender, Greece, Slovenia, Italy, Japan, emergency management, natural and technological disasters

Relevant Thematic Working Group: Natural Hazard Mitigation

Link in the FIRE-IN platform: https://fire-in.eu/fr/challenges-resources/validated-solutions/earthquake-induced-crises-game-tree-approached-risk-communication-and-lessons-learnt

Scope/Rational

Earthquakes, large or even moderate, are often followed by secondary phenomena, such as landslides, tsunamis, fires and technological disasters, leading to cascading effects that may, in turn, cause severe damage. Before, during and after the occurrence of these events, risk communication, currently evolved to codified legislation, is a crucial factor. Policy selection in this study is approached by the application of the game, or decision tree, with the earthquake being the "attacker who moves first". The studied events in view of policy making have occurred both in the past and recently, to account for different level of exposure and anthropogenic hazards, in Greece, Italy, Japan and Slovenia. In all case studies the whole disaster management cycle is examined, i.e. mitigation, preparedness, response and recovery. The 1894 Atalanti earthquakes were followed by tsunami, rockfalls, landslides, surface faulting, liquefaction and land subsidence. News that the first shock was predicted had a negative impact to the reliability of Greek geoscientists. The management of the 1917 Brežice earthquake by the defenders had to deal with the very low temperatures and the fact that it occurred during the First World War, related to poverty and lack of food supplies. One fatality was caused by the attacker itself, whereas the second by seismo-geological secondary effects. Extensive rockfalls and fires followed the destructive 1953 Kefallinia earthquake series, consisting of three large events. More than 450 fatalities and 2,500 injuries were cumulatively caused, with difficulty to distinguish the number of fatalities corresponding to each event. The 1976 Friuli earthquake sequence caused more than 1,000 fatalities mainly due to the high vulnerability of buildings. This event initiated the procedure for the protection of Italian cultural heritage buildings and contributed to the detailed seismic hazard and risk assessment of the area. The 2003 Lefkas earthquake was followed by landslides, rockfalls, liquefaction and damage to the road network. However, no fatalities occurred, despite the high PGA values. The 2015 Lefkas event caused two fatalities, one of which due to the earthquake. The preparedness of the local community against the earthquake effects proved to be in a good level, which was not the case for the 2003 event, especially regarding landslides. The Tōhoku 2011 earthquake was accompanied by both secondary, i.e. tsunami, major aftershock, landslides, fires and land deformation, as well as tertiary, i.e. technological disaster due to tsunami, as well as additional

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tsunamis due to the major foreshock and aftershock, as fellow attackers. Even though Japan is considered as a highly prepared country against both earthquake and tsunami effects, it failed to deal with the consequences of a mega event. This earthquake is considered a lesson for the future. Disaggregation of earthquake-related crises and risk communication are taken into account in the present study and ethical challenges are posed both to scientists and policy makers.

1st cycle CCCs addressed *(added by the stakeholder)*

- ✓ Cultural changes in risk tolerance and resilience
- ✓ Develop public self-protection to minimize responders exposures (TOP CHALLENGE)
- ✓ Involve communities in preparing population for the worst scenario before it happens (TOP CHALLENGE)
- ✓ Strategies choosing safe, resilient scenarios, and maintaining credibility
- ✓ Information cycle
- ✓ Provide an efficient, flexible flow of information for a shared understanding
- ✓ Focus on capacity building towards more resilient societies
- ✓ Organizational learning focusing efforts in key risks and opportunities (TOP CHALLENGE)
- ✓ Focus on governance and capacity building towards more resilient societies
- ✓ Negotiate solutions with stakeholders for anticipated scenarios (TOP CHALLENGE)
- ✓ Pre-plan interoperability and enhance synergies
- ✓ Build doctrine for resilience in emergency services and societies

2nd cycle CCCCs addressed *(added by WP3 leader)*

- ✓ Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …
- ✓ Change of paradigm. From 'We, authorities, will protect you' to 'You, citizen, should be actively involved'. These affirmations mean that you should be prepared to be self-sufficient concerning to your own protection and your community protection always inside the framework of the emergency. Be used to this sort of situations normalizing them.
- ✓ Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises.
- ✓ Towards a complete cycle of knowledge. Adjust Standard Operational Procedures (SOPs), doctrine and pre-plans using the feedback from real incidents and from exercises testing them (evaluators, assessors, statistics…) and identify the main gaps to focus efforts in training, procedures, personnel and equipment. Evidence based on fire scenarios. The process learning of an organization goes through the identification of own 'best practices' and the external ones:
  - to collect experiences and convert them into guides,
  - to collect 'lessons learned' and transform the best points into protocols,
  - to share experiences with the aim of generating standards.

Comments from the analysis *(added by WP3 leader)*

This study is mainly focused on policy issues and earthquake risk communication to the general public. It is a mixture of the "*Community Involvement*" and the "*Knowledge cycle*" capabilities.

P8. Data Fusion and AI processes from Hyperspectral Satellites – GEOSYSTEMS HELLAS S.A.

Solution Name:	**Solution provider:**
Data Fusion and AI processes from Hyperspectral Satellites	**GEOSYSTEMS HELLAS S.A**
Solution Type: Publication	
Solution short description	

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

Hyperspectral remote sensing leverages information in many (often more than 100) narrow (smaller than 20 nm) spectrally contiguous bands, in contrast to multispectral remote sensing of few (up to 15) non-contiguous wider (greater than 20 nm) bands. To date, hyperspectral fire applications have primarily used airborne data in the visible to short-wave infrared region (VSWIR, 0.4 to 2.5 µm). This has resulted in detailed and accurate discrimination and quantification of fuel types and condition, fire temperatures and emissions, fire severity and vegetation recovery. Many of these applications use processing techniques that take advantage of the high spectral resolution and dimensionality such as advanced spectral mixture analysis.

TRUTHS is a new satellite mision that will be added to the list of missions to be financed in the Earth Observation Earth Watch programme. The TRUTHS mission aims to establish an SI-traceable space-based climate and calibration observing system to improve confidence in climate-change forecasts – a kind of 'standards laboratory in space'. It would carry a hyperspectral imager to provide benchmark measurements of both incoming solar radiation and outgoing reflected radiation with an unprecedented accuracy. These benchmark measurements would improve our ability to estimate radiative imbalance underlying climate change and, importantly, in a shorter time than is currently possible. Reference datasets from TRUTHS would also serve to calibrate other satellite sensors, such as those carried on the Copernicus missions.

Scope / Rational context

Data Fusion and AI processes from Hyperspectral Satellites eg. ESA TRUTHS program that Greece is participating, over forestry areas.

Relevant Thematic Working Group: Landscape Fires

Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/data-fusion-and-ai-processes-from-hyperspectral-satellites

1st cycle CCCs addressed

- ✓ Focus on sustainability of safe operations (TOP CHALLENGE).
- ✓ Anticipate vulnerability, and communicate to the public (TOP CHALLENGE).
- ✓ Pre-plan interoperability and enhance synergies.
- ✓ Negotiate solutions with stakeholders for anticipated scenarios (TOP CHALLENGE).

2nd cycle CCCCs addressed

- ✓ Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points…
- ✓ Base the prediction of scenarios on historical events and on statistics (baseline), including the modelling of the actual conditions (at local level) and human factors.
- ✓ Maintain situation awareness. Avoid the loss of information with shifts' changes.

Comments from the analysis *(added by the WP3 leader)*

A proposed solution for the monitoring of landscape fires through satellite data in the framework of TRUTHS satellite program. Too early to be characterized as a product. Still in research.

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Best practices and Guidelines

In Table 14 the matching of CCCs between the two cycles and the number of solutions submitted as best practices and guidelines in the FIRE-IN e-platform are enlisted. Best practices submitted address all the capabilities identified so far by the FIRE-IN project except that of "*Technology*". Despite the fact that "Standardization" is also clearly addressed, capabilities of "*Community Involvement*", "*Knowledge Cycle*", "*Incident Command Organization*" are also highly engaged in the lessons learnt and best practices submitted, with higher percentage than standards. Trying to deep in further we applied the traffic light system as considered for the case of standards (Table 2) in each one of the submitted solutions. Seven (7) out of twelve (12) are considered to be in the "Green" level, three (3) in the "Yellow" and two (2) in the "Red" level meaning that the majority of the solutions is based on international guidance. For three of "Green" solutions the international use or impact of these guidelines is not well described or established but due to the fact that guidelines are published and used at least in some level is marginally green. The two "Red" solutions may not exactly be solutions in the framework of the FIRE-IN but to their importance are not disregarded. The fact that they are not described adequately affects their level of characterisation in terms of traffic light system.

B1 to B12 below detail the best practices posted on FIRE-IN e-platform and analysed in the present deliverable.

Table 14. Matching of the submitted best practices CCCs between the 2 cycles of FIRE-IN.

1st cycle CCCs matching for Publications	Nr of solutions	2nd cycle prioritized CCCs matching for Best practices and guidelines	Capability
Build doctrine for resilience in emergency services and societies	1		Standardization
Establish an interagency framework	1		Standardization
Establish specific procedures and guides facilitating operativity	1		Standardization
Standardize capabilities in front of pre-established scenarios (TOP CHALLENGE).	1	Adapt the legal framework and requirements on prevention and self-protection of infrastructures and activities to first responders' needs, lessons learned from past events... Plan the implementation of laws and plans. Adapt the regulations to emergency situations.	Standardization
Build a shared understanding of emergency and train interagency scenarios (TOP CHALLENGE)	3	Once the standard roles of different actors have been trained and drilled inside each agency, organize multiagency joint trainings and exercises with the focus on decision-making, coordination and interactions between agents. Train in overlapped competences and limits of competences. Train the trainers of the different agencies. Share on-line training and exercises.	Knowledge cycle
Organizational learning focusing efforts in key risks and opportunities (TOP CHALLENGE)	1	Towards a complete cycle of knowledge. Adjust Standard Operational Procedures (SOPs), doctrine and pre-plans using the feedback from real incidents and from exercises testing them (evaluators, assessors, statistics…) and identify the main gaps to focus efforts in training, procedures, personnel and equipment. Evidence based on fire scenarios. The process learning of an organization goes through the identification of own 'best practices' and the external ones: • to collect experiences and convert them into guides, • to collect 'lessons learned' and transform the best points into protocols,	Knowledge cycle

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		• to share experiences with the aim of generating standards.	
Anticipate vulnerability, and communicate to the public (TOP CHALLENGE)	3	Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points…	Incident Command Organization
Strategies choosing safe, resilient scenarios, and maintaining credibility	1		Incident Command Organization
Focus on sustainability of safe operations (TOP CHALLENGE).	2	Maintain situation awareness. Avoid the loss of information with shift's changes.	Incident Command Organization
Develop public self-protection to minimize responders exposures (TOP CHALLENGE)	5	Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …	Community Involvement
Cultural changes in risk tolerance and resilience.	4		Community Involvement
Involve communities in preparing population for the worst scenario before it happens (TOP CHALLENGE)	3	✓ Change of paradigm. From 'We, authorities, will protect you' to 'You, citizen, should be actively involved'. These affirmations mean that you should be prepared to be self-sufficient concerning to your own protection and your community protection always inside the framework of the emergency. Be used to this sort of situations normalizing them. ✓ Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises. ✓ Be prepared to provide massive alerts to population.	Community Involvement
Focus on governance and capacity building towards more resilient societies	2		Pre-planning

B1. Decontamination procedures

Solution Name: **Decontamination procedures**	**Solution provider:** **Chemical hazards emergency medical management**
Solution Type: Guidelines	
Solution short description Procedure for decontaminating individuals as well as victims of a mass casualty incident. It was derived from Guidelines for Mass Casualty Decontamination during an HAZMAT/Weapon of Mass Destruction Incident: Volumes I and II, published by the U.S. Army Edgewood Chemical Biological Center (ECBC) and updated in August 2013, and from the Emergency Response Safety and Health Database.	
Website of the solution: https://chemm.nlm.nih.gov/decontamination.htm	
Scope / Rational context	

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

Terrorist organizations throughout the world have used a variety of chemical, biological, and radiological weapons (collectively known as HAZMAT/weapons of mass destruction [WMD]) to further their agendas. The possibility of such incidents requires first to prepare for such incidents, which can affect individuals or inflict mass casualties.
Relevant Thematic Working Group: CBRNe
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/decontamination-procedures
1st cycle CCCs addressed ✓ Build doctrine for resilience in emergency services and societies. ✓ Establish an interagency framework. ✓ Establish specific procedures and guides facilitating operativity. ✓ Standardize capabilities in front of pre-established scenarios (TOP CHALLENGE).
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Adapt the legal framework and requirements on prevention and self-protection of infrastructures and activities to first responders' needs, lessons learned from past events... Plan the implementation of laws and plans. Adapt the regulations to emergency situations.
Comments from the analysis *(added by WP3 leader)* A strategic procedure in the filed of CBRNe with high operational value for first responders. Guidelines are based on army tactis accepted by the USA Center for Disease Control and Prevention as well as the National Fire Protection Association of USA. Guidelines are published but the level of acceptance from the international community is unknown. Although guidance is published information on review or use is based only in the USA. Overall, with the application of the traffic light system, is characterized as "Green" due to the fact that guidelines are already avaiable and pubished.

B2. Entrainement interministériel zonal NRBCE – France (FR content)

Solution Name: **Entrainement interministériel zonal NRBCE - France**	**Solution provider:** **CERISC**
Solution Type: Best practice/Initiative	
Solution short description Objectifs - Améliorer les capacités d'intervention face aux menaces et aux risques NRBC-e - Partager des connaissances spécifiques à chaque entité - Amplifier l'interopérabilité - Optimiser les capacités conjointes des acteurs de l'intervention Organisation Ces entrainements sont financés par le CNCMFE. Ils sont réalisés et joués au sein des sept zones de défense. Concrètement, l'EIZ se déroule sur 2 journées : - J1 Apport théorique et ateliers de mécanisation selon son secteur d'appartenance - J2 Entrainement	
Website of the solution: http://pnrs.ensosp.fr/	
Relevant Thematic Working Group: CBRNe	
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/entrainement-interministeriel-zonal-nrbce-France	
1st cycle CCCs addressed	

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

✓Build a shared understanding of emergency and train interagency scenarios (TOP CHALLENGE)
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓Once the standard roles of different actors have been trained and drilled inside each agency, organize multiagency joint trainings and exercises with the focus on decision-making, coordination and interactions between agents. Train in overlapped competences and limits of competences. Train the trainers of the different agencies. Share on-line training and exercises.
Comments from the analysis *(added by WP3 leader)* Clearly an initiative regarding the response on CBRNe in France. Unfortunately, the information provided was not adequate to properly characterize the level of the operational value. No data are provided regarding the existence of guidelines from this initiative. The topic has surely been raised. In traffic light system terms is characterized as "Red".

B3. GUIDE FOR CORONAVIRUS PLANNING & RESPONSE

Solution Name: **GUIDE FOR CORONAVIRUS PLANNING & RESPONSE**	**Solution provider:** **IAFC Coronavirus Task Force**
Solution Type: Best practice/guideline	
Solution short description IAFC Guide for Coronavirus Planning and Response. The 2019 novel Coronavirus (COVID-19) is creating a rapidly changing environment for public safety agencies. This is a dynamic event that will likely stretch out for months. As a result, recommendations will undoubtedly change over time. We would request that chief officers return back to the IAFC Coronavirus Resources page frequently to check for updates. As fire departments and local governments continue planning to respond to Coronavirus (COVID-19) occurrences in their communities, the IAFC Coronavirus Task Force has developed a guide to identify key recommendations, best practices, and considerations.	
Website of the solution: https://www.iafc.org/docs/default-source/1ems/covid-response-and-planning-recommendations.pdf?sfvrsn=a53f920d_10	
Relevant Thematic Working Group: SAR	
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/guide-for-coronavirus-planning-response	
1st cycle CCCs addressed ✓Anticipate vulnerability, and communicate to the public (TOP CHALLENGE)	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points…	
Comments from the analysis *(added by WP3 leader)* Guidelines for dealing with the planning and response of the worldwide pandemic 2019-2020 of COVID-2019. Issued by the International Association of Fire Chiefs. In traffic light system terms is characterized as **"**Green".	

B4. CBFIM – VILLAGE DEFENSE

Solution Name: **CBFIM – VILLAGE DEFENSE** **(submitted by Fraunhofer INT)**	**Solution provider:** **Global Fire Monitoring Center**

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

Solution Type: Best practice/guideline
Solution short description In many regions globally rural settlements (villages, towns, scattered farmsteads) and other rural assets (agricultural fields / crops, infrastructures and other values at risk) are increasingly endangered by wildfires. This trend is driven by the consequences of land-use change, regional climate change and particularly by the rural exodus, which has resulted in the weakening of rural workforce and selfprotection ability and increasing wildfire hazard on abandoned lands. In order to enhance the capabilities of local rural communities to defend themselves against wildfires a set of guidelines was developed for the Balkans as a pilot region, designed to be adapted to the conditions of other regions and countries as deemed appropriate.
Website of the solution: https://gfmc.online/Manag/CBFiM_11.html
Relevant Thematic Working Group: Landscape Fires
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/cbfim-village-defense
1st cycle CCCs addressed ✓ Develop public self-protection to minimize responders exposures (TOP CHALLENGE)
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …
Comments from the analysis *(added by WP3 leader)* Guidelines provided for the training, understanding and response in case of wildfires especially for rural settlements and other rural assets. Provided from Council of Europe / UNECE / OSCE member states to continuously expand capacities in rural fire management, especially designed for the general public. Wide acceptance from Eastern Europe, Western Balkans and Central Asia. In terms of traffic light system is characterized as "Green".

B5. Guidelines to increase the benefit of social media in emergencies

Solution Name: **Guidelines to increase the benefit of social media in emergencies**	**Solution provider:** **Fraunhofer INT**
Solution Type: Best practice/guideline	
Solution short description The EmerGent project summarised its findings and conclusions in the form of guidelines and provides a list of recommendations for emergency services and citizens on how to make the most of social media. Emergent project consortium.	
Website of the solution: http://www.fp7-emergent.eu/guidelines/	
Relevant Thematic Working Group: SAR, Structure Fires, Landscape Fires, Natural Hazard Mitigation	
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/guidelines-to-increase-the-benefit-of-social-media-in-emergencies	
1st cycle CCCs addressed ✓ Develop public self-protection to minimize responders exposures (TOP CHALLENGE).	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable.	

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …
Comments from the analysis *(added by WP3 leader)* The results of the EmerGent project. Guidelines already published and provided for emergency services and citizens. European countries participated in the consortium. The element of "internationality" is missing despite the fact that some of the partners may provide this element. Based on the fact that guidelines are issued and the existence of broader European organizations/associations in the consortium, in terms of traffic light system is characterized marginally "Green".

B6. ORGANISATION DE LA REPONSE SANITAIRE (FR content)

Solution Name: **ORGANISATION DE LA RÉPONSE SANITAIRE**	**Solution provider:** **Service Départemental d'incendie et de secours 78**
Solution Type: Guidelines / Operational initiative	
Solution short description L'objectif principal est de s'adapter aux risques et de limiter les brassages et les échanges au sein du Service: Activation d'une cellule de veille « Coronavirus » Rappels des consignes en matière de prévention et d'hygiène individuelle et collective, augmenter le niveau de rigueur S'assurer de la présence des produits d'hygiène et de nettoyage et dresser l'inventaire des stocks existants (savon, gel hydro alcoolique, lessives…). Définir les zones de travail nécessitant un nettoyage quotidien (postes opérateurs, zones de restauration…). Réalisation et conception : SSSM DOP SQVS Rédaction : SQVS Service départemental d'incendie et de secours des Yvelines BP 60 571 - 78 005 Versailles Cedex	
Website of the solution: http://www.sdis78.fr/	
Relevant Thematic Working Group: SAR, Natural Hazard Mitigation	
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/organisation-de-la-reponse-sanitaire	
1st cycle CCCs addressed ✓ Anticipate vulnerability, and communicate to the public (TOP CHALLENGE). ✓ Strategies choosing safe, resilient scenarios, and maintaining credibility.	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points… ✓ Adapt the legal framework and requirements on prevention and self-protection of infrastructures and activities to first responders' needs, lessons learned from past events... Plan the implementation of laws and plans. Adapt the regulations to emergency situations.	
Comments from the analysis *(added by WP3 leader)* The recent COVID-19 pandemic outbreak forced all the first responders to reorganize. A few fragmentary guidelines are provided. No further data are provided. The topic has surely been raised. In traffic light system terms is characterized as "Red" since the information provided was not adequate to properly characterize the level of the operational value.	

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

B7. Flash info covid 19 (FR content)

Solution Name: **Flash info covid 19 - french content**	**Solution provider:** **Service départemental d'incendie et de secours de l'Hérault**
Solution Type: Guidelines	
Solution short description La réorganisation du SDIS qui vise à inscrire notre capacité opérationnelle dans la durée pour fournir un service public de qualité et un niveau de protection aux agents optimal est aujourd'hui en place. Ainsi une distribution de masques chirurgicaux et de solutions hydro-alcooliques vers les centres de secours va débuter selon les modalités établies par la chaine logistique. Chaque chef de centre veillera à ce que ces dotations soient utilisées selon les règles établies et que les stocks soient régulièrement réalimentés. Pour les masques, à chaque intervention pour secours à personnes, les personnels pourront utiliser un masque. Les masques ne sont prévus que pour les opérations. Les mesures barrières doivent être appliquées en caserne afin de se protéger les uns les autres et d'éviter la propagation du virus.	
Website of the solution: https://www.sdis34.fr/	
Relevant Thematic Working Group: SAR, Natural Hazard Mitigation	
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/flash-info-covid-19-french-content	
1st cycle CCCs addressed ✓ Anticipate vulnerability, and communicate to the public (TOP CHALLENGE). ✓ Focus on sustainability of safe operations (TOP CHALLENGE).	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points… ✓ Maintain situation awareness. Avoid the loss of information with shifts' changes.	
Comments from the analysis *(added by WP3 leader)* The recent COVID-19 pandemic outbreak forced all the first responders to reorganize. Few but specific guidelines based on the international experience and guidelines for protection measures of first responders teams. In terms of traffic light system it is characterized as "Green" based solely on the fact that this reorganization is based exactly on international practice. Not exactly a "solution" in the framework of FIRE-IN but also not adequate infromation to disregard it from the analysis.	

B8. Firefighters Plus

Solution Name: **Firefighters Plus**	**Solution provider:** **Firefighters Plus**
Solution Type: Best practice / Initiative	
Solution short description Firefighters are ranked as one of the most trustworthy professions across all global regions (GFK Verein, 2015). Therefore, firefighters have the potential to do something more for their communities than firefighting. Being aware of this, some firefighters have already used, with very successful results, their trustworthy position to promote fire safety among the most vulnerable groups. As an example the following video is provided: "The story of Zouhair", https://www.en.firefightersplus.eu/#h.p_fKLHPivMlMmM. This proves that something is changing in the Fire and Rescue Services. Firefighters are becoming aware of their potential to do something more for their communities than firefighting. However, a lot more can be done	

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if firefighters can access high quality training on how to use their position as role models to promote fire safety among the most vulnerable groups. In this context, the first online platform (www.firefightersplus.eu) for firefighters on how to use their position as role models to promote fire safety among the most vulnerable groups has been developed. The platform includes the following sections: GET INSPIRED with videos of the actions to promote fire safety among the most vulnerable groups carried out during the project by firefighters from several EU countries. ONLINE COURSE on how firefighters can make the most of their position as Role Models to promote fire safety among the most vulnerable groups. TOOLS to plan, implement, evaluate and disseminate the results of actions to promote fire safety among the most vulnerable groups. The Firefighters Plus project is an initiative of Frederiksborg Fire & Rescue Service (Denmark) in collaboration with Northumberland Fire & Rescue Service (UK), Provincial Headquarters of State Fire Service in Poznan (Poland), Instituut Fysieke Veiligheid (The Netherlands), Alcala de Guadaira Fire & Rescue Service (Spain), Centrul de Resurse pentru Diversitate Etnoculturală (Romania) and Stowarzyszenie WIOSNA (Poland). The Firefighters Plus project has been co-funded by the Erasmus+ Programme of the European Union.
Website of the solution: https://www.firefightersplus.eu/
Relevant Thematic Working Group: All TWGs
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/firefighters-plus
1st cycle CCCs addressed *(added by the stakeholder)* ✓Cultural changes in risk tolerance and resilience
2nd cycle CCCCs addressed *(added by WP3 leader – closest match with prioritized CCCs)* ✓Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits … ✓Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises.
Comments from the analysis *(added by WP3 leader)* An effective strategy not only for top training of fire fighters, but also for interaction with the society and the vulnerable communities. Based on te inrfomation provided this initiative can be charatcerized as “Yellow” in terms of the traffic light system as certain guidelines have not been published.

B9. Global Recommendations for Emergency Services Organisations to manage the outbreak of COVID-19

Solution Name: **Global Recommendations for Emergency Services Organisations to manage the outbreak of COVID-19 (submitted by KEMEA- Center for Security Studies)**	**Solution provider:** **Collaborative Coalition for International Public Safety (CC:IPS) (submitted by KEMEA- Center for Security Studies)**
Solution Type: Guidelines	
Solution short description Recommendations on the use of emergency numbers and communication techniques to the public, paying attention to misinformation. Measurements are proposed with respect to employees health and safety. Links	

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are provided for proposed guidelines to the agencies for the preparation of a COVID-19 continuity of operations (COOP) response plan.
Website of the solution: https://eena.org/document/global-recommendation-for-emergency-services-organisations-to-manage-the-outbreak-of-covid-19?utm_source=EENA+112+-+General+list&utm_campaign=9afd2fe5a3-EMAIL_CAMPAIGN_2020_03_24_02_07_COPY_01&utm_medium=email&utm_term=0_18e82b5e
Scope / Rational context The Collaborative Coalition for International Public Safety (CC:IPS) - Association of Public Safety Communications Officials, Canada (APCO Canada), the British Association of Public Safety Communications Officials (BAPCO), the European Emergency Number Association, the National Emergency Communications Working Group - Australia / New Zealand, (NECWG-A/NZ), and NENA: The 9-1-1 Association – has compiled a number of recommendations for Emergency Services Organisations, including Public Safety Answering Points (PSAPs), in order to help organisations respond and prepare in the best way possible during the COVID-19 outbreak.
Relevant Thematic Working Group: CBRNe
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/global-recommendations-for-emergency-services-organisations-to-manage-the-outbreak-of-covid-19
1st cycle CCCs addressed ✓ Focus on sustainability of safe operations (TOP CHALLENGE). ✓ Establish specific procedures and guides facilitating operativity.
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Maintain situation awareness. Avoid the loss of information with shifts' changes. ✓ Adapt the legal framework and requirements on prevention and self-protection of infrastructures and activities to first responders' needs, lessons learned from past events... Plan the implementation of laws and plans. Adapt the regulations to emergency situations (closest match with prioritized CCCs).
Comments from the analysis *(added by WP3 leader)* Global recommendations for emergency management services on ow to manage the outbreak pandemic of COVID-19. Issued by the Collaborative Coalition for International Public Safety (CC:IPS). In terms of traffic light system, it is characterised as "Green".

B10. Development of Trauma-Informed Practices in US Classrooms and Refugee Camps in Greece

Solution Name:	**Solution provider:**
Development of Trauma-Informed Practices in US Classrooms and Refugee Camps in Greece	**National and Kapodistrian University of Athens**
Solution Type: Best practices/ Initiative	
Solution short description Phase I: Identification of best practices in social and emotional learning that educators and volunteers could use in different environments and situations. U.S. Child Traumatic Stress Network distributed resources for teachers, primary care providers, clinicians, and parents for children traumatized by refugee trauma, natural disasters, and other severe stressors. Greek team prepared the workshop on earthquake preparedness and self-protection measures and presented it to three elementary schools in Athens. The team shared curated resources around social and emotional learning and how best this might be used to support educators. Both short term trainings, as well as more systemic shifts in how this work could be sustained on a more long-term basis were explored.	

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Team members presented a workshop with 30 elementary school students in Boulder, CO, USA, on earthquake preparedness, including earthquake basics, self-protection measures before, during, and after the disaster, and post-earthquake trauma recovery, using emotional support strategies integrated into the lesson throughout. This same lesson will be presented by team members in Greece during Phase II and Phase III as a demonstration for formal and informal educational sites.

U.S. team presented the workshop "Fostering Positive Interactions" for 31 educators (representing 19 different schools, with total populations of around 8,500+ students) within Boulder, CO district, wishing to increase social and emotional learning, especially with students who have experienced trauma or are demonstrating stress behaviors. Prior, input and a needs assessment from those attending to help tailor the content, as well as an online resource guide made available on the district's learning management system (Schoology) to house resources and additional content was collected.

The results were very positive. Along with filling the course and receiving very positive feedback from the evaluation, two different departments expressed the necessity to offer the training again.

Website of the solution: https://alumni.state.gov/highlight/2019-citizen-diplomacy-action-fund-winners

Scope / Rational context

Objective 1: Provide data-supported training regarding vulnerability of schoolchildren to threats that may arise in the refugee camp due to natural disasters and in self-protection measures, personal hygiene and health interventions. The training also wor

Relevant Thematic Working Group: Natural Hazard Mitigation

Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/development-of-trauma-informed-practices-in-us-classrooms-and-refugee-camps-in-greece

1st cycle CCCs addressed

- ✓ Cultural changes in risk tolerance and resilience
- ✓ Develop public self-protection to minimize responders exposures (TOP CHALLENGE)
- ✓ Involve communities in preparing population for the worst scenario before it happens (TOP CHALLENGE)
- ✓ Build a shared understanding of emergency and train interagency scenarios (TOP CHALLENGE)
- ✓ Focus on capacity building towards more resilient societies
- ✓ Organizational learning focusing efforts in key risks and opportunities (TOP CHALLENGE)

2nd cycle CCCCs addressed *(added by WP3 leader)*

- ✓ Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …
- ✓ Change of paradigm. From 'We, authorities, will protect you' to 'You, citizen, should be actively involved'. These affirmations mean that you should be prepared to be self-sufficient concerning to your own protection and your community protection always inside the framework of the emergency. Be used to this sort of situations normalizing them.
- ✓ Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises.
- ✓ Once the standard roles of different actors have been trained and drilled inside each agency, organize multiagency joint trainings and exercises with the focus on decision-making, coordination and interactions between agents. Train in overlapped competences and limits of competences. Train the trainers of the different agencies. Share on-line training and exercises.
- ✓ Base the prediction of scenarios on historical events and on statistics (baseline), including the modelling of the actual conditions (at local level) and human factors (closest matc to prioritized CCCs).
- ✓ Towards a complete cycle of knowledge. Adjust Standard Operational Procedures (SOPs), doctrine and pre-plans using the feedback from real incidents and from exercises testing them (evaluators, assessors, statistics…) and identify the main gaps to focus efforts in training, procedures, personnel and equipment.

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Evidence based on fire scenarios. The process learning of an organization goes through the identification of own 'best practices' and the external ones: • to collect experiences and convert them into guides, • to collect 'lessons learned' and transform the best points into protocols, • to share experiences with the aim of generating standards.
Comments from the analysis *(added by WP3 leader)* A collaboration initiative between USA and Greece. Focus on the community involvement and Knowledge cycle capabilities. Worldwide best practices and guidelines are used to document, train and confront problems in the general public. In terms of traffic light system is characterized as "Yellow" as no particualr guidelines have been issued and is a work in progress.

B11. Mocking Disasters with NIMS: Global Disaster Policy

Solution Name: **Mocking Disaster with NIMS: Global Disaster Policy**	**Solution provider:** **National and Kapodistrian University of Athens**
Solution Type: Best practice / Initiative	
Solution short description National Incident Management System (NIMS) is a template that is used as a national model for natural and man-made disasters in USA. It is a proactive guide to authorize disaster responders to seamlessly address all of the theoretical possibilities and needs subsequent to a disaster. Its primary purpose is to create a common approach to calamities. That is, it creates and chain of command with clear position delineation and the beauty of it is that the unifying paradigm of the model is methodological, rather than substantive, and it therefore can be implemented with equal efficiency in any situation. The Saint Cloud State University, MN, USA and the National and Kapodistrian University of Athens, Greece bring their students together every year to discuss how local disasters can have wide-reaching effects, the response of relief organization and government management and/or mismanagement of the disaster, based on NIMS. Courses and exchange of information take place during one semester, followed by a mock disaster in Athens. In May, chief professors from USA and Greece meet in Athens with all the students, where they approach the event with a sense of local as well as potential global impacts related to exposure to the disaster. The teams joined first in 2018, mocking a damaging earthquake in Athens. In 2019, the Eastern Attica fires in Athens were simulated.	
Scope / Rational context Natural disasters cover the earth. The major issue revolves around the response to such event rather than the event itself. Despite the availability of predictive models that in many cases allow for some lead time prior to the event that avails scientist and subsequently the citizenry some defense, the disaster itself is inevitable. Therefore, there must be a guide of sorts to organize a well-choreographed efficient response that will minimize the human and economic losses in the wake for such an event. Bearing in mind that application of experiential pedagogy reinforces cognitive mastery and enhances the learner outcomes, university students are offered the experience of studying and simulating the management of a hypothetical disaster.	
Relevant Thematic Working Group: All TWGs	
Link in the FIRE-IN platform: https://fire-in.eu/fr/challenges-resources/validated-solutions/mocking-disasters-with-nims-global-disaster-policy	
1st cycle CCCs addressed ✓ Cultural changes in risk tolerance and resilience ✓ Develop public self-protection to minimize responders exposures (TOP CHALLENGE) ✓ Involve communities in preparing population for the worst scenario before it happens (TOP CHALLENGE) ✓ Build a shared understanding of emergency and train interagency scenarios (TOP CHALLENGE) ✓ Focus on capacity building towards more resilient societies ✓ Organizational learning focusing efforts in key risks and opportunities (TOP CHALLENGE)	

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2nd cycle CCCCs addressed *(added by WP3 leader)*

- ✓ Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …
- ✓ Change of paradigm. From 'We, authorities, will protect you' to 'You, citizen, should be actively involved'. These affirmations mean that you should be prepared to be self-sufficient concerning to your own protection and your community protection always inside the framework of the emergency. Be used to this sort of situations normalizing them.
- ✓ Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises.
- ✓ Once the standard roles of different actors have been trained and drilled inside each agency, organize multiagency joint trainings and exercises with the focus on decision-making, coordination and interactions between agents. Train in overlapped competences and limits of competences. Train the trainers of the different agencies. Share on-line training and exercises.
- ✓ Base the prediction of scenarios on historical events and on statistics (baseline), including the modelling of the actual conditions (at local level) and human factors (closest matc to prioritized CCCs).
- ✓ Towards a complete cycle of knowledge. Adjust Standard Operational Procedures (SOPs), doctrine and pre-plans using the feedback from real incidents and from exercises testing them (evaluators, assessors, statistics…) and identify the main gaps to focus efforts in training, procedures, personnel and equipment. Evidence based on fire scenarios. The process learning of an organization goes through the identification of own 'best practices' and the external ones:
    - to collect experiences and convert them into guides,
    - to collect 'lessons learned' and transform the best points into protocols,
    - to share experiences with the aim of generating standards.

Comments from the analysis *(added by WP3 leader)*

A collaboration initiative between USA and Greece. Focus on the community involvement and Knowledge cycle capabilities. Worldwide best practices and guidelines are used to document, train and confront problems in the general public. In terms of traffic light system is characterized as "Yellow" as no particualr guidelines have been issued and is a work in progress.

B12. The Earthquake Suitcase

Solution Name:	**Solution provider:**
The Earthquake Suitcase	**National and Kapodistrian University of Athens**

Solution Type: Best practice

Solution short description

The Earthquake Suitcase contains a portable earthquake simulator representing the horizontal shaking produced by seismic waves. Rotational motion produced manually is converted to linear motion of a surface with dimensions 45x25 cm. 3D building models of various response to the shaking are constructed on the simulator surface. One portable accelerometer is mounted on the shake table surface, recording and storing the time histories of the simulated strong shaking. The related software can represent this in real time as wave motion on a computer screen by the instructor and/or on a mobile phone or tablet by the students and perform signal analysis of wave motion.

The suitcase also contains:

- Building material for more complex structures to be tested by students
- The Emergency Kit for Earthquakes

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

- Books, leaflets, etc. related to earthquake education

Scope / Rational context

The Earthquake Suitcase is an educational tool, based on STEM education, aiming at improving the earthquake education degree of school children. It is based on experiential education for familiarization with strong ground motion, buildings response, earthquake basics and wave physics.

Relevant Thematic Working Group: Natural Hazard Mitigation

Link in the FIRE-IN platform: https://fire-in.eu/en/challenges-resources/solutions-awaiting-validation/the-earthquake-suitcase

1st cycle CCCs addressed

- ✓ Cultural changes in risk tolerance and resilience
- ✓ Develop public self-protection to minimize responders exposures (TOP CHALLENGE)
- ✓ Involve communities in preparing population for the worst scenario before it happens (TOP CHALLENGE)

2nd cycle CCCCs addressed *(added by WP3 leader)*

- ✓ Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …
- ✓ Change of paradigm. From 'We, authorities, will protect you' to 'You, citizen, should be actively involved'. These affirmations mean that you should be prepared to be self-sufficient concerning to your own protection and your community protection always inside the framework of the emergency. Be used to this sort of situations normalizing them.
- ✓ Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises.

Ideas and Future developments *(provided by the user)*

In the first version of the earthquake simulator, strong motion simulation is achieved through a simple rotary-linear motion converter operating manually. In the second version, motion is produced by a motor. In the newest version, a rotator cuff will be used.

Comments from the analysis *(added by WP3 leader)*

Educational material mainly for school children. Provide STEM games (earthquake simulator) as well as high end low-cost accelerometer to the students. Book and leaflets are also provided for the children. Children can learn about earthquakes and be familiarized with the earthquake phenomenon and shaking. Simple but extremely interesting and valuable to the society approach. In terms of the traffic light system it can be characterized as "Green" since the educational process is based on well established international guidelines regarding earthquakes and self-protection measures.

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4.2.3. Technological solutions submitted in the FIRE-IN e-platform

This section is devoted to the presentation of the solutions submitted in the FIRE-IN e-platform and characterized as "Technological innovations". Each solution is presented in the form of table presenting data as submitted by the end users, including also data and comments from the analysis carried out for the purposes of the present deliverable.
Also, the matching between the 1st cycle and the 2nd cycle CCCs is presented. All solutions practically cover the prioritized CCC2 of "Technology" of the 2nd cycle. Thus, this as a de facto CCC is omitted of being continuously referenced, but it is encountered in Table 25.
The analysis shows that all prioritized CCCs of the 2nd cycle are covered by at least three solutions. The CCC with the highest number of solutions is CCC9: "Maintain situation awareness", followed by CCC7 and CCC6. All three of them belong to the capability "Incident Command Organisation". This first outcome is in accordance with the technologies screened in WP2.
CCC8 which belongs to the "Pre-planning" capability is also represented by a satisfying number of solutions (28% in total).
The CCCs that belong to the "Community Involvement" capability (CCC1, CCC3, CCC4 and CCC12) are represented by a low number of solutions (14% in the total submitted solutions).
"Knowledge Cycle" capability is also represented by a low number of solutions (17% in total).
"Standardisation" capability is also represented by a low number of solutions (6 out of 29), although better to the numbers of "Community Involvement".
In Table 15 the level of coverage of the prioritized CCCs is presented based on the traffic light system. It is apparent that the "Incident Command Organisation" CCCs are in a "Green" level. The same can be said for "Pre-planning" and marginally for the "Knowledge cycle" capabilities. An inconsistency that needs to be highlighted concerns the "Community Involvement". More specifically, from the solutions submitted so far in the FIRE-IN e-platform it seems that this capability is well covered, which is not in accordance with the screened solutions of WP2 (Table 6). This is explained by the small number of solutions in the FIRE-IN e-platform that address this capability. Reliable results cannot be derived exclusively from the solutions submitted in the e-platform. The actual level of "Community Involvement" is "Yellow". This is the reason why "Community Involvement" CCCs are marked as yellow level.

Also, it needs to be noted that for every technological solution submitted in the FIRE-IN e-platform and presented herein, most of the technologies have a sufficient level of interoperability and most of them follow specific standards in order to access in sufficient interoperability although the standards under which they function are not fully described. Moreover, it is possible that even if technological standards may sometimes be well satisfied (green level), in many cases there is no evidence if operational/professional or formal standards that first responders may use in their daily response missions are adequately applied in the technologies (probably in yellow level).

It is also interesting that **"Standardisation" is in a "Yellow" level, also due to the low number of technologies** that can address directly standardization issues.
"Technology" in overall can be marked as "Green" level although this decision is slightly marginal between "Green" and "Yellow"**. In any case with no doubt, it is concluded that existing technologies can cover sufficiently the current prioritized Common Capability Challenges.**
In the following pages, all technological solutions are presented one by one. Specific comments for each solution, as well as the traffic light system implementation are also presented.
Finally, out of the total 29 solutions with future developments, 16 solutions have been integrated in the form, with 10 of them being sufficiently descriptive and providing valuable information.

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Table 15. Level of coverage of each prioritised CCC of the 2nd cycle based on the solutions submitted in the FIRE-IN e-platform.

A/A	CCCs 2nd Cycle	CCCs 1st cycle	Nr of solutions	Criteria	Green	Yellow	Red
1	Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …	Develop public self-protection to minimize responders exposures	4	Operational Value	3	1	
				Solution Maturity	3	1	
				Interoperability & Standards	4		
2	Technologies used in interventions should be: • Useful. • Simple, intuitive and easy to use. • Easy to integrate and interoperable. • Easy to transport, deployable on field, light, with high autonomy. • Robust, resistant, long duration, able to tolerate severe/harsh conditions. • Open access. • Usable by people with disabilities	Use technology to assess risks and minimize responder's engagement	29	Operational Value	13	10	6
				Solution Maturity	14	8	7
				Interoperability & Standards	23	4	2
3	Change of paradigm. From 'We, authorities, will protect you' to 'You, citizen, should be actively involved'. These affirmations mean that you should be prepared to be self-sufficient concerning to your own protection and your community protection always inside the framework of the emergency. Be used to this sort of situations normalizing them.	Involve communities in preparing population for the worst scenario before it happens	4	Operational Value	2	2	
				Solution Maturity	2	2	
				Interoperability & Standards	4		
4	Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises.	Involve communities in preparing population for the worst scenario before it happens	5	Operational Value	2	3	
				Solution Maturity	2	3	
				Interoperability & Standards	5		
5	Once the standard roles of different actors have been trained and drilled inside each agency, organize multiagency joint trainings and	Build a shared understanding of	5	Operational Value	3	2	
				Solution Maturity	4	1	

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A/A	CCCs 2nd Cycle	CCCs 1st cycle	Nr of solutions	Criteria	Green	Yellow	Red
	exercises with the focus on decision-making, coordination and interactions between agents. Train in overlapped competences and limits of competences. Train the trainers of the different agencies. Share on-line training and exercises.	emergency and train interagency scenarios		Interoperability & Standards	5		
6	Identify points of coordination in the different zones: from local (hot zone, warm zone ...) to regional and to national. Establish different levels of liaison officers, translators; communication; entrance points; and infrastructures as needed.	Distribute decision-making	11	Operational Value	6	2	3
				Solution Maturity	5	3	3
				Interoperability & Standards	8	2	1
7	Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points…	Anticipate vulnerability, and communicate to the public	12	Operational Value	7	3	2
				Solution Maturity	7	3	2
				Interoperability & Standards	10		2
8	Base the prediction of scenarios on historical events and on statistics (baseline), including the modelling of the actual conditions (at local level) and human factors.	Negotiate solutions with stakeholders for anticipated scenarios	7	Operational Value	4	3	
				Solution Maturity	5	2	
				Interoperability & Standards	7		
9	Maintain situation awareness. Avoid the loss of information with shifts' changes.	Focus on sustainability of safe operations	16	Operational Value	5	5	6
				Solution Maturity	4	5	7
				Interoperability & Standards	10	4	2
10	Adapt the legal framework and requirements on prevention and self-protection of infrastructures and activities to first responders' needs, lessons learned from past events... Plan the implementation of laws and plans. Adapt the regulations to emergency situations.	Standardize capabilities in front of pre-established scenarios	6	Operational Value	3	2	1
				Solution Maturity	5		1
				Interoperability & Standards	5	1	
11	Towards a complete cycle of knowledge. Adjust Standard Operational Procedures (SOPs), doctrine and pre-plans using the feedback from real incidents and from exercises testing them (evaluators, assessors, statistics…) and identify the main gaps to focus efforts in training, procedures, personnel and equipment. Evidence based on fire scenarios. The process learning of an	Organizational learning focusing efforts in key risks and opportunities	5	Operational Value	4	1	
				Solution Maturity	5		
				Interoperability & Standards	5		

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

A/A	CCCs 2nd Cycle	CCCs 1st cycle	Nr of solutions	Criteria	Green	Yellow	Red
	organization goes through the identification of own 'best practices' and the external ones: • to collect experiences and convert them into guides, • to collect 'lessons learned' and transform the best points into protocols, • to share experiences with the aim of generating standards.						
12	Be prepared to provide massive alerts to population	Involve communities in preparing population for the worst scenario before it happens	3	Operational Value	2	1	
				Solution Maturity	2	1	
				Interoperability & Standards	3		

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T1. Climate change scenarios at local scale – MeteoGrid

Solution Name: **Climate change scenarios at the local scale**	**Solution provider:** **MeteoGrid**
Solution Type: Technological innovation	
Solution short description Climate Models (CMs) are the main tool used to simulate future climate conditions. They provide valuable information on the general characteristics of the atmosphere in the future, but have limitations with respect to surface effects (e.g., precipitation, temperature) and details at the local scale. These limitations are mainly due to the low resolution of the MCs (100-300 km cells), which prevents the proper representation of the details of the topography that greatly influence the local climate.	
Website of the solution: https://www.meteogrid.com/experiencia/clarity/	
Scope / Rational context MeteoGrid offers weather forecasting services applied to the planning of hazardous events such as fires. These services are geared towards research into complex future scenarios and planning consultancy. MeteoGrid is currently involved in the Clarity project (H2020) as the coordinating partner of the pilot in Spain and is responsible for generating future fire hazard indicators based on predicted changes in weather variables such as temperature, humidity and precipitation. The expected results are to improve resilience in urban and infrastructure areas and are applicable in Spain or any other European Union country. CORDEX models are used for forecasting and statistical dowscaling methods (FICLIMA) are used for their reduction on a local scale.	
Relevant Thematic Working Group: All TWGs	**TRL**: 9: System Test, Launch & Operations
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/climate-change-scenarios-at-the-local-scale	
1st cycle CCCs addressed ✓Focus on capacity building towards more resilient societies. ✓Organizational learning focusing efforts in key risks and opportunities (TOP CHALLENGE) ✓Focus on governance and capacity building towards more resilient societies ✓Pre-plan a time-efficient, safe response, minimizing responder's engagement.	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓Once the standard roles of different actors have been trained and drilled inside each agency, organize multiagency joint trainings and exercises with the focus on decision-making, coordination and interactions between agents. Train in overlapped competences and limits of competences. Train the trainers of the different agencies. Share on-line training and exercises. ✓Base the prediction of scenarios on historical events and on statistics (baseline), including the modelling of the actual conditions (at local level) and human factors. ✓Towards a complete cycle of knowledge. Adjust Standard Operational Procedures (SOPs), doctrine and pre-plans using the feedback from real incidents and from exercises testing them (evaluators, assessors, statistics…) and identify the main gaps to focus efforts in training, procedures, personnel and equipment. Evidence based on fire scenarios. The process learning of an organization goes through the identification of own 'best practices' and the external ones: • to collect experiences and convert them into guides, • to collect 'lessons learned' and transform the best points into protocols, • to share experiences with the aim of generating standards.	
Comments from the analysis *(added by WP3 leader)* State of the art technological innovation, which assesses the vulnerability of infrastructure to meteorological hazards, due to the cilmate change phenomenon. It contains a large database and maximizes the re-use of existing related technologies. Based on the description of the supplier, the technology is available on the market and is used at least in pilot projects. It seems that it is in the form of service inside a decision support	

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system. Not further information is provided if the system is currently in use by an organisation outside the project CLARITY (H2020)
Traffic Light System analysis *(added by WP3 leader)* **Operational Value**: Yellow. **Solution maturity**: Green. **Interoperability & Standardisation**: Green

T2. Saver - MeteoGrid

Solution Name: **Saver: management system for vulnerable elements**	**Solution provider:** **MeteoGrid**
Solution Type: Technological innovation	
Solution short description: Saver is a geographic information platform and a tool for the management of vulnerable elements in the face of hydrometeorological hazards in the short, medium or long term. Saver allows dynamic updating of geospatial information with advanced online editing options by the entities responsible for the services. This information is the basis for obtaining indicators derived from exposure (set of elements located in areas with hazards), vulnerability (level of sensitivity or propensity to be affected by an event) and associated risks (consequences or losses associated in economic, human or structural terms). Saver offers an operational and predictive service which can integrate personalized alarms to support the decision making process.	
Website of the solution: https://www.meteogrid.com/productos/saver/	
Scope / Rational context: MeteoGrid begins to deploy its expertise in several Spanish regions, such as the Canary Islands and Madrid, primarily for the purpose of land management by law enforcement agencies. Subsequently, the service became part of other weather risk management platforms at a European level, interacting with independent developments as a specific module for certain events. At present, its development is progressing to Latin American countries.	
Relevant Thematic Working Group: All TWGs	**TRL**: 9: System Test, Launch & Operations
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/saver-management-system-for-vulnerable-elements	
1st cycle CCCs addressed ✓ Negotiate solutions with stakeholders for anticipated scenarios (TOP CHALLENGE). ✓ Forecast and simulate complex scenarios. ✓ Get a clear picture of the risk evolution. ✓ Pre-plan a time-efficient, safe response, minimizing responder's engagement. ✓ Technological tools to support data sharing.	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points… ✓ Base the prediction of scenarios on historical events and on statistics (baseline), including the modelling of the actual conditions (at local level) and human factors. ✓ Towards a complete cycle of knowledge. Adjust Standard Operational Procedures (SOPs), doctrine and pre-plans using the feedback from real incidents and from exercises testing them (evaluators, assessors, statistics…) and identify the main gaps to focus efforts in training, procedures, personnel and equipment. Evidence based on fire scenarios. The process learning of an organization goes through the identification of own 'best practices' and the external ones: • to collect experiences and convert them into guides, • to collect 'lessons learned' and transform the best points into protocols • to share experiences with the aim of generating standards.	
Comments from the analysis *(added by WP3 leader)* A GIS with weather analytics and tools for risk assessment. Based on the description provided by the supplier, it is already in operational use and its continued to further development and customisation for Latin American countries. Interoperable with other systems.	
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Green. **Solution maturity**: Green. **Interoperability & standardization**: Green.	

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T3. Fire Simulator – MeteoGrid

Solution Name: **Fire simulator**	**Solution provider:** **MeteoGrid**
Solution Type: Technological innovation	
Solution short description MeteoGRID makes use of weather forecasts, now-casting, observation of meteorological variables, numerical models of wind, atmospheric structure, interpretation of risk indexes and derived variables, use of fire simulation systems and other information sources to give assessment on the potential threats, evolution of scenarios and options for fire fighting and population protection. This is performed by specialists interacting under the same inter-operable information platform.	
Website of the solution: https://www.meteogrid.com/productos/saver/	
Scope / Rational context MeteoGRID is making use of the gis-web platforms to provide a complete pack of services for several Civil Protection and Firefighting bodies in Spain for the operational assessment in the preventive, pre-alert, emergency and post-emergency phases of the development of a forest fire.	
Relevant Thematic Working Group: Landscape Fires	**TRL**: 9: System Test, Launch & Operations
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/saver-management-system-for-vulnerable-elements	
1st cycle CCCs addressed ✓Technological tools to support data sharing. ✓Forecast and simulate complex scenarios. ✓Get a clear picture of the risk evolution.	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points… ✓Base the prediction of scenarios on historical events and on statistics (baseline), including the modelling of the actual conditions (at local level) and human factors. ✓Towards a complete cycle of knowledge. Adjust Standard Operational Procedures (SOPs), doctrine and pre-plans using the feedback from real incidents and from exercises testing them (evaluators, assessors, statistics…) and identify the main gaps to focus efforts in training, procedures, personnel and equipment. Evidence based on fire scenarios. The process learning of an organization goes through the identification of own 'best practices' and the external ones: • to collect experiences and convert them into guides, • to collect 'lessons learned' and transform the best points into protocols to share experiences with the aim of generating standards.	
Comments from the analysis *(added by WP3 leader)* Use of related tecnologies (GIS web platform, e.t.c.) and assessment of already existing or future threats, which are related to weather conditions. Essential for fire fighting and civil protection agencies. Similar to the previous although concentated to forest fires.	
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Green. **Solution maturity**: Green. **Interoperability & standardization**: Green.	

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T4. Weather Forecast Systems and Early Warnings – MeteoGrid

Solution Name: **Weather forecasts systems (WFS) and Early Warning Systems (EWS)**	**Solution provider:** **MeteoGrid**
Solution Type: Technological innovation	
Solution short description Hydrometeorological forecasts are operational support tools for the various actors involved in the management of emergencies such as forest fires. Meteogrid provides detailed forecasting services in the short (up to ten days) and medium term (next months) with high spatial resolution. Forecast variables can be transformed into high value-added derivative products to provide warnings or alarms in different sectors of activity, including fire danger and impacts on the territory. Furthermore, these forecasts are supported by gis-web platforms and patented supply systems whose interface and functionality are adapted to the needs of the type of emergency and to the user's preferences in order to provide a utility in the operational field.	
Website of the solution: https://www.meteogrid.com/productos/saver/	
Scope / Rational context MeteoGRID technical team has been developing and improving Weather Forecasting Systems (WFS) since 1996.	
Relevant Thematic Working Group: All TWGs	**TRL**: 9: System Test, Launch & Operations
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/weather-forecasts-systems-wfs-and-early-warning-systems-ews	
1st cycle CCCs addressed ✓Provide an efficient, flexible flow of information for a shared understanding. ✓Negotiate solutions with stakeholders for anticipated scenarios (TOP CHALLENGE). ✓Pre-plan a time-efficient, safe response, minimizing responder's engagement. ✓Pre-plan interoperability and enhance synergies. Forecast and simulate complex scenarios. ✓Get a clear picture of the risk evolution. ✓Technological tools to support data sharing.	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓Identify points of coordination in the different zones: from local (hot zone, warm zone ...) to regional and to national. Establish different levels of liaison officers, translators; communication; entrance points; and infrastructures as needed. ✓Base the prediction of scenarios on historical events and on statistics (baseline), including the modelling of the actual conditions (at local level) and human factors.	
Comments from the analysis *(added by WP3 leader)* Weather forecast services already provided in the market.	
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Green. **Solution maturity**: Green. **Interoperability & standardization**: Green.	

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T5. Toxi-triage project

Solution Name: **Toxi-triage project**	**Solution provider:** **Admin**
Solution Type: Technological innovation	
Solution short description: Not provided by the supplier	
Website of the solution: http://toxi-triage.eu/about	
Scope / Rational context concept of operations that envisages accelerated delivery of situational awareness through an ensemble of embedded sensors, drones, standoff detectors (including cameras), artificial intelligence for processing sensor signals and web-traffic from social media, and centralised command and control. Wireless traceability of casualties provides dynamic mapping including medical care. Distinctive technological attributes of TOXI-triage include: • Rapid non-invasive assessment of exposure/ injury through monitoring metabolic markers of injury • Managing and exploiting the semantic web • Traceability by design • Aptamer-based biosensing • Casualty-to-discharge system integration • Integrated environmental and stand-off hazard designation	
Relevant Thematic Working Group: CBRNe	**TRL**: 1-2: Basic Technology Research
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/toxi-triage-project	
1st cycle CCCs addressed ✓Focus on sustainability of safe operations (TOP CHALLENGE)	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓Maintain situation awareness. Avoid the loss of information with shifts' changes.	
Comments from the analysis *(added by WP3 leader)* A set of solutions that is developed in the framework of Toxi-project. The solution is still under development. Although this technological innovation is at a premature level, in the design of the concenpt the factor of interoperability is already considered.	
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Red. **Solution maturity**: Red. **Interoperability & standardization**: Yellow.	

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T6. SAPI – SDIS78 (FR content)

Solution Name:	**Solution provider:**
SAPI - système de surveillance et d'alerte du personnel	**SDIS78**
Solution Type: Technological innovation	
Solution short description Le système permet de signaler à l'instant en temps réel, tout véhicule entrant dans la zone de sécurité. Ce système est constitué d'une caméra fixée à l'arrière du VSR et d'une lampe stroboscopique, d'un logiciel de traitement de l'image sur un PC embarqué, et d'un écran tactile à l'intérieur de la cabine de l'engin. Grâce à ce système en quelques secondes, , un membre de l'équipage du VSR dessine sur l'écran tactile de manière très intuitive et rapide la zone de surveillance. Cette zone est alors surveillée par le SAPI. Si un véhicule pénètre dans la zone définie, trois types d'alerte se déclenchent en simultanée afin de prévenir le personnel intervenant : 1. Une lumière flash type stroboscopique, positionnée à l'arrière du VSR qui alerte le conducteur du véhicule qu'il est dans une zone interdite. 2. Une sirène de type corne de brume très puissante avertit les sapeurs-pompiers présents sur le chantier. 3. En option, un gilet haute visibilité équipé de Leds qui changent de couleur, et passeront du blanc au rouge à réception du message émis par le logiciel.	
Website of the solution: http://www.sp78.tv/prevention-pour-tous/679-78cooc-tutoriel-video-sur-un-nouveau-materiel-s-a-p-i	
Scope / Rational context Le sur accident. Toutes les personnes intervenant sur un accident de la route sont au fait de ce danger. Les sapeurs-pompiers ont déjà un lourd passé, souvenez-vous Loriol en 2002 où cinq sapeurs-pompiers sont décédés victimes d'un chauffard, plus récemment un sous-officier de la Réunion est lui aussi décédé sur la route, fauché par une voiture et à deux reprises dernièrement, les militaires de la BSPP en intervention sur le périphérique Francilien ont été percutés par des véhicules ayant pénétré dans la zone balisée. Éviter le sur accident parait impossible par contre prévenir les intervenants cela est possible, des solutions existent.	
Relevant Thematic Working Group: SAR	**TRL**: 9: System Test, Launch & Operations
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/sapi-systeme-de-surveillance-et-d-alerte-du-personnel	
1st cycle CCCs addressed ✓ Develop public self-protection to minimize responders exposures (TOP CHALLENGE)	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …	
Comments from the analysis *(added by WP3 leader)* A solution that warns first responders for imminent danger and, at the same time, the general public that is entering the safety zone during search and rescue operations. Addresses both first responders and the public. Already in use.	
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Green. **Solution maturity**: Green. **Interoperability & standardization**: Green.	

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T7. Ofire+ - Omikron Environmental Consultants SA

Solution Name: **Ofire+**	**Solution provider:** **Omikron Environmental Consultants SA**
Solution Type: Technological innovation	
Solution short description The main features of the Ofire+ system, which makes it innovative, are the functionalities that are described below: - the provision of local information in order to carry out targeted preventive actions during the days with high probability for a wildfire so as to increase the levels of direct and indirect protection. - support in making informed decisions on the proper management of response time in the face of a threat from a wildfire. - support in providing timely and credible, targeted and personalized communication and guidance to users by the administrator, where and when required, on days with high or very high probability for a wildfire or during the course of a fire incident. To achieve the purpose of the system, scientific (fuel models, meteorological parameters, simulation of fire event behavior), operational (user location, collection points, control points, fire hydrants) and other spatial (roads, trails, etc.) data are used. Keywords: decision making, crisis management, early warning, two way communication, wildfires	
Website of the solution: https://omikron-sa.gr/services/ofire-plus-plus/	
Scope / Rational context Ofire+ is a human-centered decision-support system for managing (prevention, early warning information and response) crises related to the occurrence of wildfires. The key components of the system are the cloud application (administrator) and the mobile application (users). The two parts complement each other and the communication channel they create through their connectivity is the main advantage of the system, in addition to the individual functionalities and information provided by each component separately. The cloud application (admin) is intended to facilitate the operational needs of security managers of private or public critical infrastructure such as touristic, industrial, health, cultural, archeological, municipal and others. The mobile application is intended to be utilized by residents, visitors and/ or field actors such as civil protection volunteers, security crews and others, who can be found on site of infrastructures having the system in operation. The system is currently under development by Omikron SA.	
Relevant Thematic Working Group: Landscape Fires	**TRL**: 5-6: Technology Developement & Demonstration
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/ofire	
1st cycle CCCs addressed ✓Anticipate vulnerability, and communicate to the public (TOP CHALLENGE). ✓Manage key information focused on decision-making. ✓Forecast and simulate complex scenarios.	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Identify points of coordination in the different zones: from local (hot zone, warm zone ...) to regional and to national. Establish different levels of liaison officers, translators; communication; entrance points; and infrastructures as needed. ✓ Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points… ✓ Be prepared to provide massive alerts to population	
Ideas and future developments (from the side of the provider)	

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Future developments will include functionalities related to early warning of fire using satellite media, crowdsourcing of relevant to wildfires public information and better resource management in the field
Comments from the analysis *(added by WP3 leader)* Innovation that currently is under development. Technological innovation with high interoperability, using cloud and mobile apps for informing and alerting both agencies, responsible for critical infrastructure and the community.
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Yellow. **Solution maturity**: Yellow. **Interoperability & standardization**: Green.

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T8. Seismic hazard Assessment – National and Kapodistrian University of Athens

Solution Name:	**Solution provider:**
Seismic Hazard Assessment	**National and Kapodistrian University of Athens**

Solution Type: Technological innovation

Solution short description

The first step towards reliable seismic hazard assessment is the compilation of the earthquake catalogue that will be utilized. For that purpose, a detailed seismological study has to be compiled. Sources of both historical and instrumental seismicity are used. Following, the completeness of the earthquake catalogue is examined.

Both the probabilistic and the deterministic seismic hazard assessment require the assignment of a ground motion prediction equation (GMPE). GMPEs are probabilistic relations between earthquake characteristics, distances and site conditions. In other words, GMPEs are statistical models used to predict the ground shaking in terms of ground motion parameters. GMPEs are a powerful tool for engineering seismology and earthquake engineering and are widely used to assess seismic hazard. .

Probabilistic Seismic Hazard Assessment (PSHA) is performed with two independent methodologies. The first, zone-free, adopts the extreme values method and requires only an earthquake catalogue and one GMPE per ground motion parameter (PGA, PGV and PGD). The second, apart from the above, also requires the inclusion of seismogenic sources. Both methods are applied for certain return periods:

• 475 years (90% probability of not being exceeded in 50 years), the return period adopted in National Building Codes

• 950 years (90% probability of not being exceeded in 100 years) that represents the Safe Shutdown Earthquake (SSE)

• 1950 years (95% probability of not being exceeded in 100 years) that represents the Maximum Design Earthquake (MDE)

The extreme values distribution was founded by Gumbel in 1939 and has extensively been applied to seismic hazard studies. Catalogue completeness causes less severe problems when maximum values are used. The maximum values approach is useful in aseismic design, where the knowledge of either the maximum dynamic load that might be applied on a structure in its life expectancy period, or the most probable reoccurrence period of such a load at that site is essential. The results of all seismic hazard parameters (Mmax, PGA, PGV and PGD) fare will be presented with maps and iso-contour lines.

The second PSHA methodology that is applied incorporates sesimotectonic models which combine seismicity and the basic tectonic elements. The main objective of any modeling effort is the determination of a distribution law for the parameter of interest i.e. PGA, PGV and PGD, in terms of time intervals and area. Thus, the methodology presently applied in estimating seismic hazard, includes the following stages: (i) Definition of the seismic zones. (ii) Assumption of a certain stochastic process in time for earthquake occurrence. (iii) Determination of the relation between number of earthquakes and magnitude for each zone. (iv) GMPE assignment per seismic hazard (PGA, PGV and PGD) parameter. (v) Determination of the seismic hazard. The results of the seismic hazard parameters (PGA, PGV and PGD) are presented with maps and iso-contour lines.

Results obtained by the two independent methodologies are compared.

Deterministic Seismic Hazard Assessment (DSHA) refers to the computation of synthetic time histories of ground motion. The simulation of the strong ground motion is performed through an empirical method where time and frequency features of the motion are represented through the physical spectrum, extending the spectral moment's theory to the nonstationary case by summing Fourier series with time-dependent coefficients. The simulated time histories fit the recorded accelerograms in terms of ground-motion amplitude measures, such as peak acceleration, peak velocity and peak displacement. The main advantage of the method that is applied consists in correlating the simulation parameters with earthquake magnitude, source distance and soil conditions.

Scope / Rational context

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Estimation of seismic hazard is seismic prone areas and for critical infrastructure (e.g. bridges, national roads, pipelines). These studies can be provided as a service. Seimic hazard assessment is based on scientific methods and tools that are applied worldwide and accepted by the scientific community	
Relevant Thematic Working Group: Natural Hazard Mitigation	**TRL**: 9: System Test, Launch & Operations
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/seismic-hazard-assessment	
1st cycle CCCs addressed ✓ Focus on governance and capacity building towards more resilient societies. ✓ Negotiate solutions with stakeholders for anticipated scenarios (TOP CHALLENGE). ✓ Pre-plan a time-efficient, safe response, minimizing responder's engagement. ✓ Forecast and simulate complex scenarios.	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises. ✓ Once the standard roles of different actors have been trained and drilled inside each agency, organize multiagency joint trainings and exercises with the focus on decision-making, coordination and interactions between agents. Train in overlapped competences and limits of competences. Train the trainers of the different agencies. Share on-line training and exercises. ✓ Base the prediction of scenarios on historical events and on statistics (baseline), including the modelling of the actual conditions (at local level) and human factors.	
Ideas and future developments *(from the side of the provider)* Use of algorithms to perform hybrid seismic hazard assessment regarding low, intermediate and high frequencies to be applied for both residential buildings and critical infrastructures.	
Comments from the analysis *(added by WP3 leader)* This technological innovation assesses the seismic hazard for critical infrastructure combining not only historical data, but also pioneering scientific tools and technologies. Thus, it has high operational value for all civil protection agencies and responders in case of seismic events close to critical structures. Practically a service, not a technogy itself. Technological innovations, especially, high-end seismometers and software for further analysis are used in order to carry out the described services.	
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Green. **Solution maturity**: Green. **Interoperability & standardization**: Green.	

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T9. First responders flow simulation – ONHYS

Solution Name: **First responders flow simulation**	**Solution provider:** **ONHYS**
Solution Type: Technological innovation	
Solution short description A behavioral simulator named ONHYS ONE®, that incorporates Building information Modeling (BIM) technology along with spatial processing algorithms that makes it capable of using standard 3D mockups for simulation without further user effort. The simulated pedestrian agents have multi-layered cognitive behaviors reflecting human capacities such as path planning, visual perception, collision avoidance. This technology is versatile in the sense of being applicable to many use cases generically, and updatable with situation specific simulation models.	
Website of the solution: https://www.onhys.com	
Scope / Rational context ONHYS provides solutions (software and consulting) to improve planning the operations of public places with pedestrian logistics issues. The current fields of applications are mobility (e.g. train station), security (e.g. evacuation), and quality of service (e.g. access control in sport events).	
Relevant Thematic Working Group: SAR, Structure Fires	**TRL**: 9: System Test, Launch & Operations
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/first-responders-flow-simulation	
1st cycle CCCs addressed ✓ Forecast and simulate complex scenarios	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points… ✓ Towards a complete cycle of knowledge. Adjust Standard Operational Procedures (SOPs), doctrine and pre-plans using the feedback from real incidents and from exercises testing them (evaluators, assessors, statistics…) and identify the main gaps to focus efforts in training, procedures, personnel and equipment. Evidence based on fire scenarios. The process learning of an organization goes through the identification of own 'best practices' and the external ones: • to collect experiences and convert them into guides, • to collect 'lessons learned' and transform the best points into protocols, • to share experiences with the aim of generating standards.	
Comments from the analysis *(added by WP3 leader)* Very high operational value , especially for first responders during structure fire crises. Already in use.	
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Green. **Solution maturity**: Green. **Interoperability & standardization**: Green.	

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T10. CIPcast DSS – ENEA

Solution Name:	**Solution provider:**
CIPcast DSS, Critical Infrastructure Protection risk analysis and foreCAST Decision Support System	**ENEA, Analysis and Protection of Critical Infrastructures Laboratory APIC**
Solution Type: Technological innovation	
Solution short description	
Website of the solution: https://www.unisdr.org/conference/2019/globalplatform/programme/platform/view?id=957	
Scope / Rational context CIPCast is conceived as a combination of free/open source software environments and it is provided to customers through a user--friendly web GIS interface which allows: -- the access to a large information database for situational awareness; - - the forecast of the external event, with the support of prediction models; - - the estimate of the expected location and severity of damages induced on CI elements and on the built and natural environment; -- the consequent outages or reduced availability of critical services; - real time update of forecasted hazard, damage and impact scenarios via field sensors, satellite data, crowd-sourced data; - the estimate of cascading and interdependency effects; -- the estimate of the consequences experienced by citizens and other sectors of societal life; - the suggestion pf optimized re--configuration strategies to CI operators. CIPCast can also be run for user- defined scenarios, in a what-if mode of operation, for supporting experiential learning and the planning of mitigation and emergencies. CIPCast is currently used by EISAC.IT, "Italian node of the European Infrastructure Simulation and Analysis Centre" EISAC. EISAC is an international initiative aiming at establishing a collaborative, european-wide platform in the domain of Critical Infrastructure Protection (CIP), for supporting Operators and Public Authorities in better protecting assets and in enhancing their resilience with respect to different kind of natural and man-induced hazards.	
Relevant Thematic Working Group: Natural Hazard Mitigation	**TRL**: 9: System Test, Launch & Operations
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/cipcast-dss-critical-infrastructure-protection-risk-analysis-and-forecast-decision-support-system	
1st cycle CCCs addressed ✓ Establish an interagency framework	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Once the standard roles of different actors have been trained and drilled inside each agency, organize multiagency joint trainings and exercises with the focus on decision-making, coordination and interactions between agents. Train in overlapped competences and limits of competences. Train the trainers of the different agencies. Share on-line training and exercises. ✓ Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points… ✓ Adapt the legal framework and requirements on prevention and self-protection of infrastructures and activities to first responders' needs, lessons learned from past events... Plan the implementation of laws and plans. Adapt the regulations to emergency situations.	

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

Ideas and future developments *(from the side of the provider)* Develop IT advanced technologies and innovative tools to allow for a two--way communication and data exchange from the field to the Control Rooms, thus empowering the emergency operators to make informed and evidence--based decisions. e.g. IT devices and devices and Augmented Reality (AR) to allow for a two--way exchange between the control room and the emergency field (in collaboration with YLICHRON SRL http://www.ylichron.it/). The use of innovative IT tools (such as google glasses, smart-eyes, and augmented reality, AR) along with satellite images is envisaged to bring/get data, videos, images and voice communications from the emergency field to the Control Room aiming to update in real-time and dynamically CIPCast predicted scenarios. On the other hand, it is envisaged to make available the simulated impact scenario produced by CIPCast, to the first responders on mobile devices allowing them, to filter and query specific information. The IT tools allowing for the distribution/acquisition of data to/from the field, via web, will rely both on standard telecom platforms (GPRS, 3G-4G) and on satellite communications.
Comments from the analysis *(added by WP3 leader)* CIPCast is a decision support platform with high level of interoperability that can run scenarios and can provide the user with an overall picture. Already being used in Italy.
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Green. **Solution maturity**: Green. **Interoperability & standardization**: Green.

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

T11. Raybird 3 Fixed-wing Drone – Skyeton

Solution Name: **Raybird 3 Fixed-wing Drone / Autonomous Swarm-Unmanned Aerial System**	**Solution provider:** **Skyeton**
Solution Type: Technological innovation	
Solution short description Tailored system to suit industry and works in tandem with the First Responders. Pick up hotspot as small as 2m by 1 from 800 m above the ground. Fully autonomous drone (executing the flight plan, detects a hotspot, navigating to point of interest, taking pictures autonomously). Images transmitted to the Ground Control Station and consequently dispatched to First Responders. Through AI, 5 targets can be dected and First Responder sent to the location to rescue (SAR case).	
Website of the solution: https://www.skyeton.com/	
Scope / Rational context Scope: Proactive Wildfire Management / Early Detection of Wildfire Rational: The conversation is changed from "investing in reactive infrastructure" to being "proactive and anticipating risk through early detection of early wildfire". And the swarm fully-autonomous UAV can deliver just that. Skyeton is the designer and producer of fixed-wing drone system (here is our video on YouTube: https://youtu.be/7pqOnljAJpk). The system is tailored to suit industry and works in tandem with the First Responders. A hotspot as small as 2m by 1 from 800 m above the ground can be picked up. The drone is fully autonomous. The drone is autonomous, meaning while it is executing the flight plan and detects a hotspot, it will automatically go to the coordinate to take pictures. Images then transmitted to the Operator at the Ground Control Station so he/she can dispatch the First Responder to the coordinate for corrective action before the situation gets out of control. Through AI, 5 targets can be dected and First Responder sent to the location to rescue (SAR case). The system was featured by UAV Commercial just a few weeks ago (https://bit.ly/3coQeSe). And here is a 3 slides presentation for a review: https://www.linkedin.com/smart-links/AQEnay5yts3JRg.	
Relevant Thematic Working Group: SAR, Landscape Fires, Natural Hazard Mitigation	**TRL**: 9: System Test, Launch & Operations
Link in the FIRE-IN platform: https://www.fire-in.eu/challenges-resources/validated-solutions/raybird-3-fixed-wing-drone-autonomous-swarm-unmanned-aerial-system	
1st cycle CCCs addressed ✓ Distribute decision-making (TOP CHALLENGE). ✓ Provide an efficient, flexible flow of information for a shared understanding. ✓ Pre-plan a time-efficient, safe response, minimizing responder's engagement. ✓ Pre-plan interoperability and enhance synergies.	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Identify points of coordination in the different zones: from local (hot zone, warm zone ...) to regional and to national. Establish different levels of liaison officers, translators; communication; entrance points; and infrastructures as needed. ✓ Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points… ✓ Maintain situation awareness. Avoid the loss of information with shifts' changes.	
Ideas and future developments *(from the side of the provider)* Development of Unmanned-Aerial-Vehicle Traffic Management (UTM)	

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Comments from the analysis *(added by WP3 leader)* An Unmanned Aerial Vehicle (UAV) with multiple features and capable of completing various missions. This technology is addressed only to professionals and mainly in governmental agencies. Already in the market and used by various organizations.
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Green. **Solution maturity**: Green. **Interoperability & standardization**: Green.

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

T12. ARFiDD – Unisystems

Solution Name: **Aerial Robotic Fire Defender Drone (ARFiDD)**	**Solution provider:** **Unisystems**
Solution Type: Technological innovation	
Solution short description ARFiDD is an innovative fire protection system against fires in open and forest areas, aiming to the detection of fire outbreaks and the support of firefighting, with emphasis on the initial fire intervention. The ARFiDD integrated solution will consist of two types of drone (rotorcrafts), respectively A and B. Type A will be patrol drones with the task of monitoring, detecting and locating fire outbreaks in forests and open spaces and type B will be the drones of initial intervention. A-type will be equipped with a high-resolution camera for monitoring open areas, an infrared camera to create a spatial temperature profile and the detection of thermal differences in their field of view, atmospheric measurement sensors, distance measuring systems from ground targets (points of interest), and a communication system for real-time data transmission. B-type drones will also have a high-resolution camera, an infrared camera for hot spot detection, fire detection and temperature measurement, target approach control system, transfer and release system, on the perimeter of the fire, and dry foam spheres for immediate intervention and extinction. Both types will have an autonomous scheduled flight function and additional remote control from the ground station, if required during their mission.	
Website of the solution: https://www.unisystems.gr/	
Scope / Rational context ARFiDD is an innovative fire protection system against fires in open and forest areas, aiming to the detection of fire outbreaks and the support of firefighting, with emphasis on the initial fire intervention. The objective of ARFiDD is: a) The surveillance, in real-time, of large areas with a high level of risk and increased incidence of fire. b) The prompt and timely notification of first responders and services for fire ignition detected by the drones in the surveillance areas. c) A firefighting drone with a mission to extinguish and control fires detected by monitoring drones, with the use of special equipment, preventing the spread of the fire. This technology is a proposal submitted to the Greek General Secretariat for R&D and currently is under evaluation. The pilot area for ARFiDD is the Ainos National Park at Kephalonia island, where forest fires are very common and dangerous during summer. The system is designed to be delivered in the form of an Emergency Management Support Service, also an innovative approach, so that operators who use it are relieved of the cost of purchasing and maintaining specialized equipment and software, as well as qualified personnel. A monitoring, coordination and communication platform will be developed to standardize the ARFiDD system, which will make it applicable to different areas.	
Relevant Thematic Working Group: SAR, Landscape Fires	**TRL**: Not applicable
Link in the FIRE-IN platform: https://www.fire-in.eu/challenges-resources/validated-solutions/aerial-robotic-fire-defender-drone-arfidd	
1st cycle CCCs addressed ✓ Pre-plan a time-efficient, safe response, minimizing responder's engagement	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Identify points of coordination in the different zones: from local (hot zone, warm zone ...) to regional and to national. Establish different levels of liaison officers, translators; communication; entrance points; and infrastructures as needed. ✓ Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points… ✓ Maintain situation awareness. Avoid the loss of information with shifts' changes.	

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Ideas and future developments *(from the side of the provider)* This technology has been proposed for funding to the Greek General Secretariat for R&D and currently is under evaluation.
Comments from the analysis *(added by WP3 leader)* Technology with very high operational value exploiting the use of drones for both detecting-monitoring fire outbreaks and facing the crises with firefighting mechanisms. It also has high interoperability potential collecting data and notifying first responders when required. In a level of idea and future implementation.
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Red. **Solution maturity**: Red. **Interoperability & standardization**: Red.

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T13. THE FOREST FIRE DETECTION AND MONITORING SYSTEM – HR AZARI

Solution Name: **THE FOREST FIRE DETECTION AND MONITORING SYSTEM**	**Solution provider:** **HR AZARI**
Solution Type: Technological innovation	
Solution short description Smart-Dust With Primary Purpose of Detecting Wildfire A new protocol in Smart-Dust, Smart-Dust to prevent forest fires. This project is a flexible - low-cost approach and cost-effective tool available to generate the scientific data needed to protect nature in various topography and its benefits to people. The concept is examined based on an example network, which simulates a self-organizing network with primary purpose of detecting fire in large jungles. The supposed jungle is remote and not easily accessible by human, so motes will be thrown down into the area, they will self-organize themselves and form a self-organized wireless sensor network.	
Website of the solution: https://ir.linkedin.com/in/hr-azari-a5980311b	
Scope / Rational context From the Amazon to Australia, the world's forests are burning and the damage goes far beyond the Amazon. THE FOREST FIRE DETECTION AND MONITORING SYSTEM Smart-Dust With Primary Purpose of Detecting Wildfire ''Studies on Hyrcanian Forests-Biosphere Reserves,' Smart-Dust'' to prevent forest fires. A new structure of the FPI, "The suitable routing protocol for Forest Fire Detection and active fire Monitoring System uses data to detect, locate, characterize and monitor forest fires''. Smart Dust is a flexible - low-cost approach and cost-effective tool available to generate the scientific data needed to protect nature in various topography and its benefits to people; and transmits important information as request and is a breakthrough in forest fire protection. The primary objective of the research is to tackle the global challenges faced in preservation of forests and fire protection. The prime devastating examples of such fires were recently in the news with Brazilian rain forest fires and the difficult job of controlling it once started. This involves innovative approaches, experimental and monitoring of complex environmental systems to better understand the various factors and processes that help us develop national and global sustainable plans and meet international goals on climate change, biodiversity, ecosystem preservation. The proposal plan and idea is best tech-based innovation for humanitarian aid in order to protect World Heritage Forest, and the design meet with "Iran's Department of Environment (DOE)" approval.	
Relevant Thematic Working Group: Landscape Fires	**TRL**: 3-4: Research to prove Feasibility
Link in the FIRE-IN platform: https://www.fire-in.eu/challenges-resources/validated-solutions/the-forest-fire-detection-and-monitoring-system	
1st cycle CCCs addressed ✓ Forecast and simulate complex scenarios	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points… ✓ Maintain situation awareness. Avoid the loss of information with shifts' changes.	
Ideas and future developments *(from the side of the provider)* First and foremost, I'm interested to establish a global network of world System with primary purpose of detecting wildfire to protect world heritage; such as biosphere reserves, national parks, Natura 2000 sites, Hyrcanian Forests and numerous endemic species and with the aim of developing the underpinning	

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knowledge necessary for the Environmental Protection on Smart production systems and define a performance baseline to compare against novel, low- cost-effective tool and approaches.
Comments from the analysis *(added by WP3 leader)* Although this technological innovation is at a premature level, regarding the technological readiness aspect, it has a good operational value potential, especially regarding remote areas, that are difficult to handle during landscape fire crises. Nevertheless, is more a research that can lead to technological innovation than a ready to system, application or sensor.
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Red. **Solution maturity**: Red. **Interoperability & standardization**: Red.

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T14. SmokeD Wildfire Detector – IT For Nature

Solution Name: **SmokeD Wildfire Detector**	**Solution provider:** **IT For Nature**
Solution Type: Technological innovation	
Solution short description Installation of the SmokeD detectors is straightforward. It requires finding a site with a good overview of the surrounding landscape. Detectors can be installed on roofs or chimneys of house structures, or even better on poles or towers with an unobstructed view of large areas. Electric power and internet connection are needed. When 4 detectors are installed in the same location, a complete coverage of the surrounding area within a radius of 10 miles is provided day and night.	
Website of the solution: https://smokedsystem.com/	
Scope / Rational context The SmokeD detectors are sophisticated devices intended for early fire detection and an immediate notification of users about their occurrence. For that purpose artifical intelligence (AI) has been applied resulting in fast, effective, and accurate detection of smoke and flames up to 10 miles. The main purpose of SmokeD systems is to detect fires before they become too large for their effective control. The system is aimed at individual, government, and corporate users.	
Relevant Thematic Working Group: SAR, Structure Fires, Landscape Fires, Natural Hazard Mitigation, CBRNe	**TRL**: 9: System Test, Launch & Operations
Link in the FIRE-IN platform: https://www.fire-in.eu/challenges-resources/validated-solutions/smoked-wildfire-detector	
1st cycle CCCs addressed ✓ Pre-plan a time-efficient, safe response, minimizing responder's engagement	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Identify points of coordination in the different zones: from local (hot zone, warm zone ...) to regional and to national. Establish different levels of liaison officers, translators; communication; entrance points; and infrastructures as needed. ✓ Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points… ✓ Maintain situation awareness. Avoid the loss of information with shifts' changes.	
Comments from the analysis *(added by WP3 leader)* Technologies are usually used by governmental agencies or critical infrastructure in order to monitor forests and acquire early warnings. Proven capability especially in remote area with small degree of supervision. Already in the market for purchase.	
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Green. **Solution maturity**: Green. **Interoperability & standardization**: Green.	

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T15. White Hawk tethered Aerostat – CNIM Air Space

Solution Name: **White Hawk Tethered Aerostat**	**Solution provider:** **CNIM Air Space**
Solution Type: Technological innovation	
Solution short description The White Hawk tethered aerostat solution from CNIM Air Space is composed of several elements: - The tethered aerostat, spherical, with a volume of 40m3, which can reach a flying height of 150m. - Its trailer, which brings mobility to the solution: it can easily be inserted into a convoy of rescue vehicles, and, once on an operation site, it can be deployed from one place to another. - Its payload, which can be adapted according to needs, whether they are related to observation or communication: EO/IR optronic gimbal, communication sensors (radio relay, 4G bubble, IMSI catcher, etc.). - Its ground station, which controls the payload, and display or save data. The standard configuration for the transmission of information between the aerostat and the ground is via PLC/Ethernet. However, other transmission modes can be adapted (LTE or radio), allowing the data to be processed away from the intervention site, for example inside a nearby fire truck. CNIM Air Space's White Hawk tethered aerostat presents advantages such as 24/7 persistence: the tethered aerostat can be deployed on missions lasting up to several weeks. It is also a mobile solution, with low operational costs (only 1 person to operate the camera) and quickly deployable: once inflated the aerostat can reach its maximum flying height in less than 10min. Finally, the tethered aerostat is quick to handle and no remote certification pilot is required. Those characteristics make it a remote aerial surveillance or communication mean perfectly adapted for infrastructure fires and Search & Rescue missions.	
Website of the solution: https://cnim.com/en/medias/airstar-aerospace-becomes-cnim-air-space#	
Scope / Rational context A tethered aerostat is a lighter-than-air balloon connected to its mooring station by a tether. It takes onboard a payload, which can be composed of an EO/IR optronic gimbal or any other type of sensors (radio relay, 4G bubble, IMSI catcher, ...). The tethered aerostat is characterised by its high persistence: during missions, unlike a drone, it can be deployed for several days or even weeks. Thus, it will be able to carry out its surveillance mission during large infrastructure fires that are long-lasting. Giving firefighters a three-dimensional aerial view (up to 150 meters high), the White Hawk tethered aerostat can be used to observe and monitor the entire site during infrastructure fires, such as the recent fire at Notre Dame de Paris in France or the fire at the Lubrizol plant. It enables the firefighters to identify strategic points of the fire, and to transmit reliable information to the ground, which is essential for decision-making. During a natural disaster (e.g. an earthquake), the tethered aerostat, thanks to its on-board sensors, provides help to the rescue services in terms of organisation and victim assistance (locating victims using IR vision or an IMSI catcher, enabling communication between all the firefighters on site using a 4G bubble, etc.). This CNIM Air Space system has been tested by the French Customs and the French Gendarmerie Nationale.	
Relevant Thematic Working Group: SAR, Structure Fires	**TRL**: 7-8: System/Subsystem development
Link in the FIRE-IN platform: https://www.fire-in.eu/challenges-resources/validated-solutions/white-hawk-tethered-aerostat	
1st cycle CCCs addressed ✓ Get a clear picture of the risk evolution	
2nd cycle CCCCs addressed *(added by WP3 leader)*	

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✓ Identify points of coordination in the different zones: from local (hot zone, warm zone ...) to regional and to national. Establish different levels of liaison officers, translators; communication; entrance points; and infrastructures as needed. ✓ Maintain situation awareness. Avoid the loss of information with shifts' changes.
Comments from the analysis *(added by WP3 leader)* High interoperability using various modes of transmitting information between the ground station and the deployable aerostat. Since it is quick and easy to handle and, furthermore, ready to be used immediately, once on operation site, it has high operational value.
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Green. **Solution maturity**: Yellow. **Interoperability & standardization**: Green.

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

T16. Drone on a moving platform – CNBOP-PIB

Solution Name: **drone on a moving platform enabling autonomous landing and battery replacement and further flight**	**Solution provider:** **CNBOP-PIB**
Solution Type: Technological innovation	
Solution short description The drone uses a gyroscope to land on a special socket where the battery is replaced. After replacement, you can proceed to further departures.	
Website of the solution: https://www.cnbop.pl/en	
Scope / Rational context The technology was created for the needs of the Fire Brigade so that interoperability could be ensured. Often the Fire Brigade needs to perform several flights one after the other - the technology was created, among others to improve the battery replacement process of a moving vehicle.	
Relevant Thematic Working Group: SAR	**TRL**: 7-8: System/Subsystem development
Link in the FIRE-IN platform: https://www.fire-in.eu/challenges-resources/validated-solutions/drone-on-a-moving-platform-enabling-autonomous-landing-and-battery-replacement-and-further-flight	
1st cycle CCCs addressed ✓ Technological tools to support data sharing	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Maintain situation awareness. Avoid the loss of information with shifts' changes.	
Ideas and future developments *(from the side of the provider)* Research is still optimalized/on going.	
Comments from the analysis *(added by WP3 leader)* System still on development and testing. Interesting approach in order to make the use of drones more valuable.	
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Yellow. **Solution maturity**: Yellow. **Interoperability & standardization**: Green.	

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T17. Real time earthquake shaking maps for Greece – National and Kapodistrian University of Athens

Solution Name:	**Solution provider:**
Real time earthquake shaking maps for Greece	**National and Kapodistrian University of Athens**

Solution Type: Technological innovation

Solution short description

The Seismological Laboratory of the National and Kapodistrian University of Athens (SL-NKUA, http://www.geophysics.geol.uoa.gr/) monitors on real-time basis the seismicity in Greece, based on the recordings of the Hellenic Unified Seismological Network (HUSN). In the framework of constant upgrade of the seismicity monitoring and the innovation spirit that characterizes the National and Kapodisitran University of Athens has developed its own application for ground shaking maps, the Real-time Shaking Maps (Sakkas et al. 2018, Sakkas et al., 2019), publicly available in the following address: http://macroseismology.geol.uoa.gr/realtime/. This application is used in addition other similar applications (e.g. ShakeMaps).

Since 2015 (first version) in the framework of the "Greco-Risks - Hellenic Natural-Hazards Risk-Management System of Systems" project. The work of constant upgrade continues under the framework of the HELPOS research project. Currently, in its latest version, calculates and creates ground shaking maps of Peak Ground Acceleration (PGA) and Peak Ground Rotations (PGR) based on Ground Motion Prediction Equations (GMPEs) for Greece. Shaking maps are created and published online for earthquakes with magnitudes M≥3.8. For shallow earthquakes five regional GMPEs are used for the calculation of PGA and one GMPE for the rotational components (torsion and rocking). Regional GMPES are calibrated with Hellenic earthquakes. The algorithm estimates the fault type (normal, thrust, strike-slip) of the earthquake based on the Hellenic seismicity and tectonic zones on real-time. Soil types (rock, stiff soil, soft soil) are known based on the geotechnical map of Greece.

The innovation of the algorithm is that PGR are calculated for the first time worldwide and the output maps are in a vector map. Currently, for reducing computing effort the grid calculates PGA and PGR in distances up to 100km around the earthquake epicenter in a grid of about 4.5km X 4.5km. The algorithm is written in Matlab. RSS standards are used. Results are updated every 1 (one) minute. The algorithm is in operational mode for about five years and has proved a valuable tool.

The latest upgrade was the interoperability with other infrastructure of NKUA and can read the recordings of the seismological stations. The user can zoom in and out the map and click on a specific grid point or a seismological station in order to see the exact value of PGA and PGR. Also, the user can select from multiple regional seismic models. Outputs are provided in html format, readable by any computer with a simple browser, compatible with all famous web browsers.

Website of the solution: http://macroseismology.geol.uoa.gr/realtime/

Scope / Rational context

The main concept of the technological tool is to create Peak Ground Acceleration Maps (Linear and rotational) in real-time in a few seconds up to two minutes after the earthquake occurrence and automatic calculation of its main parameters (earthquake epicenter, magnitude, focal depth and origin date & time).

Peak ground acceleration (PGA) and peak ground rotations (PGR) are provided for research and operational purposes to respective bodies and to the general public. PGA and PGR are calculated through regional models calibrated for Greece and data from stations. The system is unique in terms of calculating PGR worldwide. In addition, the version currently running presents the results in vector format, has multiple options as basemap and multiple regional models embedded.

The system works 24/7/365. Technical and scientific details are provided in the following sections.

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These maps may serve for the real-time delineation of the potentially damage area. This, coupled with population exposure and vulnerability of buildings and infrastructure, will provide a quick estimate of the overall expected damage, as well as of the necessary first response operations.

Relevant Thematic Working Group: Natural Hazard Mitigation | **TRL**: 9: System Test, Launch & Operations

Link in the FIRE-IN platform: https://www.fire-in.eu/challenges-resources/validated-solutions/real-time-earthquake-shaking-maps-for-greece

1st cycle CCCs addressed

- ✓ Develop public self-protection to minimize responders exposures (TOP CHALLENGE)
- ✓ Involve communities in preparing population for the worst scenario before it happens (TOP CHALLENGE)
- ✓ Focus on sustainability of safe operations (TOP CHALLENGE)
- ✓ Information cycle
- ✓ Manage key information focused on decision-making
- ✓ Provide an efficient, flexible flow of information for a shared understanding
- ✓ Forecast and simulate complex scenarios
- ✓ Get a clear picture of the risk evolution
- ✓ Technological tools to support data sharing

2nd cycle CCCCs addressed *(added by WP3 leader)*

- ✓ Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …
- ✓ Change of paradigm. From 'We, authorities, will protect you' to 'You, citizen, should be actively involved'. These affirmations mean that you should be prepared to be self-sufficient concerning to your own protection and your community protection always inside the framework of the emergency. Be used to this sort of situations normalizing them.
- ✓ Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises.
- ✓ Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points…
- ✓ Maintain situation awareness. Avoid the loss of information with shifts' changes.
- ✓ Be prepared to provide massive alerts to population

Ideas and future developments *(from the side of the provider)*

In the future, more information will be provided, such as spectral acceleration, macroseismic intensity, population affected and land use (urban-rural areas) and national heritage sites. The notification e-mail service is also under development. Manual update. Upgrade of the algorithm for use in various programming languages. Provide outputs in other formats. Provide denser grids, more detailed soil type and faulting mechanisms.

Comments from the analysis *(added by WP3 leader)*

Technological tool, that records earthquakes of magnitude > 3,8 and provides Peak Ground Acceleration and Rotation to both, the civil protection agencies and the general public. Thus, it becomes easier to assess the seismological risk in a certain area, when the seismological hazard and the population vulnerability are combined. System in operation. Built for Greece but it can be adjusted to other areas if necessary input data are provided. Already in operational mode.

Traffic Light System Analysis *(added by WP3 leader)*

Operational value: Green. **Solution maturity**: Green. **Interoperability & standardization**: Green.

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T18. GIS-based Fire Hazard and Risk Assessment – Majaczech, z.s.

Solution Name: **GIS-based Fire Hazard and Risk Assessment**	**Solution provider:** **Majaczech, z.s.**
Solution Type: Technological innovation	
Solution short description Multi-layer GIS map system with specific fire hazard and risk assessment implemented in online platform. For development of the maps data are used from FIRMS (NASA), Copernicus, OpenStreetMaps, Google Maps and local information depending on local conditions (emergency response capacity, local specific hazards e.g. minefields). Fire Risk Maps include three main components: 1) Fire Hazard Map (Orography, Vegetation, Climate, Forest Management, Local hazards - e.g. minefields, trains, etc., Fire Statistics and historical fires location) 2) Vulnerability Assessment (Distance from roads, Distance from Settlements, Occurrence of protected species, Occurrence of Vulnerable population categories, etc.) 3) Emergency Response Capacity (Distance from water sources, Distance from observation stations / fire patrol routes, Distance from first responders) Assessment can be improved with respect to local conditions, special needs in the area, specific data provided by end-user, etc.	
Website of the solution: https://www.majaczech.cz/	
Scope / Rational context This system is focused on mapping local forest fire hazard and risks being implemented in an online platform. This approach allows application on four levels, with given examples of implementation in: 1) Fire Prevention - Define area with increased number of fires (based on fire statistics from NASA) - Establishing fire prevention patrols in defined areas and routes - Propose location of surveillance station (watch towers, CCTV, fire patrols, etc.) 2) Support Commanders in Decision Making - Supporting information for decision making of first-responders - Defining vulnerable area required protection / evacuation in case of fire 3) Building Emergency Response Capacity - Complex assessment of vulnerable area with action required (distance from observation stations, first-responders, tourist routes, number of fires, distance from water sources, etc.) 4) Increasing Community Resilience - Informing general public about local risks - Mitigation approach and fire prevention measures, especially in Wildland Urban Interface Similar maps have been delivered by Majaczech,z.s. under United Nations Development Programme (UNDP) to Bosnia and Herzegovina, where it was delivered for two case study areas - Livno (Federation of Bosnia and Herzegovina) and Mrkonjic Grad (Republika Srpska). Methodology was prepared in collaboration with local branch of UNDP, stakeholders and local municipalities. The resulting maps were presented and approved by local stakeholders. https://dras.undp.ba/public The implementation is in progress, since now is imported only final Fire Hazard Map.	
Relevant Thematic Working Group: SAR, Landscape Fires, Natural Hazard Mitigation	**TRL**: 7-8: System/Subsystem development

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Link in the FIRE-IN platform: https://www.fire-in.eu/challenges-resources/validated-solutions/gis-based-fire-hazard-and-risk-assessment

1st cycle CCCs addressed

- ✓ Involve communities in preparing population for the worst scenario before it happens (TOP CHALLENGE).
- ✓ Strategies choosing safe, resilient scenarios, and maintaining credibility.
- ✓ Focus on governance and capacity building towards more resilient societies.
- ✓ Negotiate solutions with stakeholders for anticipated scenarios (TOP CHALLENGE).
- ✓ Pre-plan a time-efficient, safe response, minimizing responder's engagement.
- ✓ Get a clear picture of the risk evolution.

2nd cycle CCCCs addressed *(added by WP3 leader)*

- ✓ Change of paradigm. From 'We, authorities, will protect you' to 'You, citizen, should be actively involved'. These affirmations mean that you should be prepared to be self-sufficient concerning to your own protection and your community protection always inside the framework of the emergency. Be used to this sort of situations normalizing them.
- ✓ Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises.
- ✓ Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points…
- ✓ Base the prediction of scenarios on historical events and on statistics (baseline), including the modelling of the actual conditions (at local level) and human factors.

Ideas and future developments *(from the side of the provider)*

Majaczech currently works on a system feature that will estimate and recognise areas considered as vulnerable to non-direct fire spread. It counts with flying hot firebrands generated during large forest fires which can be moved up to a few kilometres from the fire front. This implementation in the system would help especially in wildland and urban interfaces as the most vulnerable against this kind of fire spread.

Comments from the analysis *(added by WP3 leader)*

Fire hazard maps and fire risk under development.

Traffic Light System Analysis *(added by WP3 leader)*

Operational value: Yellow. **Solution maturity**: Yellow. **Interoperability & standardization**: Green.

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

T19. XENIOS – XENIOS Project Consortium

Solution Name:	**Solution provider:**
XENIOS	**XENIOS Project Consortium: CREATIVE PEOPLE, Laboratory of Forest Management and Remote Sensing, Demokritos – Environmental Research Laboratory (INRASTES, NCSRD), KE.ME.A, NAGREF, HAO DIMITER, SNPMB, Typorama**

Solution Type: Technological innovation

Solution short description

Tourism is a major driver of economic growth in Greece. Therefore, great attention and effort are required to offer quality services to visitors/tourists who should feel safe and relaxed when visiting tourist areas. A positive experience for tourists begins with the features of the site they visit, whether it is archaeological, cultural, environmentally unique, recreational, etc. However, they must also feel that adequate attention is paid to them and their well-being. Such attention includes receiving reliable information regarding the features of the site they are interested in as well as feeling safe. The importance of safety for tourism can be substantiated easily by looking at the speed with which tourist destinations change as the result of emerging threats; a frequent phenomenon in recent years. A case in point is the internationally negative tourism promotion of Greece in 2007, when the archaeological site of Olympia was gravely damaged by the severe August fires.

The proposed XENIOS project aims at developing services for the short-, medium- and long-term forecast of extreme natural events and natural disasters in areas of particular tourist and cultural interest, which are also vulnerable to natural hazards. This way, it contributes to more effective management of these risks. In addition, the project aspires to enhance safety and improve the tourism product at these sites, through a mobile app which will offer visitors prompt and reliable information. XENIOS will propose solutions for: i) providing comprehensive information to the competent site management bodies on time, and ii) supporting these bodies for issues related to managing the means and methods to protect both the visitors and the surrounding area from natural events and disasters.

Depending on the nature of the information, forecasts will be available in the form of clear maps, alerts or brief reports, through an online application and mobile app, which will be designed for this purpose according to user needs. The proposed combined platform that will host these services will function interactively throughout the risk management levels, from the local (cultural/tourist site) to the regional and national ones, by exchanging informational material, and real-time status reports and updates. To develop these services, selected satellite and meteorological data as well as field and aerial data, will be processed and analysed accordingly, in order to support the predictions in different spatial and temporal scales. The collaborating research and business bodies possess the required experience and know-how to ensure both timely planning as well as sound implementation of the services and final platform. Finally, all conditions for the commercial exploitation of the end results will be examined and studied in detail by drawing up a comprehensive business plan.

Website of the solution: https://xenios-project.eu/

Scope / Rational context

Relevant Thematic Working Group: SAR, Landscape Fires, Natural Hazard Mitigation	**TRL**: 7-8: System/Subsystem development

Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/xenios

1st cycle CCCs addressed

- ✓ Anticipate vulnerability, and communicate to the public (TOP CHALLENGE).
- ✓ Strategies choosing safe, resilient scenarios, and maintaining credibility.
- ✓ Provide an efficient, flexible flow of information for a shared understanding.
- ✓ Pre-plan a time-efficient, safe response, minimizing responder's engagement.
- ✓ Pre-plan interoperability and enhance synergies.

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

✓ Forecast and simulate complex scenarios.

2nd cycle CCCCs addressed *(added by WP3 leader)*

✓ Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …

✓ Identify points of coordination in the different zones: from local (hot zone, warm zone ...) to regional and to national. Establish different levels of liaison officers, translators; communication; entrance points; and infrastructures as needed.

✓ Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points…

✓ Base the prediction of scenarios on historical events and on statistics (baseline), including the modelling of the actual conditions (at local level) and human factors.

✓ Maintain situation awareness. Avoid the loss of information with shifts' changes.

✓ Be prepared to provide massive alerts to population.

Ideas and future developments *(from the side of the provider)*

Based on the operational and technical needs derived from the aforementioned study, a Business Process Model (BPM) has been developed that describes the way each system component is used while fulfilling those needs, respecting legal, ethical, and societal constraints. The BPM led to the use cases and the interconnected and interrelated components, also defining the methods, processes, interfaces, and flow of information between them. The high-level architecture and the services offered have been designed accordingly.

More specifically, the XENIOS system consists of the following early warning components: Fire Forecast System (FFS), Meteorological Risks (MRS), Fire Danger Forecast (FDF), and the Flood Danger Forecast System (FDFS). Interfacing with the tourists is achieved via the dedicated XENIOS Mobile Application (XMA), which provides visitors with useful information regarding points of interest and tours, in different languages, whereas in the case of an emergency it will act as the visitor's safe exit navigator, taking advantage of the incorporated emergency plans addressed to visitors.

XENIOS provides its own ticketing system but can also interoperate with existing ones for keeping count of visitors in the monitored areas. Moreover, it interoperates with UAVs using the UAV Support Request (USR) system and receives visitors' dispersion data along with live video footage from the area requested by its operators. XENIOS is enhanced with emergency plans (customized for each monitored area), it is accompanied by a VOIP subsystem, and it provides a fully functional operation center for crisis management, featuring call center capabilities, supporting visitors of the touristic attraction areas.

The above sophisticated and state-of-the-art subsystems are orchestrated by the XENIOS Core (XC), which utilizes other core components such as the Forecaster, the Alerter and the Reporter for managing requests and data handling in and out of the system, whereas the Web Services Provider and Communication Middleware (WSP) provide data feed from XENIOS to other legacy systems. The system's architecture follows a modular design, allowing other early warning or information components to be easily incorporated and feed information into the system as pluggable components.

All the research and development actions described above will be tested in two different touristic areas, the Samaria Gorge National Park and the Archaeological Park of Dion at the base of Mount Olympus in Greece. These tests will focus and address the fire and flood hazards, respectively, in close cooperation with the managing entities of each site. The pilot operations will provide the necessary feedback and evaluation, leading to a modular solution that will operate at all levels of risk management from local to regional, exchanging information and updating with status reports and real-time information.

Comments from the analysis *(added by WP3 leader)*

Solution in development in a collaborative project funded in Greece. Very high operational value and interoperability. It collects data from various sources and disseminates information to both tourists and the Authorities. Moreover, it will provide forecasts for potential natural threats and also alerts for the public via a obile application.

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Yellow. **Solution maturity**: Yellow. **Interoperability & standardization**: Green.

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

T20. Coordination Center for CIP – KEMEA

Solution Name: **Coordination Center for CIP**	**Solution provider:** **KEMEA**
Solution Type: Technological innovation	
Solution short description The national platform for national CIs and the under development information system aims at the systematic information of the Infrastructure operators for their level of risk after analysis of natural and technological risks and anthropogenic threats. In addition, infrastructure operators are requested to provide pilot reporting of emergency safety and security incidents exceeding the limits of their Infrastructure, through a secure online application, in order to inform the competent authorities and to contribute to the register of security incidents. The scientific elaboration of the latter, in collaboration with the Infrastructure and the operational bodies, is done for reasons of improvement of the infrastructure protection plan at national level. The Center and its operations are developed according to the standards of European CIWIN and ERNCIP.	
Website of the solution: http://www.ciprotection.gr/index.php/en/	
Scope / Rational context KE.ME.A. within its current Action and related activities in the field of Critical Infrastructure Protection is developing a pilot Coordination Center in its premises, following the supply of equipment and cut-edge GIS software. The main objective of the Center is the possibility of exchanging information among the crisis management agencies and first responders and the operators and managers of Critical Infrastructures in security-related topics.	
Relevant Thematic Working Group: Natural Hazard Mitigation	**TRL**: 7-8: System/Subsystem development
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/coordination-center-for-cip	
1st cycle CCCs addressed ✓ Provide an efficient, flexible flow of information for a shared understanding. ✓ Build a shared understanding of emergency and train interagency scenarios (TOP CHALLENGE).	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises. ✓ Once the standard roles of different actors have been trained and drilled inside each agency, organize multiagency joint trainings and exercises with the focus on decision-making, coordination and interactions between agents. Train in overlapped competences and limits of competences. Train the trainers of the different agencies. Share on-line training and exercises. ✓ Maintain situation awareness. Avoid the loss of information with shifts' changes.	
Ideas and future developments *(from the side of the provider)* One of the future developments is the real-time estimation of risk (natural and man-made) for certain infrastructures, the 3D photo-realistic imaging as well as the development of crowd-sourcing algorithms through the main core of the GIS.	
Comments from the analysis *(added by WP3 leader)* Still in development and testing with high interoperability between the various systems. Mainly built for critical infrastructures.	
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Yellow. **Solution maturity**: Yellow. **Interoperability & standardization**: Green.	

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

T21. Automatic Post Earthquake Damage Assessment – GEOSCIENCES

Solution Name: **Automatic Post Earthquake Damage Assessment**	**Solution provider:** **GEOSCIENCES**
Solution Type: Technological innovation	
Solution short description The algorithm is under development in its early stages. Image acquisition and data sharing through drone is nowadays a usual task. The aim of the project is to acquire pre- and post-earthquake images of an area, to compare them and evaluate the damage grade in building level or detect changes in the landscape for possible landslide phenomena. Drones could fly fast, take the image and sent it back to a command and control center. Besides, the simple image, an evaluation of the damage grade observed due to ground shaking, so first responders can compare it with other data and be better prepared. Drones and GIS is the heart behind the philosophy of this algorithm. Inputs and outputs of the algorithm will be on the most usual file formats for further editing. Keywords: GIS, Drones, damage grade, landslides, image analysis, machine learning, deep learning	
Website of the solution: https://www.geosciences.gr/	
Scope / Rational context The scope of this particular solution is the automatic post earthquake reliable damage assessment on buildings as well as the identification of probable changes in the landscape due to earthquake using drones.	
Relevant Thematic Working Group: Natural Hazard Mitigation	**TRL**: 1-2: Basic Technology Research
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/automatic-post-earthquake-damage-assessment	
1st cycle CCCs addressed ✓ Distribute decision-making (TOP CHALLENGE). ✓ Focus on sustainability of safe operations (TOP CHALLENGE). ✓ Information cycle. ✓ Get a clear picture of the risk evolution. ✓ Technological tools to support data sharing.	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Identify points of coordination in the different zones: from local (hot zone, warm zone ...) to regional and to national. Establish different levels of liaison officers, translators; communication; entrance points; and infrastructures as needed. ✓ Maintain situation awareness. Avoid the loss of information with shifts' changes.	
Ideas and future developments *(from the side of the provider)* The algorithm is under development, the ultimate goal is to make it operational and interoperable with the majority of systems that exist in the market.	
Comments from the analysis *(added by WP3 leader)* Promising solution with high interoperability potential, though the technology is in basic stages.	
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Red. **Solution maturity**: Red. **Interoperability & standardization**: Yellow.	

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

T22. Automatic Fire Damage Assessment – GEOSCIENCES

Solution Name: **Automatic FIRE DAMAGE ASSESSMENT**	**Solution provider:** **GEOSCIENCES**
Solution Type: Technological innovation	
Solution short description Estimate as fast as possible areas under fire danger. Identify possible routes of evacuation. Monitor for possible future direction of the fire.	
Website of the solution: https://www.geosciences.gr/	
Scope / Rational context Estimate as fast as possible the area under fire risk, identify starting points, monitor its evolution through the sky with low cost, identify possible areas of evacuation	
Relevant Thematic Working Group: Landscape Fires	**TRL**: 1-2: Basic Technology Research
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/automatic-fire-damage-assessment	
1st cycle CCCs addressed ✓ Distribute decision-making (TOP CHALLENGE). ✓ Focus on sustainability of safe operations (TOP CHALLENGE). ✓ Information cycle. ✓ Get a clear picture of the risk evolution. ✓ Technological tools to support data sharing.	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Identify points of coordination in the different zones: from local (hot zone, warm zone ...) to regional and to national. Establish different levels of liaison officers, translators; communication; entrance points; and infrastructures as needed. ✓ Maintain situation awareness. Avoid the loss of information with shifts' changes.	
Ideas and future developments *(from the side of the provider)* The algorithm is under development, the ultimate goal is to make it operational and interoperable with the majority of systems that exist in the market.	
Comments from the analysis *(added by WP3 leader)* Promising solution with high interoperability potential, though the technology is in basic stages.	
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Red. **Solution maturity**: Red. **Interoperability & standardization**: Yellow.	

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

T23. Air Logger - device and software that allows measurement of important moving drone parameters – CNBOP-PIB

Solution Name: **Air Logger - device and software that allows measurement of important moving drone parameters**	**Solution provider:** **CNBOP-PIB**
Solution Type: Technological innovation	
Solution short description The device is using many systems miniaturized into the cube (5x5x5cm). The cube is being mounted to the drone and the test begins. All parameters are transported via an encrypted radio link. The device was created by cooperation of 2 units (private firm and scientific unit CNBOP-PIB). The device is tailored to CNBOP needs and has been developing continuously.	
Website of the solution: Not provided by the user	
Scope / Rational context The device with the software is currently used to test drones that have their use in broadly scoped fire protection units. That means drones that are declared to be used in specific conditions like conditions that occur in the time of extinguishing and fire protection need to endure specific requirements (not obligatory right now) like proper velocity (that allows it for operational use), accuracy of telemetry, resist to wind blows, etc. All these parameters can be tested by presented equipment. Currently, we are working on a standard that will set specific rules that the drones need to fulfill.	
Relevant Thematic Working Group: Natural Hazard Mitigation	**TRL**: 9: System Test, Launch & Operations
Link in the FIRE-IN platform: https://fire-in.eu/fr/challenges-resources/validated-solutions/air-logger-device-and-software-that-allows-measurement-of-important-moving-drone-parameters	
1st cycle CCCs addressed ✓ Establish specific procedures and guides facilitating operativity.	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Adapt the legal framework and requirements on prevention and self-protection of infrastructures and activities to first responders' needs, lessons learned from past events... Plan the implementation of laws and plans. Adapt the regulations to emergency situations.	
Ideas and future developments *(from the side of the provider)* Developing taking into consideration is ongoing (changes that happened in the world of drones).	
Comments from the analysis *(added by WP3 leader)* Sensor for UAVs and drones for fire protection and records specific parameters of the drones. In addition, no specific information is provided regarding its availability on the market.	
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Yellow. **Solution maturity**: Green. **Interoperability & standardization**: Green.	

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

T24. Identification and tracking of UAV to safe and secure operational areas/zones – uspace.aero

Solution Name: **Identification and tracking of UAV to safe and secure operational areas/zones**	**Solution provider:** **uspace.aero**
Solution Type: Technological innovation	
Solution short description Unmanned Traffic Management (UTM) support designated to safely manage future congested U-space traffic. Research on WiFi and narrowband networks are promising and leads to develop UAV e-identification, localization and detect, sense and avoid technologies which are introduced as SESAR U-space key functions. It allows to detect drones that may violate the operational area, contamination zones - i.e. UAV operate by media, reporters, journalists. Moreover, solution may help to manage a local Unmanned Traffic Management form different uniformed services - fire fighters, police, medics. Keywords: UAV, Unmanned Traffic Management, drones, identification, hazards.	
Website of the solution: http://www.uspace.aero	
Scope / Rational context During operations, no foreign drones should fly nearby, which is why there is a need to detect drones (controlled by journalists, media, onlookers) that may disturb or impede the conduct of operational activities in zones of contamination, forest fires, collisions, landslides.	
Relevant Thematic Working Group: All TWGs	**TRL**: 5-6: Technology Development & Demonstration
Link in the FIRE-IN platform: https://fire-in.eu/fr/challenges-resources/validated-solutions/identification-and-tracking-of-uav-to-safe-and-secure-operational-areas-zones	
1st cycle CCCs addressed ✓Focus on sustainability of safe operations (TOP CHALLENGE). ✓Technological tools to support data sharing.	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓Maintain situation awareness. Avoid the loss of information with shifts' changes.	
Ideas and future developments *(from the side of the provider)* uspace.aero is a technical company focused on unmanned air traffic management. The company leads R&D activity into UTM solutions. Its activity focuses on UAV identification, localization and detect, sense & avoid issues and as an integration need the company implements aeronautical data sharing and processing for unmanned traffic management purposes. The team's engineers have solid aeronautical, electronic and IT experience with over 20 years of unmanned aerial systems development.	
Comments from the analysis *(added by WP3 leader)* Although at a premature level regarding TRL it has high operational value potential.	
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Yellow. **Solution maturity**: Red. **Interoperability & standardization**: Green.	

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

T25. Remote detection (from UAV) of potentially infected people – Codifive

Solution Name: **Remote detection (form UAV) of potentially infected people**	**Solution provider:** **Codifive**
Solution Type: Technological innovation	
Solution short description Software system (architecture, algorithms) in unmanned aerial vehicle sensors to: - detect people with higher temperature, - identification people in masks, with hidden face, - remote measurement of human temperature, - detecting clusters/groups of people, - disinfection of people suspected of being infected COVID19.	
Website of the solution: https://codifive.pl/	
Scope / Rational context In the current epidemiological situation, drones can help fight coronavirus. Drones equipped with thermal cameras are able to accurately measure the temperature and catch from the crowd of people with fever - automatically suspected of coronavirus infection. The recipients of technology can be uniformed services: police, city guard, army. In the event of a high risk of infection, the services will not risk knocking directly on the door, unless they are properly prepared.	
Relevant Thematic Working Group: SaR, CBRNe	**TRL**: 3-4: Research to prove Feasibility
Link in the FIRE-IN platform: https://fire-in.eu/fr/challenges-resources/validated-solutions/remote-detection-form-uav-of-potentially-infected-people	
1st cycle CCCs addressed *(added by WP3 leader)* ✓ Focus on sustainability of safe operations (TOP CHALLENGE). ✓ Establish specific procedures and guides facilitating operativity.	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Maintain situation awareness. Avoid the loss of information with shifts' changes. ✓ Adapt the legal framework and requirements on prevention and self-protection of infrastructures and activities to first responders' needs, lessons learned from past events... Plan the implementation of laws and plans. Adapt the regulations to emergency situations.	
Comments from the analysis *(added by WP3 leader)* High interoperability potential, though the technology is in basic stages.	
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Red. **Solution maturity**: Red. **Interoperability & standardization**: Yellow.	

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

T26. ENGAGE IMS/CAD (Incident Management & Computer Aided Dispatch) – Satways Ltd

Solution Name:	**Solution provider:**
ENGAGE IMS/CAD (Incident Management & Computer Aided Dispatch)	**Satways Ltd**

Solution Type: Technological innovation

Solution short description

ENGAGE is designed for operational use by professional organizations employing mobile resources, such as Police, Fire Departments, Rescue Services, Emergency services, Security Departments etc. ENGAGE is designed to support multi-Agency deployments permitting: a) Each Agency autonomous operation, b) Exchange of information and operational picture among Agencies and Collaborative response in cases of crisis and Large economy of scale

Based on a highly modular and reconfigurable S/W platform and a reliable, distributed Event Driven architecture, ENGAGE supports comprehensive incident control and dispatching for Public Safety offering an unmatched combination of speed, reliability, and features adaptive to highly complex communication environments.

The modularity and expandability of ENGAGE permits:

- To adapt the final solution to the exact user requirements in a cost and time efficient way
- To enable customers to incrementally upgrade to high end system
- To ensure the final outcome of Multi-phase projects (e.g. Security Coordination Centers)
- To permit independency from vendor S/W, hardware and sensor technologies

Next Generation Emergency Call systems is about managing data (IP voice, text, pictures, video). Building upon ENGAGE's proven emergency call taking and incident data management platform, personnel can take actions through the real-time exchange of incoming and historical information.

Website of the solution: https://www.satways.net/products-sw/engage-ims-cad/

Scope / Rational context

The ENGAGE IMS/CAD constitutes an integrated Call-Center solution for public safety organizations providing all the tools for call & incident management, computer aided dispatch, operational resource management and disparate crucial information data integration. Combining advanced searching; filtering in current and historical data and geo-correlation of data operations are enhanced with situational awareness, decision support and electronic logging of incident information and related actions of the involved organizations.

ENGAGE IMS/CAD is currently in use by the Hellenic Fire Service at National Scale.

Relevant Thematic Working Group: All TWGs	**TRL**: 9: System Test, Launch & Operations

Link in the FIRE-IN platform: https://fire-in.eu/fr/challenges-resources/validated-solutions/engage-ims-cad-incident-management-computer-aided-dispatch

1st cycle CCCs addressed

✓Distribute decision-making (TOP CHALLENGE).
✓Define common information management processes between agencies.
✓Manage key information focused on decision-making.
✓Provide an efficient, flexible flow of information for a shared understanding.
✓Build a shared understanding of emergency and train interagency scenarios (TOP CHALLENGE).
✓Pre-plan interoperability and enhance synergies.
✓Establish an interagency framework.
✓Get a clear picture of the risk evolution.
✓Technological tools to support data sharing.

2nd cycle CCCCs addressed *(added by WP3 leader)*

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

✓ Identify points of coordination in the different zones: from local (hot zone, warm zone ...) to regional and to national. Establish different levels of liaison officers, translators; communication; entrance points; and infrastructures as needed. ✓ Once the standard roles of different actors have been trained and drilled inside each agency, organize multiagency joint trainings and exercises with the focus on decision-making, coordination and interactions between agents. Train in overlapped competences and limits of competences. Train the trainers of the different agencies. Share on-line training and exercises. ✓ Adapt the legal framework and requirements on prevention and self-protection of infrastructures and activities to first responders' needs, lessons learned from past events... Plan the implementation of laws and plans. Adapt the regulations to emergency situations.
Ideas and future developments *(from the side of the provider)* Augmented Reality capability. Rich client & Pure Web solution capability.
Comments from the analysis *(added by WP3 leader)* Already in the market. **In operational use from the Hellenic Fire Service in a National scale**.
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Green. **Solution maturity**: Green. **Interoperability & standardization**: Green.

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

T27. G-Sense - Earthquake Rapid Damage Assessment for Buildings – Satways Ltd

Solution Name: **G-Sense - Earthquake Rapid Damage Assessment for Buildings**	**Solution provider:** **Satways Ltd**
Solution Type: Technological innovation	
Solution short description Satways Ltd recently developed the G-sense system comprising of a network of sensor nodes installed in different floors of a building measuring acceleration. The nodes include a low noise MEMS tri-axial accelerometer, a 16bit ADC, a power control (UPS) unit, an integrated processing unit enabling on-board processing, GPS option for time synchronization and a gateway (mini PC) for real-time data acquisition, analysis and archiving. The gateway is calculating damage probabilities for every floor following an earthquake event and sends damage alerts to a central command and control software that monitors all G-sense installations in different buildings, the nodes state of health and change the nodes and gateway configuration remotely when required.	
Website of the solution: https://www.satways.net/products-hw/motus-16-sm/	
Scope / Rational context G-Sense is a rapid damage assessment of buildings based on the new low cost accelerograph that can be installation in different floors of buildings. Just after an earthquake the system automatically estimates the probability of damages for every instrumented building and the damage data are collected in a central C2 s/w where the probable damages are visualized and response is prioritized. Currently deployed in a number of public buildings (schools and hospitals) in Greece.	
Relevant Thematic Working Group: SAR, Natural Hazard Mitigation	**TRL**: 9: System Test, Launch & Operations
Link in the FIRE-IN platform: https://fire-in.eu/fr/challenges-resources/validated-solutions/g-sense-earthquake-rapid-damage-assessment-for-buildings	
1st cycle CCCs addressed ✓Develop public self-protection to minimize responders exposures (TOP CHALLENGE). ✓Distribute decision-making (TOP CHALLENGE). ✓Focus on sustainability of safe operations (TOP CHALLENGE). ✓Strategies choosing safe, resilient scenarios, and maintaining credibility. ✓Information cycle. ✓Manage key information focused on decision-making. ✓Focus on capacity building towards more resilient societies. ✓Organizational learning focusing efforts in key risks and opportunities (TOP CHALLENGE). ✓Focus on governance and capacity building towards more resilient societies. ✓Pre-plan a time-efficient, safe response, minimizing responder's engagement. ✓Pre-plan interoperability and enhance synergies. ✓Establish specific procedures and guides facilitating operativity. ✓Forecast and simulate complex scenarios. ✓Get a clear picture of the risk evolution.	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits … ✓Identify points of coordination in the different zones: from local (hot zone, warm zone ...) to regional and to national. Establish different levels of liaison officers, translators; communication; entrance points; and infrastructures as needed. ✓Maintain situation awareness. Avoid the loss of information with shifts' changes.	

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

✓Adapt the legal framework and requirements on prevention and self-protection of infrastructures and activities to first responders' needs, lessons learned from past events... Plan the implementation of laws and plans. Adapt the regulations to emergency situations. ✓Towards a complete cycle of knowledge. Adjust Standard Operational Procedures (SOPs), doctrine and pre-plans using the feedback from real incidents and from exercises testing them (evaluators, assessors, statistics…) and identify the main gaps to focus efforts in training, procedures, personnel and equipment. Evidence based on fire scenarios. The process learning of an organization goes through the identification of own 'best practices' and the external ones: • to collect experiences and convert them into guides, • to collect 'lessons learned' and transform the best points into protocols, • to share experiences with the aim of generating standards.
Ideas and future developments *(from the side of the provider)* Lower cost and smaller accelerometer with better dynamic range (24bit) and better sensor sensitivity.
Comments from the analysis *(added by WP3 leader)* A low cost, smaller size of satisfying level of sensitivity and data logging. Ready-to-use and install with many applications that provide fast, real time and reliable measurements. Already available for purchase in the market and **installed in critical infrastructures**.
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Green. **Solution maturity**: Green. **Interoperability & standardization**: Green.

This project has received funding from the European Union's Horizon 2020 Coordination and Support Action programme under grant agreement No 740575.

T28. Dronesbench – CNBOP-PIB

Solution Name: **Dronesbench**	**Solution provider:** **CNBOP-PIB**
Solution Type: Technological innovation	
Solution short description The devices have a platform where drones are put and tied with plastic protections that immobilize the drone. The safe location of the drone allows you to test thrust, the center of mass, power consumption and battery capacity. The substitution of these parameters to the appropriate equations allows for example the drone's operational time to be calculated.	
Website of the solution: Not provided by the user	
Scope / Rational context The device with the software is currently used to test drones that have their use in broadly scoped fire protection units. That means drones that are declared to be used in specific conditions (it refers only to static ones such as mass, center of gravity and not dynamic such as velocity, slope to the ground, capacity of the battery, time of flight). Static parameters can be tested by presented equipment and they are very important for interoperability because they have a big impact for planning a scenario, mission. Currently, we are working on a standard that will set specific rules that the drones need to fulfill.	
Relevant Thematic Working Group: All TWGs	**TRL**: 9: System Test, Launch & Operations
Link in the FIRE-IN platform: https://fire-in.eu/fr/challenges-resources/validated-solutions/dronesbench	
1st cycle CCCs addressed ✓ Establish specific procedures and guides facilitating operativity.	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓ Adapt the legal framework and requirements on prevention and self-protection of infrastructures and activities to first responders' needs, lessons learned from past events... Plan the implementation of laws and plans. Adapt the regulations to emergency situations.	
Ideas and future developments *(from the side of the provider)* The device was created by cooperation of 2 units (private firm and scientific unit CNBOP-PIB). The device is tailored to CNBOP needs and is being developed continuously.	
Comments from the analysis *(added by WP3 leader)* Available for customizing neds. Further developments take place. Not in operational use.	
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Yellow. **Solution maturity**: Green. **Interoperability & standardization**: Green.	

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T29. Custom drone to measure level of explosive gases like methane – CNBOP-PIB

Solution Name: **Custom drone to measure level of explosive gases like methan**	**Solution provider:** **CNBOP-PIB**
Solution Type: Technological innovation	
Solution short description The drone is electrical safe - it means that no spark would come out of the whole mechanism (drone and measuring device) during the flight. Tests are made in order to be safely used in explosives zones. It measures gases and sends parameters in real time to server installed in CNBOP-PIB premises.	
Website of the solution: Not provided by the user	
Scope / Rational context We have made a custom drone with unique gases measuring system.	
Relevant Thematic Working Group: All TWGs	**TRL**: 7-8: System/Subsystem development
Link in the FIRE-IN platform: https://fire-in.eu/fr/challenges-resources/validated-solutions/custom-dron-to-measure-level-of-explosis-gases-like-methan	
1st cycle CCCs addressed *(added by WP3 leader)* ✓Use technology to assess risks and minimize responder's engagement (TOP CHALLENGE). ✓Get a clear picture of the risk evolution. ✓Focus on sustainability of safe operations (TOP CHALLENGE).	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓Maintain situation awareness. Avoid the loss of information with shifts' changes. ✓Technology.	
Ideas and future developments (from the side of the provider) It has been still developing to maintain allowance to flight in explosives zones.	
Comments from the analysis *(added by WP3 leader)* Extremely promising and useful for first responders, especially in CBRNe events. Not fully ready, developments are still on the way. Not for operational use at the time.	
Traffic Light System Analysis *(added by WP3 leader)* **Operational value**: Yellow. **Solution maturity**: Yellow. **Interoperability & standardization**: Green.	

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T30. Assistant Volunteer – Nable Solutions

Solution Name: **Assistant Volunteer**	**Solution provider:** **Nable Solutions**
Solution Type: Technological innovation	
Solution short description Voluntary organizations need a reliable and efficient way to screen, match and certify volunteers for actions, and a trustworthy and secure channel for vulnerable citizens to ask for help. “Assistant Volunteer”, is a platform aiming to assist organizations and government programs manage volunteering. “Assistant Volunteer” will be a digital assistant, a communication channel that will connect vulnerable citizens with voluntary organizations and local government programs so that citizens can request assistance via a user-friendly and trustworthy solution. The centralized coordination (organization, government etc.) will ensure the integrity of the service. The solution can be configured to support organizations of all types and sizes to achieve modernization and upgrade of the operations, seamlessly with their workflow. The “Assistant Volunteer” will help voluntary organizations become more flexible by providing them with the tools to recruit, train, organize, coordinate and supervise volunteers. This will allow organizations to optimize services and streamline communications, reducing workload and increasing efficiency. With the “Assistant Volunteer” it is easy to not just manage the volunteers, but effectively engage them and dedicate more time to making a difference. “Assistant Volunteer” is a solution that helps voluntary organizations and governments to harness the power of volunteers to deal with the COVID-19 crisis and afterwards. “Assistant Volunteer” consists of three (3) parts that work together in order to meet the expectations of all involved parties. The Central Automated Management System (Cloud SaaS Platform), the Web Apps (web apps for registry & missions) and the Mobile Apps (mobile apps for volunteers & citizens). “Assistant Volunteer” is designed by Modular Architecture allowing to replace or add any component (module) without affecting the rest of the system. This enables to consistently improve the solution and it leads to higher quality. “Assistant Volunteer” will include a central registry of volunteers and a dynamic management system of volunteers and missions. Through the solution, volunteers would be able to sign up on missions while organizations would be able to optimize services and streamline communications by providing them with the tools to recruit, organize, coordinate and supervise volunteers remotely. The missions are either automatically created and entered in the system following the citizens’ requests or are created by the organization and assigned to the volunteers. The Assistant Volunteer will provide real time information to the users. Finally, “Assistant Volunteer” will also collect data (analytics), which will facilitate the evaluation of volunteers and actions, optimizing processes, increasing efficiency, providing valuable data to organizations.	
Website of the solution: https://assistant.nable.gr	
Scope / Rational context “Assistant Volunteer” is a SaaS platform aiming to the management and coordination of volunteers by organizations, to create and administrate actions and effectively respond to the assistance requests of citizens in need! Volunteering is an extremely effective and beneficial way to empower society, especially in difficult times like this. Also, it supports the increased operational needs of organizations at times such as this pandemic.	
Relevant Thematic Working Group: SAR	**TRL**: 9: System Test, Launch & Operations
Link in the FIRE-IN platform: https://fire-in.eu/challenges-resources/validated-solutions/assistant-volunteer	
1st cycle CCCs addressed ✓Involve communities in preparing population for the worst scenario before it happens (TOP CHALLENGE).	
2nd cycle CCCCs addressed *(added by WP3 leader)* ✓Change of paradigm. From ’We, authorities, will protect you’ to ‘You, citizen, should be actively involved’. These affirmations mean that you should be prepared to be self-sufficient concerning to your own	

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protection and your community protection always inside the framework of the emergency. Be used to this sort of situations normalizing them. ✓Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises.
Comments from the analysis *(added by WP3 leader)* A highly interoperable technological innovation, that not only connects vulnerable citizens with voluntary organizations and government programmes, but also enables the organizations to train, coordinate and supervise volunteers. Moreover, via this innovation, the government programmes and organizations will be provided with suitable tools and applications for the registration and supervision of volunteers, while they are operating in missions, according to the citizens' needs. The application seems to be in a pilot level and have been tested in an operational level yet. Based on the information provided by the supplier, it is also on a level before entering the market and be properly tested.
Traffic Light System analysis *(added by WP3 leader)* **Operational Value**: Yellow. **Solution maturity**: Yellow. **Interoperability & Standardisation**: Green

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5. Conclusions

This chapter presents the main conclusions of the RfI procedure and how the CCCs identified in WP1 are addressed with existing solutions or not, and therefore it gives the justification for new research on topics to be described in the Strategic Research and Innovation Agenda.
Nevertheless, it is important at this stage to notice and emphasize that the method developed and implemented in FIRE-IN as well as the tools such as the FIRE-IN e-platform are effective to support practitioner oriented identification of solutions and research programming. It was not obvious at the beginning of the project; now, at mid-term of the project, we can be reassured that the process works well, fulfil the objectives of the project and will be further improved with the 3rd cycle.

5.1. Coverage level of CCCs

The discrete analysis of the 50 solutions submitted in the e-platform (Table 15) and the solutions screened in WP2 (Table 6), especially for the category of "Technological solutions" had the purpose of presenting the various steps of the project to the reader in a understandable and comprehensive way and to merge the findings in a single table. The merged results for the 2nd cycle of the prioritized CCCs are presented in Table 16. CCC2 "Technology" and CCC10 "Standards" are omitted on purpose from Table 16, as the most generic CCCs. After all, Table 16 is related only to technologies and practically speaking, CCC2 includes the whole range of technologies screened and analysed (submitted in the FIRE-IN e-platform and analysed in WP2). In Table 16, each CCC has been color coded according to the approach presented below.

Table 16. Overall coverage level for technologies of the prioritised CCCs of the 2nd cycle considering both the solutions screened in D2.3 and the solutions submitted in the e-platform after the "Request for Ideas" and analysed herein.

CCC A/A	CCCs 2nd Cycle	Cumulative solutions (WP3 and e-platform	Criteria	Green	Yellow	Red
1	Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …	38	Operational Value	27	11	
			Solution Maturity	35	3	
			Interoperability & Standards	18	13	7
3	Change of paradigm. From 'We, authorities, will protect you' to 'You, citizen, should be actively involved'. These affirmations mean that you should be prepared to be self-sufficient concerning to your own protection and your community protection always inside the framework of the emergency. Be used to this sort of situations normalizing them.	35	Operational Value	23	12	
			Solution Maturity	31	4	
			Interoperability & Standards	14	13	8

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CCC A/A	CCCs 2nd Cycle	Cumulative solutions (WP3 and e-platform	Criteria	Green	Yellow	Red
4	Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises.	40	Operational Value	30	10	
			Solution Maturity	35	5	
			Interoperability & Standards	26	13	1
5	Once the standard roles of different actors have been trained and drilled inside each agency, organize multiagency joint trainings and exercises with the focus on decision-making, coordination and interactions between agents. Train in overlapped competences and limits of competences. Train the trainers of the different agencies. Share on-line training and exercises.	53	Operational Value	42	11	
			Solution Maturity	48	5	
			Interoperability & Standards	29	22	2
6	Identify points of coordination in the different zones: from local (hot zone, warm zone ...) to regional and to national. Establish different levels of liaison officers, translators; communication; entrance points; and infrastructures as needed.	55	Operational Value	49	3	3
			Solution Maturity	48	4	3
			Interoperability & Standards	51	3	1
7	Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points…	92	Operational Value	81	9	2
			Solution Maturity	81	9	2
			Interoperability & Standards	81	9	2
8	Base the prediction of scenarios on historical events and on statistics (baseline), including the modelling of the actual conditions (at local level) and human factors.	57	Operational Value	48	9	
			Solution Maturity	51	6	
			Interoperability & Standards	39	18	
9	Maintain situation awareness. Avoid the loss of information with shifts' changes.	90	Operational Value	76	8	6
			Solution Maturity	75	8	7
			Interoperability & Standards	79	9	2
11	Towards a complete cycle of knowledge. Adjust Standard Operational Procedures (SOPs), doctrine and pre-plans using the feedback from real incidents and from exercises testing them (evaluators, assessors, statistics…) and identify the main gaps to focus efforts in training, procedures, personnel and equipment. Evidence based on fire scenarios. The process learning of an organization goes through the identification of own 'best practices' and the external ones: • to collect experiences and convert them into guides, • to collect 'lessons learned' and transform the best points into protocols, • to share experiences with the aim of generating standards.	26	Operational Value	21	5	
			Solution Maturity	26		
			Interoperability & Standards	17	9	

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CCC A/A	CCCs 2nd Cycle	Cumulative solutions (WP3 and e-platform	Criteria	Green	Yellow	Red
12	Be prepared to provide massive alerts to population	38	Operational Value	37	1	
			Solution Maturity	37	1	
			Interoperability & Standards	20	14	4

The main outcomes from the analysis of TECHNOLOGICAL SOLUTIONS (the ones submitted in the FIRE-IN e-platform and solutions analysed from WP2) of the present deliverable regarding the level of coverage of the capabilities and consequently the related prioritized CCCs during the 2nd cycle are the following:

- For the capability "Incident Command Organisation", which is related to the prioritized CCC6, CCC7 and CCC9, all three CCCs are well covered. According to the traffic light system this capability can be marked as "Green" with numerous technological solutions, the majority of them already on the market and in operational use. As technological tools, most of them cover certain technological standards and have a high degree of interoperability.
- For the capability "Knowledge Cycle", which is related to the prioritized CCC5 and CCC11, both CCCs are covered in a satisfying way and the capability is close to be characterized as well-covered. Based on the traffic light system and the empirical approach followed, this capability is marginally marked as "Yellow" mainly because a significant number of solutions, which in some cases is over 40% over the total sum of the category, lies in "Yellow" level.
- For the capability "Pre-planning", it is estimated that several tools exist and the overall coverage level can be marked as "Green".
- For the capability of "Community Involvement" which is the most important for first responders, the overall level of coverage can be marked as "Yellow" according to the traffic light system. Despite the fact that the number of technologies is not small but at least adequate, there are several technological solutions marked as "Red" and a significant number marked as "Yellow". At the same time, it is not that easy to characterize in a straightforward and reliable way the criterion of "interoperability and standards". Nevertheless, this capability is one of the most interesting for the technological sector as every day new applications and technologies arise that target directly or are directly related to the community and the general public. Our strong belief is that within the next 5 years the "Community Involvement" will become "Green" as it is already for the "Incident Command Organisation".
- The capability of "Information management" seems to be marked as "Yellow", mainly because the number of solutions is small even with the 1st cycle classification of CCCs. Certain challenges could be marked as "Green", as they could be a part of the "Incident Command organization".
- The capability of "Technology" overall, by having all the other capabilities together is on the safe side and marked as "Green". It is characteristic that technologies exist for all the capabilities and CCCs of both cycles and even in cases that a CCC may be left blank, (e.g. Table 11), a closer look of the description of the CCC and of a technological solutions that covers a similar CCC may work for that CCC also. Technological solutions that currently exist in the market cover a broad spectrum of

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needs and challenges and the issue is how these are used from the first responders and practitioners.

- The above-mentioned comments are also valid for the total CCCs (27) of the 1st cycle as the link between the two cycles exist and the 2nd cycle was more or less a prioritization of them.

Regarding research items and publications, the number of submitted solutions in the e-platform is not adequate enough to lead to concrete conclusions. From the results of Deliverable D2.3 (WP2), it was derived that many research items for the "Community Involvement" capability, as well as for "Pre-planning" and "Incident Command Organisation" exist. Usually, technology follows research and in some cases these two capabilities pave parallel ways.

The biggest issue that will be relevant for the next years is the issue of "Standardisation". Research paves the way, technology follows or goes in parallel with research, while at the same time leads to the definition of specifications and standards for the final products, so that they can be interoperable and compatible with other products following recognized procedures, identified by optimization of practices.

Standards from Deliverable D3.5 are classified into Professional standards and Formal Standards. Formal standards are the well-known ISO or CEN. Professional standards are standards and guidelines issued by various organizations for the practitioners and could be general guidelines that are best practices for them or a good way for the first practitioners to do their job. If we accept the fact that guidelines and standard operating procedures do exist, along with some formal standards and technological formal and professional standards, then the answer is that standards are a capability that is somehow already covered. But the problem still exists. The following questions arise:

- Who is responsible to check the standard operating procedures?
- Procedures followed are the same for everyone inside the nation or these procedures can differ by region, county or state?
- Are these procedures and guidelines accepted and followed internationally when cooperation is needed?
- Have the procedures and professional standards been integrated officially to the laws and the regulatory aspect?
- Can the professional standards be integrated with any transformation to the technologies that appear on the market?
- Are these professional standards or can they truly become formal standards?
- If professional standards become formal standards, will first responders and practitioners have access to them?

Based on the analysis that was carried out, even if it was focused on technologies, some standardization procedures do occur and it is estimated that the level of coverage of prioritized CCC10 is "Yellow" and further development is necessary. However, a possible argument is that the current formal standards are minimum and do not cover all the aspects that FIRE-IN deals with and therefore the overall level is "Red". The number of solutions that could be classified as standards was not high, only 12 (24% of the 50 solutions) and practically these solutions were professional standards or some good practices. From the technological solutions only six (6) of them directly pointed out the priority challenge CCC10 of the 2nd cycle. Internationality of guidelines and standard operating procedures has been also revealed from D2.3. Overall, "Standardisation" as a capability with its discrete CCCs is a wide field for the future.

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All the above are summarized in Table 17 in the form of the matrix from the 1st cycle with relevant color-coding. This table refers mainly to technological solutions. For guidelines and standards this table can also be valid without significant differences. In terms of research a significant difference is the fact that the "Community Involvement" should lie on the "Green" level.

Table 17. CCCs matrix of the 1st cycle in terms of level of coverage mainly for the technological solutions.

	High Flow of effort in hostile environment	**Low frequency, high impact events**	**Multi-agency/multi-leadership environment**	**High level of uncertainty**
Incident Command Organization	Focus on sustainability of safe operations	Prioritize the reduction of vulnerability and increase interactions with the public. **Sendai 7, 19, 33**	Distribute decision-making	Strategies choosing safe scenarios, and maintaining credibility
Pre-planning	Pre-plan a time efficient, safe response. **Sendai 6, 8, 19, 24, 27, 33, 34**	Negotiate solutions with stakeholders for anticipated scenarios. **Sendai 6, 7, 19, 24, 27, 33**	Plan interoperability and enhance synergies. **Sendai 8, 19, 34**	Focus on governance and capacity building towards more resilient societies. **Sendai 7, 24, 33**
Guidance instruments	Establish procedures and guides. **Sendai 34**	Standardize capabilities in front of pre-established scenarios. **Sendai 34**	Establish an interagency framework. **Sendai 8, 19, 34**	Build doctrine for resilience in emergency services and societies.
Knowledge Cycle	Train specific roles	Learn about possible scenarios focusing efforts in key risks and opportunities. **Sendai 24.**	Build a shared understanding of emergency and train interagency scenarios. **Sendai 8, 19, 24, 33, 34.**	Focus on integral risk management. Sendai 33
Information management	Information cycle. **Sendai 24 IFAFRI 4**	Manage key information focused on decision-making **IFAFRI 4**	Define common information management processes between agencies. **Sendai 19, 24**	Provide an efficient, flexible flow of information for a shared understanding
Community Involvement	Develop public self-protection to minimize responders exposures **Sendai 27, 33**	Prepare population for the worst scenario before it happens. **Sendai 7, 24, 25, 33**		Cultural changes in risk tolerance and resilience **Sendai 7, 19, 24, 33**
Technology	Use technology to assess risks and minimize responder's engagement **IFAFRI 1, 2, 3**	Simulate complex scenarios **IFAFRI 4**	Technological tools to support data sharing	Get a clear picture of the risk evolution **IFAFRI 1**

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5.2. Recommendations and Future Ideas based on the analysis of the 2nd cycle

Based on the technological solutions screened and analysed during the 2nd cycle, including the ones submitted in the e-platform and presented herein, as well as the comments of the providers regarding the further development of their products in the future, ideas are summarized below. The following comments also considering the various scientific researches and market trends and are focused on the innovations that will dominate the future technologies for researchers, first responders and the general public. Some of them are already in use while others are on the rise. These technological ideas are presented in a keyword approach.

- **Real-time** and **Near Real-time applications** regarding **risk assessment** in all thematic fields of FIRE-IN will be a key development of existing technologies. Real-time information is crucial for the allocation of resources. Existing various tools (software and algorithms) provide real-time information, mainly on the hazad estimation of an imminent risk, such as weather data or ground shaking due to earthquakes. Weather data are updated frequently and provide in many cases rela-time information. For the case of earthquakes, real-time information is provided for the ground shaking. Future developments focus on the estimation/calculation of risk, not simply hazard, in just a few seconds or minutes after the occurrence of an event. **Damage assessment** (impacts) will be automated and rapid (within minutes) with the use of sophisticated software and hardware.
- **Early warning**, early detection, networks of **smart sensor** and **Internet of Things** (IoT) devices will be used more frequent. Early warning systems are already in use for various hazards/risks especially in the most developed societies. The trend is to make early warning systems widely used by various countries, regions and communities and to **provide accurate, faster and more reliable warnings**. The use of smart sensors, 4G and 5G will provide interoperable communications between various devices and fast data transmission speeds. IoT devices and smart sensors open communication channels directly between the devices and calculations and notifications will become faster.
- **Unmanned Aerial Vehicles**, **drones** and **autonomous robotic equipments** will be actively used for surveillance, monitoring and early detecion. They are already in use and in some cases with low cost. Many projects and applications are examining and exploiting their capabalities along with other software and algorithms. Existing solutions have proven their operational capacity and are used in the response phase. Their use will be enhanced in the next years, costs of purchase will be reduced and operational costs could significantly be reduced compared to traditional means of response.
- **Artificial Intelligence** (**AI**), **machine learning** and **deep learning** will be used more and more in software for the detection and monitoring of fires, explosives, gases, image recognition and other fields of FIRE-IN. Sophisticated algorithms are continuously evolving to read extended datasets from cameras and provide feedback to first responders along with other sensors. AI will be further used in various software and platforms for first responders.
- **Satellite technology** will be further used in all topics addressed by FIRE-IN, especially in the wildfire domain, weahter data and forecast as well as impact assessent and recognition of damaged areas.
- Information, command and control, notification services, improved forecast and other similar technologies will be available to **mobile devices** like smartphones and tablets. Already,

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technologies presented in the market provide **mobile versions suitable for tablets and mobile phones**. This will be a prerequisite in the future.

- **Augmented Reality (AR)** will be embedded in the every day operational mode of first responders. It will provide enhanced situational awareness, a better understanding of the operational environment to first responders, pracitioners, and potentially citizens.
- A **two-way communication** will be established from field to the command and control room and vice versa but more importantly, a two-way communication will be established between first responders (who are on the way to respond) and victims or threatened communities and vice versa through every day life devices, such as smartphones or smartwatches.
- **Crowdsourcing** will be higly engaged in response activities. They are already tested and some of them used under real conditions. Algorithms will be enhanced and the **public** through **social media** will be the key player to **situational awareness**.
- **Risk communication**: the way risk is communicated to the public will be of key interest. How to inform public is crucial. Communication should be designed with the aim of helping people to understand the nature of the risk they are exposed to and avoid panic that could be observed in endangered people. Ethical aspects, should also be considered.
- **Ethics** will be one of the main aspects for the future even in natural disasters. Ethics will also be incorporated to technology. What kind of information will be sent, to whom and what kind of information will be provided by the end user. Location, age, health and similar data that could be proved helpful in a search and rescue operation. From whom to whom, and why. How the information will be passed on to first responders.
- **Training of first responders to new technologies** will be a major topic. Various technologies exist, some of them have proven their capabilitis and some are being tested. All of them are on the rise. The key challenge will be the acceptance of use by the first responders. Training of first responders and practitioners to the new and emerging technologies is a part of significant importance in this process.
- **Training of general public and other stakeholders to new technologies** will also be a major topic. Similarly to first responders, the general public should be ready to filter and fully understand the input from the new technological features. Another key challenge for the future.
- Various software, such as CAD, GIS and other applications will be accessible through a simple **web browser**. Servers and software will be provided as a service. Data will be stored in the **cloud**. Maintenace costs for personal computers and serves will be reduced.
- The cost of purchase will be lower for various future sensors.
- **Procurement** costs and public procurement procedures (procurement, pre-procurement) will also be an issue of the future.
- **Interoperability** has already been raised and will continue to be an important issue. All new software should be interoperable with existing devices, mainly those supported by previous generation technologies.
- **Standardisation** has been followed in certain technological areas such as **communication protocols, data formats and other key core elements of technology**. **Formal and professional standards** will be followed more closely and will make the job of first responders easier.

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Finally, according to the experience gained so far from the two cycles, challenges marked as “yellow” will be of interest for the future. In addition, a straight comparison between research and technology, policy and strategic issues, training of first responders and the general public to new technologies, procurement of technologial innovations, costs, risk communication interoperability and standardisation apsects are of keyinterest for the future and should be cosnidered for the future capabilities. All the **aforementioned aspects** are food for thought and material that **will be further explored in the upcoming Standardisation Agenda and Policy briefs** and define pathways for the Future Common Capability Challenges.

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6. Appendix

6.1. Appendix A1 - 1st cycle CCCs matrix

Table 18. Common Capability Challenges / Sendai framework and IFAFRI. Sendai XX refers to articles of the Sendai framework and IFAFRI X refers to one of the four IFAFRI challenges. More information on CCCs of the 1st cycle can be found in Deliverable D1.2 of the FIRE-IN project. The CCCs are also accessible via the e-FIRE-IN platform (https://fire-in.eu/challenges-resources).

	High Flow of effort in hostile environment	**Low frequency, high impact events**	**Multi-agency/multi-leadership environment**	**High level of uncertainty**
Incident Command Organization	Focus on sustainability of safe operations	Prioritize the reduction of vulnerability and increase interactions with the public. **Sendai 7, 19, 33**	Distribute decision-making	Strategies choosing safe scenarios, and maintaining credibility
Pre-planning	Pre-plan a time efficient, safe response. **Sendai 6, 8, 19, 24, 27, 33, 34**	Negotiate solutions with stakeholders for anticipated scenarios. **Sendai 6, 7, 19, 24, 27, 33**	Plan interoperability and enhance synergies. **Sendai 8, 19, 34**	Focus on governance and capacity building towards more resilient societies. **Sendai 7, 24, 33**
Guidance instruments	Establish procedures and guides. **Sendai 34**	Standardize capabilities in front of pre-established scenarios. **Sendai 34**	Establish an interagency framework. **Sendai 8, 19, 34**	Build doctrine for resilience in emergency services and societies.
Knowledge Cycle	Train specific roles	Learn about possible scenarios focusing efforts in key risks and opportunities. **Sendai 24.**	Build a shared understanding of emergency and train interagency scenarios. **Sendai 8, 19, 24, 33, 34.**	Focus on integral risk management. Sendai 33
Information management	Information cycle. **Sendai 24 IFAFRI 4**	Manage key information focused on decision-making **IFAFRI 4**	Define common information management processes between agencies. **Sendai 19, 24**	Provide an efficient, flexible flow of information for a shared understanding
Community Involvement	Develop public self-protection to minimize responders exposures **Sendai 27, 33**	Prepare population for the worst scenario before it happens. **Sendai 7, 24, 25, 33**		Cultural changes in risk tolerance and resilience **Sendai 7, 19, 24, 33**
Technology	Use technology to assess risks and minimize responder's engagement **IFAFRI 1, 2, 3**	Simulate complex scenarios **IFAFRI 4**	Technological tools to support data sharing	Get a clear picture of the risk evolution **IFAFRI 1**

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6.2. Appendix A2 - 2nd cycle prioritized CCCs

Table 19. The list of prioritized concerns as it emerged from the cross analysis of capabilities and challenges during the 2nd cycle.

Nr	Description	Topic	Magnitude of importance for experts
1	Train/educate/inform general population starting from scratch and in a basic and easy way, about knowledge of risk and appropriate behaviours, specially targeting those more exposed and vulnerable. Address all phases of emergency and the different levels of risk. Provide tools to facilitate adequate decision-making: checklists, emergency kits …	Community involvement	13
2	Technologies used in interventions should be: • Useful. • Simple, intuitive and easy to use. • Easy to integrate and interoperable. • Easy to transport, deployable on field, light, with high autonomy. • Robust, resistant, long duration, able to tolerate severe/harsh conditions. • Open access. • Usable by people with disabilities	Technology	8
3	Change of paradigm. From 'We, authorities, will protect you' to 'You, citizen, should be actively involved'. These affirmations mean that you should be prepared to be self-sufficient concerning to your own protection and your community protection always inside the framework of the emergency. Be used to this sort of situations normalizing them.	Community involvement	7
4	Build trust involving communities and key stakeholders in risk management permanently: from risk awareness to the preparation of scenarios, to the decisions and behaviour during the emergency, to verifications, to drills and exercises.	Community involvement	7
5	Once the standard roles of different actors have been trained and drilled inside each agency, organize multiagency joint trainings and exercises with the focus on decision-making, coordination and interactions between agents. Train in overlapped competences and limits of competences. Train the trainers of the different agencies. Share on-line training and exercises.	Knowledge cycle	7
6	Identify points of coordination in the different zones: from local (hot zone, warm zone ...) to regional and to national. Establish different levels of liaison officers, translators; communication; entrance points; and infrastructures as needed.	Incident Command Organization	6
7	Prioritise response and resources allocation to avoid the collapse of the emergency response system: triage, build alternative scenario, identify trigger points…	Incident Command Organization	5
8	Base the prediction of scenarios on historical events and on statistics (baseline), including the modelling of the actual conditions (at local level) and human factors.	Pre-planning	4
9	Maintain situation awareness. Avoid the loss of information with shifts' changes.	Incident Command Organization	4

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Nr	Description	Topic	Magnitude of importance for experts
10	Adapt the legal framework and requirements on prevention and self-protection of infrastructures and activities to first responders' needs, lessons learned from past events... Plan the implementation of laws and plans. Adapt the regulations to emergency situations.	Guidance instruments and standards	3
11	Towards a complete cycle of knowledge. Adjust Standard Operational Procedures (SOPs), doctrine and pre-plans using the feedback from real incidents and from exercises testing them (evaluators, assessors, statistics…) and identify the main gaps to focus efforts in training, procedures, personnel and equipment. Evidence based on fire scenarios. The process learning of an organization goes through the identification of own 'best practices' and the external ones: • to collect experiences and convert them into guides, • to collect 'lessons learned' and transform the best points into protocols, • to share experiences with the aim of generating standards.	Knowledge cycle	3
12	Be prepared to provide massive alerts to population	Community involvement	3

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6.3. Appendix A3 - Revised Invitation letter to stakeholders

The creation of the e-FIRE-IN platform and the experience gained from the 1st cycle lead to the development of a new invitation letter slightly improved than the one of the 1st cycle, now exploiting the operation of the e-platform. Without any doubt the invitation letter sent to the potential stakeholders is based on the one proposed in Deliverable D3.1. In addition, the invitation letter was accompanied by a descriptive e-mail body text which provided guidance to the potential stakeholders on how to register in the e-platform and how to submit a solution based on their profile. The e-mail body text and the invitation letters are provided as follows.

E-mail Subject: Invitation to the FIRE-IN project as solution provider
E-mail Body text:
Dear ……,

The **Center for Security Studies (KEMEA, www.kemea.gr),** the research center of the Hellenic Ministry of Citizen Protection that supports security policy implementations in Greece at a strategic level, is actively involved in the implementation of numerous European and National research projects and participates in numerous European associations.

One of the ongoing projects, in which KEMEA participates, is the **FIRE-IN project** (https://fire-in.eu), the first European Fire and Rescue Innovation Network with the ultimate objective to raise the security level of the EU citizens by improving the Fire & Rescue services capabilities to address various forms of hazards, natural or manmade. FIRE-IN project aims to bring together Fire & Rescue experts, technological solutions providers and researchers in order to create a pan-European network of stakeholders for identifying and harmonizing operational capability gaps and sharing the knowledge on best practices, existing technological solutions as well as future ideas and available solutions. The common ground for this networking actions is the FIRE-IN unique collaborative on-line **platform** which is now operational.

In this context, as Leaders of the **Work Package 3 "Collaboration with research, industry and standardization bodies and recommendations"**, we welcome relevant ideas and existing solutions, both from private companies and research institutes. I hereby enclose the invitation to participate in the FIRE-IN project as solution provider in any of the following five Thematic Working Groups:

A. Search & Rescue and Emergency Response
B. Structure Fires
C. Landscape Fires – Crisis Mitigation
D. Natural Hazard Mitigation
E. CBRNE

Please note that by becoming a member of the **FIRE-IN project network** you will also have the chance to interact with practitioners and experts in your domain across Europe.

In order for you to submit a technological idea, existing or future solution, you need to **register** first to the e-platform (https://fire-in.eu/en/register?).

For submitting an **idea** or **solution**:

- **Private Companies** please login here
- **Research Institutes** please login here
- Any **other type of organization** please login here
- Decision makers, public organisations, civil protection please login here

For further information and clarifications, please contact any of the following persons:
Dr. Georgios Sakkas: g.sakkas@kemea-research.gr
Dr. Chrysoula Papathanasiou: c.papathanasiou@kemea-research.gr
Ms Danai Kazantzidou-Firtinidou: d.kazantzidou@kemea-research.gr

Looking forward to hearing from you.

Yours Sincerely,
Dr. G. Sakkas
On behalf of the FIRE-IN consortium

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KEMEA (Center for Security studies) / FIRE-IN partner
4, P. Kanellopoulou str., Athens GR-101 77, Greece
Contact person: Dr Georgios Sakkas
Email: g.sakkas@kemea-research.gr
Tel: +30 210 7710805 (ext. 402)

Athens, February 26, 2020

Subject: Invitation to act as a solution provider to the FIRE-IN project

Dear Sir/Madam,

In the field of ***Fire & Rescue and Emergency Management***, as in most European security research and innovation domains, the successful operational uptake of the outcomes suffers from limited participation of practitioners to the research activities. This is mainly due to fact that practitioners have only limited, if at all, means to attend research activities on top of their daily operations. Moreover, no central source of information exists to summarise the fragmented results out of the various R&D programs and initiatives on national and European level. Such condition narrows down the opportunity for many practitioners in the Fire & Rescue community from learning more about existing solutions or best practices in their domain.

To this end, FIRE-IN builds on a significant and heterogeneous ***pan-European network of practitioners for identifying and harmonizing operational capability gaps*** in a central process to create a more demand driven approach for future R&D and standardisation programs. In addition, FIRE-IN aims at ***sharing the knowledge on best practices and already available solutions*** in the field of Fire & Rescue and Emergency Management. Further information on the FIRE-IN project is available in the attached leaflet and at the official FIRE-IN website.

In such framework, the FIRE-IN consortium is glad to ***invite you to join the project as a solution provider*** to contribute to the identification of existing solutions as well as to definition of the priorities for research. Indeed, FIRE-IN consortium intends to consult solution providers from research and technology organisations, industry and industry associations, from national and European standardization bodies and policy-makers at national and European level.

The expected contributions will be materialized with the interactions during workshops and meetings organized by the FIRE-IN project, or contributions to online survey.

With this letter, we would like to invite you to actively participate in the activities of the project by registering and submitting future ideas and existing solutions in the FIRE-IN e-platform.

Yours sincerely,

On behalf of the FIRE-IN consortium

Dr. Georgios Sakkas

Project Manager Jean-Michel Dumaz	Jean-michel.dumaz@safecluster.com	Facebook, Twitter: @FIREINproject LinkedIn : fireinproject	http://fire-in.eu

6.4. Appendix A4 - List of organisations/providers who submitted a solution

In Table 20 a short profile of the organizations submitted at least one solution.

Table 20. Short profile of the solutions providers.

Provider name	Short profile	Publications	Best Practices	Technological Innovations	Provider type
Associated Programme on flood management (https://www.floodmanagement.info/)	The vision of the programme is, countries to implement Integrated Flood Management and, thus, enhance their prosperity and sustainable development. Its mission is to support countries in the implementation of Integrated Flood Management (IFM) within the overall framework of Integrated Water Resources Management (IWRM) to maximize net benefits from the use of their floodplains and minimize loss of life and impacts. APFM's key strategic goals are: • To assist countries, regions and communities in the implementation of IFM • To collect and disseminate knowledge on IFM • To advocate for IFM • To grow and reinforce a network of partners for cooperation on IFM • To strengthen partnerships to increase technical, institutional, and financial contributions to IFM • Efficiently and effectively manage APFM	1			Initiative/ project
CERISC – ENSOSP (http://www.ensosp.fr/SP/pages-ENSOSP/activite/recherche-et-innovation)	The ENSOSP has set up, since the 1st of September of 2014 a research center, in order to develop and make the research, which has been carried out there for several years, visible: the CERISC. The objective of CERISC is to develop individual or collective research projects in compliance with the ENSOSP establishment contract and to offer its members the means to carry them out, in particular in the following areas: investigations, response calls for research projects, constitution of partnerships, publication of results, etc. Its activity aims to promote its recognition at the national and international level. In this perspective, it sets a quality requirement, which makes possible to enhance the work of the team and the researchers, in particular by the publication of scientific articles, books, databases, reports, communications to symposia and congresses and through the creation of collaboration and partnership networks with other research structures, institutions and companies.	2	1		Research Institute
Fraunhofer INT (https://www.int.fraunhofer.de/en.html)	The Fraunhofer Institute for Technological Trend Analysis INT provides scientifically sound assessments and counseling on the entire spectrum of technological developments. On this basis, the Institute conducts Technology Forecasting, making possible a long-term approach to strategic research planning. The Institute runs its own experimental and theoretical research on the effects of ionizing and electromagnetic radiation on electronic components, as well as on radiation detection systems. To this end, INT is equipped with the latest measurement technology. Its main laboratory and large-scale appliances are radiation sources, electromagnetic simulation facilities and detector systems that cannot be found in this combination in any other civilian body in Germany. For more than 40 years, INT has been a reliable partner for the Federal German Ministry of Defense, which it advises in close cooperation and for which it carries out research in technology analysis and strategic planning as well as radiation effects. INT also successfully advises and conducts research for domestic and international civilian clients: both public bodies and industry, from SMEs to DAX 30 companies.	3	2		Research Institute
Chemical Hazards Emergency Medical Management (https://chemm.nlm.nih.gov/)	The goals of the organization are: •To enable first responders, first receivers, other healthcare providers, and planners to plan for, respond to, recover from, and mitigate the effects of mass-casualty incidents involving chemicals. •To provide a comprehensive, user-friendly, web-based resource that is also downloadable in advance, so that it would be available during an event if the internet is not accessible. CHEMM was produced by the U.S. Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response, Tactical Programs Division, Office of Emergency Management, in cooperation with the		1		Public Organization

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	National Library of Medicine, Division of Specialized Information Services, and many medical, emergency response, toxicology and other types of experts.				
Center for Security Studies (KEMEA) (http://www.kemea.gr/en/, http://www.ciprotection.gr/index.php/el/)	The Center for Security Studies (KEMEA) has been established as the Hellenic Ministry's of Citizen Protection think tank on security policies. It is a scientific, consulting and research agency, whose purpose is to conduct theoretical and applied research and to perform studies, particularly at the strategic level, on security policies. In 2011 KEMEA was appointed as the National Contact Point for the protection of European Critical Infrastructure (ECIs) - "ECIP contact point". In order to fulfill its mission, KEMEA: a.Implements research projects and studies on homeland security relating to the Ministry of Citizen Protection (former Public Order and Citizen Protection) and its associated agencies as well as other foreign organisations. b.Designs and carries out research projects as a representative of the Ministry of Citizen Protection (former Public Order and Citizen Protection) subordinate organisations, on behalf of or in co-operation with respective EU, other state or international organisations according to the relevant rules and procedures. c.Develops collaborations on a national and international level with organisations and agencies, research and education centers and foundations, social, academic and productive Bodies, public and private, as well as NGOs. KEMEA within its current Action and related activities in the field of Critical Infrastructure Protection is developing a pilot Coordination Center in its premises, following the supply of equipment and cut-edge GIS software. The main objective of the Center is the possibility of exchanging information among the crisis management agencies and first responders and the operators and managers of Critical Infrastructures in security-related topics.		1	1	Research Institute
IAFC Coronavirus Taskforce (https://www.iafc.org/)	The International Association of Fire Chiefs (IAFC) represents the leadership of firefighters and emergency responders worldwide; The Association's members are the world's leading experts in firefighting, emergency medical services, terrorism response, hazardous materials spills, natural disasters, search and rescue, and public safety policy. The Association's mission is to provide leadership to current and future career, volunteer, fire-rescue and EMS chiefs, chief fire officers, company officers and managers of emergency service organizations throughout the international community through vision, information, education, services and representation to enhance their professionalism and capabilities. The fire and emergency service reaches every community, covering urban, suburban and rural neighborhoods. The fire service is the only entity that is locally situated, staffed, trained and equipped to respond to all types of emergencies. The fire department responds to natural disasters, such as earthquakes, floods, tornadoes and hurricanes, as well as to man-made catastrophes, such as hazmat spills, arson and terrorism. As such, the fire and emergency service is a dynamic all-hazard, all-risk response entity.		1		Firefighters Asoociation
SDIS78 (http://www.sdis78.fr/)	The Departmental Fire and Rescue Services of Yvelines (Sdis78) is made up of professional and voluntary firefighters and administrative, technical and specialized personnel who participate, with other actors, in civil security missions. The Sdis78 is responsible for preventing, protecting and fighting fires. It contributes, with the other services and professionals concerned, to the protection and the fight against other accidents, disasters and disasters, to the evaluation and the prevention of technological or natural risks as well as to emergency aid.		2	1	First Reponders/Practitioners
Firefighter Plus (https://www.firefightersplus.eu/)	Firefighter Plus is an online platform dedicated to firefighters and other people working in, or with, the emergency services, who want to do something additional for their community. It doesn't matter if one has worked for the fire and rescue service for a long time or if one is new to the brigade. It doesn't matter if one is a firefighter, watch manager or policy maker who works in partnership with the emergency services. It doesn't matter if one is already involved in social projects or if one is just starting to consider it. The only thing one needs is his/her willingness to engage in social inclusion activities and to develop his/her knowledge, skills and competencies in this area. This online platform will help one to develop and implement his/her first social project. It might also inspire you to develop the social activities one is already working on.		1		Firefighters Asoociation
National and Kapodistrian University of Athens (http://www.geophysi	In the course of the University's activities over the years, a better understanding of the seismicity, seismic hazard and seismic risk of the area of Greece was accomplished. Several local seismic networks were deployed,	1	3	2	Academic /Research Institute

cs.geol.uoa.gr/main_engl.html)	monitoring the seismicity and determining the seismotectonic regime of certain seismogenic areas. Moreover, applications of theoretical seismology to Greek data resulted in revised and/or local seismic intensity and seismic energy attenuation laws and in the determination of seismic source parameters for a large number of earthquakes At the same time, a large number of microzonation studies aiming at the mitigation of seismic risk was performed. Emphasis is given on the application of modern methodologies, i.e. seismic and geoelectric tomography, high-resolution reflection including shear waves reflection, etc. The Laboratory welcomes a large number of physics and geology undergraduates, pursuing post-graduate studies in the field of Seismology, thus contributing to the education of the young generation of scientists.				
Meteogrid (https://www.meteogrid.com/)	Meteogrid is a company that offers high value of products and services in the field of applied climatology and meteorology, weather forecasting and early warning and risk management. The Meteogrid technical team began its activities, in the meteorological and climatological field, in 1992, being the forerunner of meteorological services integrated into geographic information systems, specialized in the fight against forest fires. Meteogrid has focused its business activity, since 2004, on the provision of weather forecasting services, specific meteorological applications and the development and integration of ad hoc information systems in the public and private spheres. Meteogrid products and services have always had the vocation of adapting to customer needs and transferring research results.			4	Private company
TOXI-TRIAGE Tools for Detection, Traceability, Triage and Individual Monitoring of Victims (http://toxi-triage.eu/about)	TOXI-triage project addresses the operational, technological, ethical and societal dimensions of CBRN response and recovery, and importantly the economic base from which sustainable CBRN and multiuse systems are derived. The approach defines a concept of operations that envisages accelerated delivery of situational awareness through an ensemble of embedded sensors, drones, standoff detectors (including cameras), artificial intelligence for processing sensor signals and web-traffic from social media, and centralised command and control. Wireless traceability of casualties provides dynamic mapping including medical care.			1	Project (multiple partners)
Omikron Environmental Consultants S.A (https://omikron-sa.gr/en/)	Omikron Environmental Consultants S.A provides consulting services on environmental issues since 2001, delivering services of excellent quality in its areas of expertise, in both national and international level. Its approaches are always holistic and based on state-of-the-art technology, while utilizing pioneering scientific methods to ensure both the quality, integrity and innovation of our activities. Omikron is delivering integrated services and products in the fields of protection, management and enhancement of the natural and human environment. The company is certified with ISO 9001: 2015 by TUV HELLAS for “Drawing up of projects and providing services on: natural, urban and suburban environments- rural development- technical projects - geographic systems (GIS) and applications -photogrammetry- cadastre- databases- software development and IT applications -forest fire management”.			1	Private company
ENEA, Analysis and Protection of Critical Infrastructure Laboratory APIC (https://www.unisdr.org/conference/2019/globalplatform/programme/platform/view?id=957)	The Global Platform for Disaster Risk Reduction is a biennial multi-stakeholder forum established by the UN General Assembly to review progress, share knowledge and discuss the latest developments and trends in reducing disaster risk. The Global Platform for Disaster Risk Reduction is a critical component of the monitoring and implementation process of the Sendai Framework for Disaster Risk Reduction (2015-2030). The outcomes of the Global Platform inform the deliberations of the High-Level Political Forum on Sustainable Development and the UN 2019 Climate Summit from a disaster risk reduction perspective. These efforts contribute towards the successful achievement of a risk-informed 2030 agenda for Sustainable Development. Over the past decade, the Global Platform has assumed the role of assessing and reviewing the progress in the implementation of the global disaster risk reduction agenda, and to serve as a platform for governments and stakeholders to share good practices, identify gaps and to make recommendations to further accelerate the implementation.			1	Research Institute
Skyeton (https://skyeton.com/)	Aviation Production Company “Skyeton” was founded by a group of engineers and pilots in 2006. The company develops and supplies unmanned aerial systems for numerous aerial solutions. The Company’s vision is developing highly automated aerial platforms, designed to continuously perform complicated applications in extended and distant environments. The company’s mission is providing full-scope aerial solutions both turnkey and			1	Private company

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	custom tailored for client needs. While implementing a full cycle of aerial system development and production, using the most globally appreciated components, we remain on an outlook for unconventional ideas in order to find the best solution for the clients' needs. "Skyeton" is certified as a developer and manufacturer of aeronautical products.				
Unisystems (https://www.unisystems.gr/)	Uni Systems delivers the benefits of traditional data center infrastructure - trust, security, control and reliability - with the power of cloud computing - flexibility, accessibility and on-demand capacity. UniSystems' data center facilities provide a worldclass physical environment to ensure uninterrupted technology operations and immediate cost benefits to our clients. Uni Systems Data Center facilities are designed with environmental control systems, raised flooring, fault-tolerant power plants, advanced fire detection and suppression systems, and multiple levels of physical security assurances. Uni Systems offers to organizations turnkey solutions with unparalleled performance, reliability and expertise. Data Center services which include:V & D hosting, business continuity, managed backup, co-location, infrastructure outsourcing. Uni Systems, as a major partner of the largest banking and financial institutions, covers all aspects of technological needs with industry specific or non-specialized solutions.			1	Private company
HR AZARI (https://ir.linkedin.com/in/hr-azari-a5980311b)	The primary objective of my research is to tackle the global challenges we face in preservation of forests and fire protection. The prime devastating examples of such fires were recently in the news with Brazilian rain forest fires and the difficult job of controlling it once started. This involves innovative approaches, experimental and monitoring of complex environmental systems to better understand the various factors and processes that help us develop national and global sustainable plans and meet international goals on climate change, biodiversity, ecosystem preservation; and" My proposal plan and idea is best tech-based innovation for humanitarian aid In order to protect World Heritage Forest, and the design meet with ""Iran's Department of Environment (DOE)"" approval. First and foremost, I'm interested to establish a global network of world System with primary purpose of detecting wildfire to protect world heritage; such as biosphere reserves, national parks, Natura 2000 sites, Hyrcanian Forests and numerous endemic species and with the aim of developing the underpinning knowledge necessary for the Environmental Protection on Smart production systems and define a performance baseline to compare against novel, low- cost-effective tool and approaches.			1	Private company
IT For Nature (https://smokedsystem.com/)	The SmokeD detectors are sophisticated devices intended for early fire detection and an immediate notification of users about their occurrence. For that purpose, artificial intelligence (AI) has been applied resulting in fast, effective, and accurate detection of smoke and flames up to 10 miles. The main purpose of SmokeD systems is to detect fires before they become too large for their effective control. The system is aimed at individual, government, and corporate users. Early Wildfire Detection System consists of:SmokeD Detector, SmokeD proprietary software and SmokeD Web and Mobile App. Installation of the SmokeD detectors is straightforward. It requires finding a site with a good overview of the surrounding landscape. Detectors can be installed on roofs or chimneys of house structures, or even better on poles or towers with an unobstructed view of large areas. Electric power and internet connection are needed. Alerts, images from the detectors and maps of the monitored areas are provided by two applications: SmokeD Alerts mobile app, SmokeD Web app.			1	Private company
CNIM Air Space (https://cnim.com/en/medias/airstar-aerospace-becomes-cnim-air-space#)	Founded in 1856, CNIM is a French equipment manufacturer and industrial contractor operating on a worldwide basis. The Group supplies products and services to major public and private sector organizations, local authorities and national governments in the Environment, Energy, Defense, and high technology markets. Technological innovation is at the core of the equipment and services designed and manufactured by the Group. They contribute to the production of cleaner and more competitive energy, to limiting the environmental impacts of industrial activities, to making sensitive facilities and infrastructures safer and protecting individuals and nation states. CNIM is listed on the Euronext exchange in Paris. It relies on a stable family-based majority shareholding structure committed to its development. A leading player in its chosen sectors, with a reputation for innovation and technical excellence, CNIM is accelerating its development on an international			1	Private company

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	scale. CNIM markets its equipment and delivers projects around the world. CNIM's remarkable story as a pioneering industrial company began back in 1856. Today, that same commitment to creativity, expertise and innovation is shared by all of the Group's 2,500 employees.				
CNBOP-PIB (https://www.cnbop.pl/en)	Scientific and Research Centre for Fire Protection – National Research Institute is a Scientific Unit with the mission of ensuring public safety of the Country in terms of fire protection, crisis management, civil protection and civil defence.			4	Research Institute
Majaczech, z.s. (https://www.majaczech.cz/)	The national representatives of CFPA-E in the Czech Republic. Elected heads of the commission for the creation of European directives within this confederation. Cooperation at the international level in the field of fire safety in all areas - preventive education, development of guidelines and methodologies, consulting, professional training of fire protection experts and firefighters, solving non-standard problems in the field of fire safety and much more. Provide professional assistance on a national and international level. Majaczech currently works on system feature that will estimate and recognise areas considered as vulnerable to non-direct fire spread. It counts with flying hot firebrands generated during large forest fires which can be moved up to a few kilometres from the fire front.			1	Firefighters Association
XENIOS project (https://xenios-project.eu/en/)	The contribution of tourism is particularly important to the economy of an area. Under certain conditions, tourism has proven to be an important growth driver. This is attributed to the particular nature of tourism as an activity, which develops primarily at a regional and local level. The tourism and cultural products are key to boosting development in Greece, with significant potential to have a positive financial impact on the productive base of regional economy. The scope of the proposed project is to design and develop an online platform for supporting the management of natural hazards posing a threat to tourist and cultural sites, substantiate prevention planning and decision-making, improve the safety of the public and the visitors and incorporate all these in the context of site protection. The platform will function interactively throughout the risk management levels, from the local (cultural/tourist site) to the regional and national ones, by exchanging informational material, and real-time status reports and updates.			1	Project (multiple partners)
GEOSYSTEMS HELLAS S.A (https://www.geosystems-hellas.gr/en/home/)	GEOSYSTEMS HELLAS S.A. [GSH] was established in Athens in November 2009 as the newest member of GEOSYSTEMS EU GROUP Member. GSH is working on commercial Environmental, Photogrammetrical, Remote Sensing projects and R&D projects for land management, crisis management and Spatial Data Infrastructure (INSPIRE Directive) implementations. GSH is a pioneer in introducing Information Technology using extensively modern, digital geodata capturing and data processing techniques for production of maps and geographic information systems. GSH is deeply involved in Big Data and Data Fusion and Data Analytics techniques for National projects and establishment of infrastructure for spatial information (Metadata, Data Specifications, Data and Service Sharing and Monitoring and Reporting). GSH holds extensive expertise in regards to operational requirements/scenarios definition in fields of data exchange/sharing in an interoperability manner. GSH business model is solution-based and committed to vertical products; cost effective and timely solutions, added-value services, training and support.	1			Private company
GEOSCIENCES (https://www.geosciences.gr/)	In Geoscience, a private company from Greece, the state-of-the-art technologies are used, in the field of Geoinformatics. Geographical Information Systems (GIS) are modern tools for support, decision making and business development. They are equally addressed through a variety of custom applications in the Public and Private sectors, as well as in the local government.			2	Private company
ONHYS (https://www.onhys.com/fr)	In the course of the smart city, the Company uses new technologies to support urban development. The Company's technologies are positioned at the crossroads of Building Information Modeling (BIM) and Artificial Intelligence (AI). These approaches are at the heart of the Company's software for simulating user behavior in urban spaces and their infrastructures. The behavioral simulation allows a clear reproduction of the dynamics of pedestrian flows and crowd movements in a virtual environment. Each situation can be very simply configured in the form of a representative scenario. The simulation makes it possible to accurately represent the interactions of users with their environment: maximum and comfortable reception capacity, management of crowd movements, calculation of travel times and frequentation, and planning of transport and urban mobility.			1	Private company

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Satways Ltd (https://www.satways.net/company/)	Satways Ltd. is a privately held organization founded in May 2006 and is based in Athens, Greece. The company is dedicated to develop integrated Geospatial command and control solutions for Security and Public Safety applications for police, coast guard, emergency medical service, civil protection and fire & rescue operations, critical public infrastructure protection, transportation security and border monitoring. Satways is ISO 9001:2008 certified for the development of geospatial command and control products and solutions			2	Private Company
uspace.aero (http://www.uspace.aero)	Technical company focused on unmanned air traffic management. R&D activity into UTM solutions. Activities focus on UAV identification, localization and detect, sense & avoid issues and as an integration need we implement aeronautical data sharing and processing for unmanned traffic management purposes.			1	Private company
Codifive (https://codifive.pl/)	A technical company focused on unmanned air traffic management. We lead R&D activity into UTM solutions. Our activity focuses on UAV identification, localization and detection, sense & avoid issues and as an integration need we implement aeronautical data sharing and processing for unmanned traffic management purposes. Our team's engineers have solid aeronautical, electronic and IT experience with over 20 years of unmanned aerial systems development.			1	Private company
Nable solutions (https://nablesolutions.com/)	Nable Solutions is an award-winning startup providing software solutions with a social cause. Main focus of Nable Solutions is on software solutions that can have a true impact on society. Software that provides the tools to recruit, train, organize, coordinate and supervise volunteers.			1	Private company

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