Project Deliverable

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Title
D3.7 **Final Strategic Research and Standardisation Agenda #3**

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Abstract:

This document provides the third FIRE-IN input to the strategic research and standardisation agenda to improve fire and rescue capabilities in Europe. It is built on cycle #3 of FIRE-IN project outputs. In the first part, the document focuses on best practises identified by practitioners; in the second part, it focuses on research and publications; in the third part, on technology and innovations; in the fourth part on standardization and in the fifth part; steps ahead. Each part considers a) the challenges; b) the achievements

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Executive Summary

The FIRE-IN project is an initiative funded by the European Commission and initiated 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 needs much stronger guidance from practitioners and better exploitation of the technology potentially available for the discipline.

The purpose of this report is to synthetize and merge the results from the third cycle process of the FIRE-IN project and propose a final strategic research and standardization agenda.

The results outlined in this report should help inform and guide the European Commission on "next steps" to take which focus on some key challenges to invest in.

Table 1. FIRE-IN partners

Participant No.	Participant organisation name	Part. short name	Country
1	Pôle de compétitivité SAFE CLUSTER (ex Pôle Pégase)	SAFE	France
2	Ecole Nationale Supérieure des Officiers de Sapeurs-Pompiers – French National Fire Fighter Officers Academy	ENSOSP	France
3	Italian Ministry of Interior, Department of Fire Corps	CNVVF	Italy
4	Bundesanstalt Technisches Hilfswerk	THW	Germany
5	INERIS Development	INEDEV	France
6	Fraunhofer INT	FhG-INT	Germany
7	Fire Ecology and Management Foundation Pau Costa Alcubierre	PCF	Spain
8	Catalonia Fire Service Rescue Agency	CFS	Spain
9	Scientific and Research Centre for Fire Protection	CNBOP	Poland
10	The Main School of Fire Services	SGSP	Poland
11	Council of Baltic Sea States Secretariat	CBSS	Sweden
12	Center for Security Studies	KEMEA	Greece
13	Czech Association of Fire Officers	CAFO	Czech Republic
14	GAC Group (ex inno TSD)	inno	France

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1. Introduction

One of the main objectives of the FIRE-IN project is to provide recommendations to develop research and standardization that is aligned with both practitioners' needs and research and technology developers (RTD)' capabilities. These recommendations can be identified after a full cycle of the project is completed: i) identification of challenges from the practitioners' perspective; ii) screening of existing solutions; iii) consultation with industry and research networks.

The final objective is to provide inputs for the European Commission to build the roadmap of research and standardization in the field of fire and rescue. As the FIRE-IN project is comprised of three cycles, this report delivers the third cycle's results.

At the end of the first cycle, a cross-analysis of the key challenges identified by the Fire and Rescue community was developed (challenge matrix); this helped to focus findings and the ongoing research and innovation efforts with a potential to address those challenges.

In the second cycle, practitioners were invited to review a wider set of challenges they identified as important and to assess research and innovation products identified in view of their applicability to address those challenges. Practitioners were also invited to present and discuss best practises they had developed to address the identified challenges.

In the third cycle we focused on the Future Common Capability Challenges (FCCCs) and made the implementation of the "Request for Ideas" procedure. During this cycle of "Request for Ideas" the inputs and outputs of the previous cycles were also considered in order to build a robust and coherent outcome, regarding the coverage level of both Current Common Capability Challenges and Future Common Capability Challenges.

2. Policy and Good Practice

2.1. Challenges

Activities related to policy and good practice relate to each of the stages of the events in which F&R practitioners are involved. The model of management during adverse events includes such activities as: planning, maintaining operational readiness of services, operational preparation of the site, taking rescue actions, restoring safety, and restoring operational readiness, as well as drawing conclusions from the event. An "After Action Review" (AAR) can directly identify good practice (or gaps) as the result of the last phase of activities. However, good practices, should refer to each of the stages of the event, including the recovery phase.

Identification, sharing and implementation of good practices is a crucial activity to fill the gap in areas where the legislative processes related to the creation of standards fail to meet (or react too slowly to) new needs or rapidly developing technologies. A further challenge area served by transfer of good practice is situation-specific emergencies for which the development of standards / SOPs is unrealistic. Additionally - the advantage of guides is that they are more accessible to firefighters and rescuers, who use them more willingly because they often refer to real situations and case studies.

Policy should be implemented coherently and at every stage; however, it should be stressed that prevention is always the most effective and overall low-cost method of management. During the last

cycle of the project, Future Common Capability Challenges (FCCCs) largely related to political activities, such as: Create certainty and shared vision of emergencies, focus on governance and integral risk management, and focus on capacity building towards more resilient societies. Throughout all stages of the project, there are several key areas related to the impact of policy and the implementation of good practices. Such areas are public involvement, encouraging self-capacities and safety.

Another important topic raised was risk awareness. For a society to be resilient and committed, risk awareness, must be continuous and include repeated training for both practitioners and citizens. The role of policy and the promotion of good practice in this regard plays a key role to overcome identified challenges.

2.2. Achievements

The EU has made significant achievements in addressing pan-European civil protection challenges, for instance, via the Union Civil Protection Mechanism and RescEU. Policy initiated activities to support international cooperation, both at the level of preparation and joint exercises and disaster response, are of great value and should be continued. The possibility of financing projects from EU funds to further develop guidelines or SOPs on the basis of good practices is also an activity that significantly supports F&R services as well as allows for the dissemination of knowledge and building a society more resilient to adverse events. However, local activities in this area are also important. In the area of security, the most important thing is to react quickly and this will be the first to counteract local forces and resources. For this reason, public administrations responsible for crisis management at national level must not be overlooked. Local activities promoting responsible attitude, and campaigns raising awareness of risks and threats should be systematically implemented among citizens, even the youngest. Similarly, it is critical to facilitate exchange and capacity building opportunities for actors outside of civil protection and F&R services who play a crucial role in prevention, preparedness and recovery.

3. Research and Publications

3.1. Challenges

During the first cycle of discussion with end-users concerning current challenges faced by their organisations in F&R, FIRE-IN produced a matrix of common capability challenges (CCCs) and future common capability challenges (FCCCS, see Table 2). These challenges were further refined and weighted after the second workshop series and surveys of the project, which resulted in a list of prioritised capability challenges (PCCs, see Appendix 2). Within the solution screening process of FIRE-IN, which was completed in 3 cycles of screening, research and technological solutions to these challenges were identified. Based on this process, a traffic light system was used to identify which capability challenges are not yet properly being addressed and discussed within the research community. Afterward, existing solutions and approaches such as research projects, technologies, standards, and guidelines for these challenges, were identified. These solutions have been evaluated in the Deliverable D3.4 - Results of the Request for Ideas: Mapping RTOs and industry potential, response and trends related to FIRE-IN CCC/ FCCCs #3. In this evaluation, the number and TRL of the solution was evaluated and the sufficiency and variety of solutions was rated with a traffic light system (green: solutions exist to a sufficient degree; yellow: solutions exist, but not to sufficient degree; red: lack of solutions).

3.2. Research achievements

As shown in *,
- 8 of the 24 challenges are met by sufficient solutions in the fields of research (green)
- 8 of the 24 challenges are partly met by sufficient solutions in the fields of research (yellow)
- 8 of the 24 challenges are not met by sufficient solutions in the fields of research (red)

Table 2: Application of the Traffic Light System to the Challenges of the third Cycle with regard to the screening results for the domain of research.

	High flow of effort in hostile environment	High Impact, Low Frequency (HILFOF)	Multiagency / Multi-leadership	High level of uncertainty
Incident Command Organisation	CCC1: Organize to sustain safe operations	CCC2: Anticipate and prioritize avoiding the collapse of the emergency system	CCC3 Build interoperability for a distributed decision-making based on a shared understanding of the emergency	FCCC4: Strategic management focused on proactively reducing sources of uncertainty and building robustness and resiliency
Community Involvement	CCC5: Develop public self-protection and awareness	CCC6: Involve communities and key stakeholders as active actors in risk management	FCCC7: Negotiate the values with communities before the emergency	FCCC8: Cultural change towards risk tolerance and resilience
Knowledge Cycle	CCC9: Train specific roles and risks and invest in a robust knowledge cycle	FCCC10: F&R services empowered to innovate and build organizational learning	CCC11: Build a shared understanding of the emergency, and train interagency scenarios	FCCC12: Focus on capacity building towards more resilient societies
Decision Making Cycle	CCC13: Make operational decisions based on building an understanding of the emergency and its evolution	CCC14: Choose a strategical scenario of resolution, and distribute tactical decision-making	CCC15: Build a shared understanding of the scenario to synchronize decision-making	FCCC16: Create certainty and shared vision of emergencies

Risk reduction	CCC17: Focus encouraging self-capacities and safety	CCC18: Negotiate solutions with stake holders for anticipated scenarios	FCCC19: Integrate risk prevention and safety into other policies and actors	FCCC20: Focus on governance and integral risk management.
Preparedness	CCC21: Pre-plan a time-efficient, safe response, minimizing responder's engagement	CCC22: Plan in a more integral way	FCCC23: Pre-plan interoperability and enhance synergies	FCCC24: Focus on governance and integral risk management

Blue font indicates Future Common Capability Challenges (from: Tsaloukidis, J., Sakkas, G., Fresu, G., Pronto, L., & Hybbeneth, N., 2022, D3.4 - Results of the Request for Ideas: Mapping RTOs and industry potential, response and trends related to FIRE-IN CCC/ FCCCs #3)

For the challenges which are not met by solutions in the field of research, a solution could be considering these fields in research programmes. As research takes time, it is crucial to already pay attention to the FCCCs. Therefore, the following challenges should be considered in research (Table 3)

Table 3: Future common capability challenges which need to be considered in research

FCCCs with high urgency to be considered in research programs	FCCC4: Strategic management focused on proactively reducing sources of uncertainty and building robustness and resiliency
	FCCC12: Focus on capacity building towards more resilient societies
	FCCC23: Pre-plan interoperability and enhance synergies
FCCCs with urgency to be considered in research programs	FCCC8: Cultural change towards risk tolerance and resilience
	FCCC10: F&R services empowered to innovate and build organizational learning
	FCCC19: Integrate risk prevention and safety into other policies and actors
	FCCC16: Create certainty and shared vision of emergencies
	FCCC20: Focus on governance and integral risk management.
	FCCC24: Focus on governance and integral risk management

The common capability challenges with gaps in research solutions should also be considered in research programmes (

), but as these are not future but present challenges, practise-oriented research aiming for high TRLs should be considered.

Table 4: Common capability challenges which need to be considered in research

CCCs with high urgency to be considered in research programs	CCC9: Train specific roles and risks and invest in a robust knowledge cycle
	CCC11: Build a shared understanding of the emergency, and train interagency scenarios

	CCC13: Make operational decisions based on building an understanding of the emergency and its evolution
	CCC21: Pre-plan a time-efficient, safe response, minimizing responder's engagement
	CCC22: Plan in a more integral way
CCCs with urgency to be considered in research programs	CCC1: Organize to sustain safe operations
	CCC2: Anticipate and prioritize avoiding the collapse of the emergency system

4. Technological Innovations

4.1. Challenges

During the third cycle of the project, 24 Capability Challenges, either Current or Future were identified. However, some modifications, in terms of the main Capabilities, were implemented i.e., the Capabilities were arranged in such a way, that they exactly depict the results of the interaction and discussion held between practitioners during the third cycle of workshops. In the following table, the Capabilities of the first and the third cycle are presented:

Table 5: Capabilities of the 1st and 3rd Cycle

Capabilities of the 1st Cycle	Capabilities of the 3rd Cycle
Incident Command Organization	Incident Command Organization
Pre-planning	Preparedness
Guidance Instruments	Decision Making Cycle
Knowledge Cycle	Knowledge Cycle
Information Management	Risk Reduction
Community Involvement	Community Involvement
Technology	

This modification does not mean that Capabilities, which do not exist in the third cycle, are negated, but are rather incorporated into the Capabilities of the current cycle. The same also applies to the challenges. Although some challenges still remain unresolved and are included in both the first and third cycle challenge matrices, there are challenges which are newly identified and are expected to pose problems to first responders' operations not only now but in the future as well. Nevertheless, this does not mean that challenges, present during the first cycle but absent during the third, are resolved but are incorporated and better expressed through the challenges of the third cycle, similarly to the Capabilities.

Although in the first cycle a specific Capability, consisting of four Challenges, was dedicated to technology, in the third cycle challenges related to the technological aspect are integrated within CCCs and FCCCs of several Capabilities. Below, the challenges of all three cycles which are related, either directly or indirectly, to technologies, are depicted.

Technology related challenges of the 1st cycle

1. Use technology to assess risks and minimize responders' engagement (TOP CHALLENGE).
2. Forecast and simulate complex scenarios.
3. Technological tools to support data sharing.
4. Get a clear picture of the risk evolution.

Technology related challenge of the 2nd cycle

1. Technologies used in interventions should be

  • Useful
  • Simple, intuitive, and easy to use
  • Easy to integrate and interoperable
  • Easy to transport, deployable on the field, light, with autonomy
  • Robust, resistant, long duration, able to tolerate severe/harsh conditions
  • Open access
  • Usable by people with disabilities

Technology related challenges of the 3rd cycle

1. Organize to sustain safe operations.
2. Focus on encouraging self-capacities and safety.
3. Focus on governance and integral risk management.

4.2. Achievements:

A large number of technological solutions were screened and analysed throughout the three cycles of the project. These solutions were identified either through desktop research, conducted under the framework of **WP2 "*Standardisation and RDI screening and identification of the potential and relevant implementations*"**, or through discussions and interaction with technological providers, who uploaded their solutions to the e-FIRE-IN platform. In addition, technological outcomes of research projects were included. This procedure was undertaken in the context of **WP3 "*Collaboration with research, industry and standardization bodies and recommendations*"** and mainly of **Task 3.2 "*Request for RDI ideas addressing CCCs and FCCCs and capitalization of the feedback*"**. A variety of technological solutions was identified such as early warning systems for various kinds of hazards, risk assessment tools, unmanned vehicles for various purposes e.g., surveillance, SaR etc., crowdsourcing applications, AR / VR / XR applications for first responders' training, applications for the recruitment and management of volunteers, Machine and Deep Learning software, Artificial Intelligence, systems enabling first responders' communications in harsh environments, GIS and geolocation tools, different kinds of sensors for the early detection of fire, smoke, embers or of dangerous CBRNE agents, Command and Control systems and propagation models for the spread of wildfires or other agents, among others. The vast majority of the screened solutions are technologies with a very high Technological Readiness Level (TRL≥8) and have a significant operational value, being already used in

first responders' operations. Moreover, these solutions are in accordance with formal technical standards, which facilitate interoperability between the various systems.

Both from the screening for solutions (WP2) and the Request for Ideas (RfI) (WP3) processes, the following table emerges, which presents the level of coverage of each challenge by technological solutions, using the Traffic Light System.

Table 6: Level of coverage of each Challenge by technological solutions. Challenges with blue font are the FCCCs and the ones with black font are the CCCs. As green are characterized the Challenges which are well addressed by technological innovations, as yellow the ones that require further investigation, and, as red, the ones that still remain a gap, Source: D3.4

	High flow of effort in hostile environment (HF)	High Impact, Low Frequency (HILOF)	Multiagency / Multileadership (ML)	High level of uncertainty (UN)
Incident Command Organization	CCC-1. Organize to sustain safe operations	CCC-2. Anticipate and prioritize avoiding the collapse of the emergency system	CCC-3. Build interoperability for a distributed decision-making based on a shared understanding of the emergency	FCCC-4. Strategic management focused on proactively reducing sources of uncertainty and building robustness and resiliency.
	T (green)	T (green)	T (green)	T (green)
Community involvement	CCC-5. Develop public self-protection and awareness	CCC-6. Involve communities and key stakeholders as active actors in risk management	FCCC-7. Negotiate the values with communities before the emergency	FCCC-8. Cultural change towards risk tolerance and resilience.
	T (green)	T (yellow)	T (green)	T (red)
Knowledge Cycle	CCC-9. Train specific roles and risks and invest in a robust knowledge cycle	FCCC-10. FRS empowered to innovate and build organizational learning	CCC-11. Build a shared understanding of the emergency, and train interagency scenarios	FCCC-12. Focus on capacity building toward more resilient societies
	T (red)	T (yellow)	T (green)	T (red)
Decision Making Cycle	CCC-13. Make operational decisions based on building an understanding of the emergency and its evolution	CCC-14. Choose a strategical scenario of resolution, and distribute tactical decision-making	CCC-15. Build a shared understanding of the scenario to synchronize decision-making	FCCC-16. Create certain and shared vision of emergencies.
	T (yellow)	T (green)	T (green)	T (green)
Risk reduction	CCC-17. Focus encouraging self-capacities and safety	CCC-18. Negotiate solutions with stake holders for anticipated scenarios	FCCC-19. Integrate risk prevention and safety into other policies and actors	FCCC-20. Focus on governance and integral risk management.
	T (red)	T (green)	T (red)	T (red)
Preparedness	CCC-21. Pre-plan a time-efficient, safe response, minimizing responder's engagement	CCC-22. Plan in a more integral way	FCCC-23. Pre-plan interoperability and enhance synergies	FCCC-24. Focus on governance and integral risk management.
	T (green)	T (red)	T (red)	T (green)

As stated above, from the third cycle matrix of challenges, three examine, inter alia, the technological factor. "*Organize to sustain safe operations*" and "*Focus encouraging self-capacities and safety*" are Current Capability Challenges, whereas "*Focus on governance and integral risk management*" of the "*Preparedness*" Capability is a Future Challenge. Although these Challenges are closely related to the technological domain, technological solutions can address and cover, to a minor or major degree, the majority of the Challenges of the third cycle, as depicted in the above matrix.

Examining the six Capabilities, one by one, it was deduced that the "*Incident Command Organization*" and "*Decision Making Cycle*" Capabilities along with their challenges are well covered by technologies. Moreover, "*Community Involvement*" presents a significant level of coverage, although there are challenges e.g., FCCC-8 "*Cultural change towards risk tolerance and resilience*" that remain a gap. Although this challenge can be handled differently, with a more political and institutional approach, technologies can still provide solutions. An example could be serious gaming applications targeting students for educational reasons and citizen awareness raising.

On the other hand, "*Knowledge Cycle*", "*Risk Reduction*" and "*Preparedness*" are Capabilities not well-addressed by technology. Some challenges individually may be covered by technological solutions, but this does not apply to the majority. In addition, there are challenges, which although are addressed by technologies, these solutions are of low TRL and still not available on the market, thus further development is required. Details regarding the level of coverage of the various Capabilities and Challenges by all the different types of solutions (technological innovations, standards, guidelines, best practices, research) can be found in **D3.4 – Results of the Request for Ideas: mapping of RTOs and Industrial potential, response and trends related to FIRE-IN CCC/FCCCs #3**.

During the Request for Ideas process of the third cycle, questionnaires were developed and disseminated to more than 100 stakeholders. The main themes of these questionnaires were technology and standardisation by the point of view of first responders and technological providers. In addition, an online event, organised jointly by the FIRE-IN and the MEDEA projects, also targeted the two aforementioned issue providing significant feedback regarding the orientation of future research, standardisation and technological development. Furthermore, national hubs between disaster management stakeholders were organised in Greece, Poland, and Germany relevant to civil protection and disaster management issues.

According to D.3.4, the most important technological solutions, for both the mid- and the long-term are early warning technologies. Crowdsourcing applications for the notification of the public, big data analysis algorithms, risk assessment systems as well as GIS apps and geolocation technologies hold a prominent position for the first responders among the various existing or under development technological types.

However, through discussions, it was highlighted that technologies should become more user friendly due to the fact, that complicated solutions, although innovative, could create more problems, on the field, than they could solve. Technological solutions also must remain effective and salient in situations of power failure, loss of connectively, or under extreme burdens on (e.g., communication) infrastructure. Additionally, technologies should not require a significant level of scientific background to be used by first responders.

A way to resolve this problem is first responders' training to the use of new systems. In particular, this training should be not only initial but recurrent, aiming at the end users' continuous practice, effective adaptation and convenience when they use a new tool. Overall, technology covers, to a significant extent, all four stages of the disaster management cycle i.e., prevention, preparedness, response, and recovery, thus proving a crucial and intimate weapon for the management of emergencies.

Standardisation, on the other hand, seems to concern first responders even more than technological innovations. Standardisation is partially related to technology, with the development of technical standards, but is also relevant to and equally important for the procedural aspect, which is linked to the cross-border and cross-sector interoperability.

Although first responders are to a great extent aware of the existence of standards, they seem to be reluctant to adopt them. This hesitation is mainly due to the fact that first responders follow specific operational procedures and widely accepted guidelines, whereas are wary of changing their usual ways of operation. In addition, standards, although they provide a uniform operational way and facilitate communication and situational awareness, are strict and limit flexibility. Another deterrent factor, pointed out already in previous cycles of the project, is that formal standards have to be purchased and are not freely provided.

5. Standardization

5.1. Challenges

The current and future challenges analysed by FIRE-IN in the 3rd screening cycle process has been presented in the Deliverable **D3.4 Results of the Request for Ideas: mapping RTOs and Industry potential, response and trends related to FIRE-IN CCC/FCCCs #3.** This report indicates that "… solutions coming from the domain of Standardization, adequately cover the majority of the identified CCCs and FCCCs. There is a great variety of both formal standards and guidelines, which are widely adopted by first responders' organizations. Moreover, in this case, there is no need for high numbers of solutions, as one standard can address, if not all, the majority of challenges, lying within the same capability." This conclusion means that the effort must be on the dissemination of the standards and guidelines that are available rather than the production of new solutions of this type.

Other challenges related to standardization have been mentioned by standardization expert partners during FIRE-IN events.

At the dissemination event on October 14, 2021, in Marseille, during the French National Congress of Firefighters, numerous inputs from standardization experts addressed the FIRE-IN project. Summarized, these main inputs addressed the following:

- In the frame of identifying capability gaps, a "pre-standardization" approach of establishing common needs to enhance preparedness and response capabilities or to support coordination as well as any everyday business, as well as establishing the state of the art and good practices can effectively lead to a standardization process, and one with a higher level of acceptability among practitioners.
- Setting priorities which already fit within the existing standardisation portfolio but fill the gaps to enhance efficiency and/or optimise resources.
- Use a platform for information, knowledge exchange and resources to build up a "pre-standardisation" to develop and validate results and use the S4S platform complementary to engage with a wider community of relevant stakeholders (e.g., communication, law enforcement, etc.)
- Facilitate the uptake of technologies by:
  - o Making coordinated choices of innovative equipment,
  - o Demonstrating added-value and relevance of the investments,

- o Coordinating budget programming for investments and training,
- o Protecting one's investments,
- o Developing interoperability where appropriate, and
- o Establishing common technical specifications

- Capitalizing on practitioner networks: As experts involved in a network, FIRE-IN practitioners can develop and use standards to support coordination, harmonise capabilities, standards and procedures, common language, incident detection and assessment, consolidated and reliable situation awareness, communication, citizen awareness, develop training, conduct exercises and identify lessons learned (identified)
- Support and advise research programming and priorities by addressing pre-standardisation and standardisation gaps, support coordinated investments where appropriate, and protect existing investments
- Use and promote the existing catalogue of solutions to authorities and pick solutions that build on the interoperability of equipment, systems or data and develop conformity assessment means

At the closing event, on October 20, 2022, in Nimes France, Mr. Pertti Woitsch, Chair of CEN-CENELEC Sector forum on Security, presented his analysis of the challenges in the fire & rescue domain.

He indicated:
- The standardisation needs of practitioners are most on common processes 41%, then data sharing 15%, common terminology 11%, community role 9%, training and education 7%, communication equipment 6% and other equipment 6%, best practice sharing 4%, legal & social issues at the end, 2%
- Standardisation needs vs disaster management: response 47%, preparedness 34%, mitigation 14%, recovery 5%.
- Constraints preventing the participation in standardisation:
  - o Lack of resources
  - o The current nature of the standardisation process
  - o Lack of awareness and understanding of the benefits of standardisation

On the day after, during the round table "Overcoming the barriers for innovation market uptake", Patricia Compard, insisted on issues already addressed in the 2nd cycle, i.e.,
- the importance to engage the practitioners in the standardization process to make sure that the standards that are produced are useful and answer their needs.
- the necessity to defragment the market for innovation by using standards that support the convergence of the practices and therefore the specifications of the innovative technologies.

Figure 1: Javier Larrañeta, Patricia Compard and Jean-Bertand Heyral in Nîmes

Finally, still at the closing event in Nîmes, during the panel discussion on <u>"Removing the barriers for the implementation of innovation in the field of F&R"</u>, standardization challenges and needs have been evoked by Ms. Compard, Javier Larrañeta and Jean-Bertand Heyral, in relation with the questions:
- What are the main barriers to adopt innovative technologies in F&R
- How to overcome these barriers?

Some challenges that have been evoked during the panel discussion:
- Need to engage practitioners in the standardization process
- To adopt innovation, there is a need to engage people, users and not only end-users
- Build a market with people talking about their business
- Provide access to all information available in the cloud, determine who can cooperate
- Start-ups are not interested to share their experience in standardization
- Need to prepare the future and anticipate
- Motivate authorities to invest; the cost of not investing is higher in the end
- Introduce "intelligence" in fire protection systems
- Need to harmonize, support interoperability
- Civil Protection market too fragmented, a clear view of the market in each country is needed
- A European PCP market will be required to lower costs

As already mentioned in the previous reports, standardization plays in important role in the context of fire and rescue innovation. Standardization has been defined as:
1. A process to "speak the same language", and establish the state of the art by consensus among experts and define common terms, methods, and solutions within a technical sector,
2. An instrument to facilitate the purchase and use of innovative technologies with the Direct Public Procurement, Public Procurement of Innovation (PPI) and Pre-Commercial Procurement (PCP) (for more details see the § 2.4.3.2 in the pre-cited deliverable D3.51),
3. A tool to share and give access to good practices among professionals and practitioners.

Reducing the distance between the standardization process and the implementation of the standards might be translated in two aspects:

- **Dissemination and promotion of existing standards and reference documents:** provide digested and targeted information on existing standards to the fire and rescue community,

and train and make explicit the content of relevant standards and possibly promote the exchanges of experiences around the implementation of the standard to bridge from theory into practice.

- **Engagement of practitioners in the standardization process**: provide the opportunity to find and engage with other practitioners who might be interested to develop or revise standards on given topics: this can be very stimulating for practitioners.

It is important to demystify the standardization process among practitioners, and to accompany any initiative useful for innovation uptake in fire and rescue.

5.2. Achievements

Taking advantage of the progress during the first 2 cycles and 3 years of the project, the activities during the last period have concentrated on the following activities.

Promotion of standards and guidelines in the FIRE-IN Dossiers

It became apparent that there was a great interest in the standards and guidelines promoted through the FIRE-IN Dossiers. The analytical tools of Mailchimp have shown that the links provided in the dossiers corresponding to the standards and guidelines were the most "clicked". This fact indicates a clear interest in "reference documents" for the professionals and practitioners. All together with the 4 FIRE-IN Dossiers which have been disseminated, FIRE-IN has contributed to raise awareness on standards and guidelines addressing practitioner challenges.
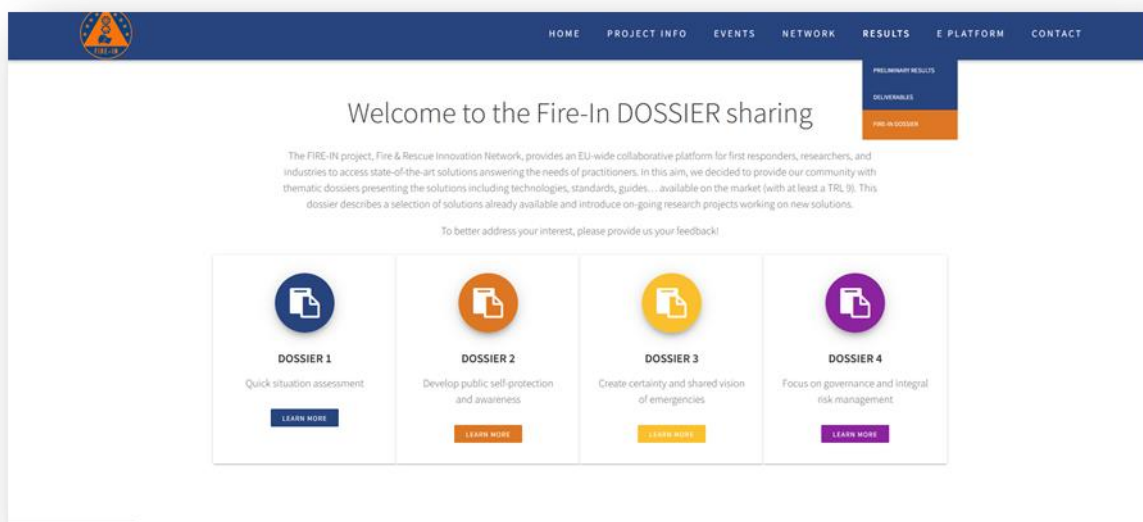
Figure 2: The 4 FIRE-IN Dossiers available on the project website (https://www.fire-in.eu/fire-in_dossier/) with content promoting standards and guidelines

Contribution to standardization process (CEN Workshop Agreement)
FIRE-IN actively contributed to the CEN Workshop Agreement (CWA) launched by the Melody Project: *Basic CBRN training curriculum for first responders and medical staff including first receivers[1].* INEDEV, as a representative of FIRE-IN, has participated in the CWA meetings between April and November 2022, and the drafting of the document taking the inputs and the framework from the Melody project.

Shared vision with standardization leaders
Interactions with many standardization experts, Ms. Patricia Compard and Mr. Pertti Woitsch, during the project have prompted the consortium to sharpen the vision regarding standardization and the role of practitioners in the standardization process. Their inputs and recommendations have supported FIRE-IN to propose concrete activities involving fire and rescue practitioners (cf., Chapter 5). These interactions during almost all FIRE-IN dissemination events have reinforced the proximity that will further facilitate the interactions between practitioners and standardizations committees in the future.

https://www.cencenelec.eu/media/CEN-CENELEC/News/Workshops/2022/2022-03-02%20-%20CBRN/projectplan.pdf

6. Steps Ahead

Research
For the CCCs or FCCCs which are not met by solutions in the field of research, a solution could be considering these fields in research programs as described in Chapter 3.1.

Another challenge to be considered, is the phenomenon of innovations plateauing before they reach full maturity (e.g. TRL 7 or 8), but become stuck at that level also referred to as the "valley of death" (Hudson & Khazragui, 2013). This phenomenon can be related to the logic of research funding. Research programs such as Horizon 2020 or Horizon Europe fund research programs with a limited budget and a limited period of time. These projects usually aim to reach a TRL not higher than 8 – not yet market ready. At that point, project participants would have to apply for further funding or find investors to get the solution market ready. Of course, funding the development to market readiness is a challenge for the European Commission as they would intervene in the market. Still, it could be useful, to fund a transition period to avoid those solutions drop into the "valley of death". In some cases, it can be also useful to steady funding in the follow-up of projects, e.g., to maintain platforms and networks. Establishing networks and trust-building are arguably the most salient outcome of many European-funded projects, however little or no permanent/long-term funding is made available to sustain networking activities and exchanges.

Another problem seems to be the variety of procurement processes in the different stakeholder organizations. In decentralized states, e.g. in Germany, procurement takes place on a municipal level. That leads to the challenge, that achievement might be very small-scale for technology providers. A solution might be standardizing, facilitating, and mainstreaming the procurement processes within the European Union as well as facilitating the procurement of technologies which were developed by

consortia of researchers, practitioners, and SMEs. Furthermore, platforms like the FIRE-IN-platform could facilitate the procurement as these match practitioners and technology providers.

Standardization

Over the whole project duration, it has become obvious that there is a need to democratize and boost standardization in the field of fire and rescue, and therefore reduce the distance between the development of standards and their implementation by practitioners.

With the strong support of standardization experts, the FIRE-IN Project has been able to support standardization activities and demonstrably establish good synergies with other relevant EU-funded projects.

The Next Steps for the standardization agenda are suggested as follows:

Further disseminate and promote existing standards

It is relevant to further use the FIRE-IN Dossiers and other channels to reach the practitioners who are not attending the European meetings organized by CERIS or the EU funded projects. The language is also a barrier that needs to be properly addressed by providing the standards in the national language of the practitioners. Access to the standards related to fire & rescue should also be addressed and made easier. For example, mechanisms should be proposed to offer a consultation free of charge for standards that could be made available by the national federation of firefighters. Indeed, it is not possible to buy standards in each fire station, for instance, but each national federation might purchase a global access to the standards for all staff.

Engage practitioners in the standardization process

Standardization is the key for interoperability, not only technical, but also procedural interoperability among agencies in cases, where cross-sector and cross-border cooperation is required.

However, first responders, although aware of the existence of several standards in their domain, seem reluctant to adopt them, whereas opt for the implementation of widely adopted guidelines. A reason for this could be the lack of participation of stakeholders in standardization procedures.

Moreover, standards, even though they provide a common approach to address an issue, reduce flexibility, which is of great importance, when first responders have to immediately decide and act.

Stakeholders should definitely be involved in standardization procedures.

Especially for the development of standards, which aim at the facilitation of cross-organization and cross-border interoperability, first responders, who have the overall picture of the prevailing situation and of the fragmented procedures that each agency follows, are the most appropriate to address the problem and participate in standardization processes, which focus on the harmonization of operational procedures at an EU level.

If we want to be successful to engage practitioners, good intentions are not enough. It will be mandatory to provide a support and some guidance to facilitate and focus their contributions where practitioner experts will have the greatest impact.

The incorporation of standards in first responders' operational procedures should be of very high priority at a national and at an EU level and governments should support and expedite these processes. Guidelines and best practices should be integrated within standards, thus becoming universally acclaimed and used. Moreover, procurement procedures should become simplified and less costly for organizations.

This activity and support might be taken over by the projects addressing the call: HORIZON-CL3-2022-SSRI-01-02 Knowledge Networks for security Research & Innovation, aiming at strengthening the exchange of knowledge and information for security research and innovation.

Capitalize on procurement innovations for market uptake of new solutions

- The activities related to EU projects and pre-commercial procurement such as the iProcureSecurity PCP project (https://pcp.iprocuresecurity.eu/) should be capitalized using standardization.
- During the PCP, one important phase is the expression of the needs of the purchasing organizations, that specify requirements. The common requirements for the technologies addressed should be translated into technical specifications in a standard.
- At the end of the technological development projects, the protocols for the assessment and the validation of the innovative solutions should also be formalized so that the procedure and the criteria of evaluation could be transparent and repeatable.
  Therefore, there are many experiences and knowledge that are relevant candidates for standardization in the EU funded research projects.
- Reduce costs and bureaucracy in procurement procedures. Procurement procedures should become more flexible and enable the acquisition of new technological solutions bypassing bureaucracy. On the other hand, technologies are becoming increasingly expensive, thus discouraging first responders' organizations from procuring them and, as a result, limiting their potential capacity. This is a very serious problem that needs to be addressed not only by technological developers and providers but also at a higher, political level.

Focus on the "Knowledge Cycle", "Risk reduction" and "Preparedness" Capabilities.
Capabilities not well-covered by technological solutions are first priorities for further research, development, and innovation. More specifically, the "Knowledge Cycle" "Preparedness" and "Risk reduction" include Challenges marked as "red" (cf., Chapter 3 and 4), with the use of the Traffic Light System, i.e., they remain a gap. However, even for these challenges, technology might provide solutions. An example could be technologies related to the training of first responders or educational applications meant for citizens and students. Furthermore, there are Challenges, which are addressed by technological solutions, but these solutions are of lower TRL or are not yet fully developed and integrated in the operational plans of first responders' organizations.

Change in the cultural perspective of the population
Citizens should become actively involved in disaster management. As a first step, the general population should be made aware of all the potential hazards that could occur, through public workshops and informative campaigns, organized by research institutes with the collaboration of municipalities and/or regions. In addition, courses related to natural and manmade hazards should be encompassed in the educational program of schools. Prevention should be cultivated in the citizens' perception at a young age. Technology, as mentioned above, could provide solutions through educative and fun applications addressed for children or adults of different ages. Exercises related to the appropriate reaction citizens should have when a disaster occurs, should be organized. This is common for the case of earthquakes, but such exercises should expand and incorporate other hazards as well e.g., wildfires, floods and extreme meteorological events.

Make use of social media to increase the citizens' level of awareness
Social media enable an immediate and consistent flow of information both among citizens and between citizens and first responders. However, attention should be paid to avoid panic behavior. There are occasions, during which overwhelming information created "noise" and led to miscommunication in operations. Therefore, the filtering of incoming / outgoing information is a crucial factor for the effective and efficient usage of social media.

Development and improvement of essential technologies for first responders

Early warning technologies are in very high demand, with the same applying to crowdsourcing applications, GIS and geolocation systems and risk assessment applications. Taking into consideration that these technology types are highlighted in the various events where first responders participated, future research and development in the EU should particularly aim at further improving and innovating solutions of this nature. Additionally, efforts are needed to break down existing barriers within the practitioner community such as resistance to adopt and use new systems and tools and not only rely on outdated but familiar technologies, with which they are confident and aware of their functionalities. Similarly, practitioners seem to adhere to specific technological providers, thus being reluctant to adopt systems from other providers. This situation leads to conservatism, which further limits first responders' access to innovation and also their potential capacity. On the other hand, some long-term product and service providers have such market dominance that new, potentially more effective solutions are choked-out or cannot contend - this is especially the case with exclusive-use contracts with the EU or governments where a certain supply quota must meet a set level of demand (cf. EU competition rules on distribution agreements).

Open data crucial for efficient collaboration between agencies

Data exist but if they are not communicated and shared among stakeholders, operations become more complicated. It has been observed, that on several occasions, first responders are hesitant or even unwilling to share their information with other agencies. This obstacle can and must be overcome with the use of open data and open-source codes which allow for effective interoperability between different systems and tools.

Train first responders to use innovative technologies

Training for the use of cutting-edge technologies should be an integral part of the overall training processes implemented in first responders' organizations across the EU. Moreover, as highlighted by the participants of the various events, this training should be both initial and recurrent, meaning that first responders should continuously practice the use of state-of-the-art technologies, in order to efficiently and conveniently operate them in emergency situations. Technologies should be easy to use and not require specific scientific background. Ease of use is persistently expressed by first responders as a top requirement, since the deployment of complex solutions, during operations, is impossible, thus rendering these solutions useless.

7. Recommendations

Recommendations provided herein are the outcome of various events that were organized either by FIRE-IN partners or by their participation in international exhibitions. A series of national hubs in Greece, Germany and Italy were organized, the FIRE-IN closing event and the participation in the international trade fair Interschutz 2022. All the events took place during 2022 when restrictions and measures due to COVID-19 had been revoked. The national hubs were also used as the main tool to overcome the language barrier among the participants.

The FIRE-IN National Hub - Germany, was organized and moderated by the Pau Costa Foundation in collaboration with the European Forest Institute. The aim of the workshop was on the hand to establish what solution providers consider as relevant in the coming years and on the other hand to cross-reference these estimations with those of thematic experts working on wildfire management in the German context. The participants consisted of various stakeholders' organizations and research institutes and practitioners across Germany.

The FIRE-IN National Hub - Greece was organized and moderated by the Center for Security Studies with the aim to create a "Hellenic Agenda" with the needs and opportunities of the disaster management community for future research programming, harmonized with the needs of other EU countries. Civil protection representatives from local and regional authorities, researchers and technology providers participated in the workshop.

The FIRE-IN National Hub – Italy was organized and moderated by CNVVF with the aim to demonstrate innovative solutions in five operational areas which were tested in 9 operational scenarios and the direct evaluation of existing equipment, devices, and systems on the market to identify new technologies to be purchased centrally or locally. In the activities of this event, representatives for companies and first responders participated.

The Polish FIRE-IN National Hub was organized jointly by The Main School of Fire Service and Scientific Centre for Fire Protection – National Research Institute. The initiative was implemented through various activities bringing together innovation providers and civil security practitioners. The main event was a conference including speeches from technology suppliers and representatives of the fire brigade presenting experiences from recent events where innovations were applied as well as three discussion panels. Presentations focused on issues such as general dissemination of the results of the Fire-IN project, standardization, technologies in international missions, new technologies developed in Poland for fire and rescue services, the use of drones and robots in fire and rescue services, trends in construction, construction and design with new technologies.

During the Interschutz 2022 trade fair, the FIRE-IN project had the opportunity to promote the project and its results, review the latest technological solutions, discuss with end users, practitioners and technological providers and exchange information related to five working groups. Also, during this event the partners and the invited experts distributed a questionnaire based on the CCCs and the FCCCs of the project to the technological providers and the fire fighters.

During the closing event of the FIRE-IN project in Nimes, partners (practitioners, researchers and invited experts such as standardization experts, first responders and technology providers) participated and the discussion focused on the standardization perspective.

The outcome of these events is summarized below in the form of recommendations for a future research agenda. The structure of the events, the topics discussed, and the conclusions drawn from every event is provided in the annexes.

The main outcome of the various discussions during the last of year of FIRE-IN, but also the essence that we have gained so far is one:

Always be prepared to expect the unexpected and focus on prevention and preparedness rather than response.

In order to respond properly, preparation is the solution. Preventive measures and actions should be in place. Innovation in collaboration with classic techniques and solutions have to be in line and in collaboration. Risk assessment is the best way to identify threats and hazards, to estimate and calculate possible impacts and be used as the guide to take the necessary preventive measures.

This turn to prevention should be a European approach as a whole, to diminish inequalities between the Member States, make sure that this approach is fair and equal for all Member States and organizations.

The recommendations are clustered in the following topics:

Technology, materials, equipment and facilities:

- New technologies for first responders and civil protection agencies exist and gradually enter the civil protection mechanism. Nevertheless, the rate of adopting new technologies is slow and the proper/correct use of these technologies is a key part in order not to create new sources of errors.
- The level of equipment in the various member states is not the same. In some countries newer equipment exists, in other countries the equipment has to be updated.
- The equipment and technologies should cover a variety of hostile environments; thus a variety of means have to be available for the first responders. Tests have proven that not all technologies perform well to all situations, but a significant improvement does exist and is available in the market. The collaboration of industry and academia/research with first responders and practitioners in general can help substantially the development of new products.
- Actions aimed at connecting and matching civil security practitioners (respondents, civil security administration) and solution providers are important: (enterprises, e.g. start-ups, SMEs, technology parks, centers and networks, researchers and academia). Manufacturers and technology providers should be able to demonstrate the capabilities of their solutions and technologies during exercises, trials, workshops, shows organized by rescue services and scientific units, rescuers, in all weather conditions, in various scenarios according to developed methodologies/procedures in cooperation with scientists. The fire protection and rescue community should be aware of the existence of new technologies and the opportunities they offer, and also know them, then they will be more willingly and quickly implemented and used.
- Technology is a main supportive tool but is not sufficient alone!
- Additionally, the proper use requires usual testing, competence centers, overall networking and coordination and in general suitable facilities for the hostile environment in relation to training.

> Keywords
> ***new technologies, updated equipment, variety of technologies & equipment, proper use, enhanced collaboration of practitioners, researchers and industry, suitable, modern, availability, facilities.***

Awareness and Training:

Awareness is one key aspect in order to understand the potential risks that we face. Awareness should be raised in three levels: (a) the political level, (b) the practitioners' level and (c) the level of the community. The whole system of our society and economy needs to understand the concept of hazard, vulnerability, risk and risk assessment. Risk should be communicated to all levels, and this has to begin from the political level. Politicians have to understand risk in order to support the process towards prevention. Practitioners need to improve their understanding to future risks and expect more violent and sudden phenomena in order for this to be properly transferred to the higher levels.
A constant loop of risk communication loop between academia, politics, practitioners and citizens has to be created.
Awareness campaigns through media should be enhanced and become more systematic.
Risk communication can be used to raise awareness in a way that panic is not created!

- Training for citizens and responders is crucial.

Citizens: The understanding of risk, of natural phenomena and other incidents has to be inserted in the national and European educational system from pupils up to the higher education levels.

Self-protective measures training should be regularly made at schools. For example, earthquake exercises, wildfire, flood and similar exercises need to be inserted at the school program. Fire (structure fires) drills should be made frequently.

Classes related to the environment such as Geology and Geography must be enhanced. In addition, the recent international experience from COVID-19 is a risk that we must learn to face for the future; thus, epidemiological and pandemics aspects must be inserted into schools, maybe through a "Biology" class or a "Hazards" class.

Gamification tools and methods can be designed and used for training and risk perception improvement.

Actions, such as "researcher's night" need to be boosted or even "researcher's days" have to be created. Schools need to follow such events.

The International Day for Disaster Risk Reduction could be a day of relevant activities at schools.

First responders: Gamification, serious games, and in general simulations either in a computer or on the field are crucial for first responders. Only through constant and regular training, first responders can be always ready to act. Emphasis should be given to the proper use of technologies and equipment. There is no point of having equipment of technologies if these are not used by the responders.

In addition, training should pass to another level and be common between Member States. Most probably now is the time to start common exercises that enable first responders from various Member States train on how to address a specific phenomenon. Climate change gives birth to extreme events. For example, high temperatures and wildfires was a problem only for the Southern Europe, nevertheless, wildfire phenomena are now recorded in Northern countries and heat waves start to be more frequent. Exchange of standard operating procedures between the various states and good practices will support the process towards an improved training.

Keywords
Education, continuous and regular training, citizens, first responders, common exercises, regular exchange of knowledge.

Personnel and Voluntarism

First responders' organizations should be enhanced with additional personnel and collaboration with experts and scientists should be a priority.

Personnel has to be motivated, available, trained (specialization) and operational.

Establishment of special forces should also be a focus. Special forces capable of operating under difficult circumstances have to exist. Existing forces should be enhanced, new forces have to be created.

As personnel recruitment is difficult due to funding, member states have to use the tool of volunteers. Volunteerism is an excellent way to enhance the available forces, but this has to be done in a proper way. Currently, inequalities and differences to the use of volunteers between the Member States exist. In simple words, volunteers have to be supported in the same way by all Member States. Continuous and regular training, provision of any type of equipment and motives need to be given. One of the simplest is, that volunteers have to be able to "leave" their job when it is necessary, and their salary

has to be paid, nonetheless. Employers do not like to miss employees due to voluntary work, but this is something that has be changed. States need to take over true and complete financial motives for employers and employees. The establishment of voluntarism reimbursement has to also be an obligation for the States.

Organization, coordination and collaboration

The structure of the civil protection mechanism organization and the coordination and collaboration between the various services in the member states and between the member states is the most difficult to be achieved.

Usually its organization, irrespective of its administrative level or operational level, has its own structure and processes.

Collaboration between sectors and domains is heavily influenced by organizational cultures and "silo thinking". Centralized organizations have to exist in order to give the overall guidance but the collaboration between the various organizations should be greatly enhanced. Competence centers should be established.

Flexibility should characterize all types of organizations. Communication and coordination between the various stakeholders, in the case of an incident, is not the optimal and this should be improved.

Roles need to be clear, structural changes, if necessary, should be made.

Cross border collaboration should be enhanced in any possible way. Not only for training but also for similar structure issues, for monitoring of events and other cases. Establishment of liaison officers is a measure that could help and support not only the current situation but a turn to a common structure and approach.

The target to move to a common structure for Europe should be examined carefully, despite the member states differences.

Standardisation, guidelines, common approach

As already stated, common actions and activities should take place. The main tool in this pathway is standardisation either in its highest level through the development, acceptance, publishing and use of new and existing standards or in a more informal way with the publishing of guidelines or standard operating procedures from central to other levels.

First responders should actively participate in the development of standards and should be engaged since the beginning of such procedures in order to transfer knowledge and reduce costs of testing and acceptance.

Also, standards should highly be used and made obligatory in procurement and other processes.

A European approach considering all technology and research trends should be considered for standardisation and it should be centrally European driven, based on good international practices, with the obligation of the Member States to follow it.

European standardisation and guidelines initiatives formal or informal are extremely significant for the success of all the above (training, policies, strategies, improved communication, collaboration, coordination, risk assessment and voluntarism).

8. Conclusions

We had very positive discussions in our National Hubs, at Interschutz 2022, our Closing Event, end-users and technology providers were interested in our CCC &FCCC matrix and technologies are available which can bring solutions to our CCCC and FCCC.

The mutual aid between European countries and the lack of capacities when a major incident involving more than one country occurs is a main topic of discussion. The coordination between 2 or more countries must be managed.

What gaps in interoperability have been displayed:

• Barriers to safe and effective interoperability between national states or in the states
• Transboundary interoperability hampered by different official languages of the Member States
• Diversity of national crisis management systems
• Technical /operational differences (e.g. apparatus, appliance, etc.)
• Various levels of training, SOPs, experience/expertise, etc.

It should be possible to standardize procedures, have a common operational language that is known to all and interoperability trainings between agencies from different countries should also be planned and structured.

Until the standardization process takes place and is accepted by the different parties, we have to create "connections". The most important is to find the best way not to standardize at this moment all technologies in Europe in order to have the same equipment (we must be flexible to implement standards progressively) but to show that there is another way in working together in having the same way to face situations with the own equipment.

Connections:
• between first responders, by getting to understand the neighbour's rescue organization and learn to trust them.
• with the establishment of liaison officers who know perfectly the operating methods of the emergency services of one or more other European countries.
• so that technical equipment can be connected to each other f.e: (we have different fire hoses connection between France and Germany, we just have to provide an intermediate piece like what we have in the Upper-Rhine region in France in F&R services to connect together)
• so that we can communicate together, with a specific tactical net on the field with a provision of specific radio equipment to distribute.
• with more common trainings between the different F&R services working in the boundary regions of our EU members states
• with the realization of Dictionaries explaining the terms we find in the different F&R services procedures, and a "transformation table App" you use arriving in a country, to be able to find the correspondence with own guidelines and technical specifications.

We feel that the insurance policy provided by the emergency services is not well developed or understood. Many technology providers have some fantastic products but they value them at private sector prices. The public sector is not cash rich and the private companies need to understand this.

The other concern is that the public sector is by nature conservative when it comes to financial risk and will often stick with what they know rather than trying something new. This is highlighted by the incumbents having large stands dwarfing many of the smaller start-ups or new products just not being able to compete. Big well-known companies had huge stands and when looking around at the smaller stalls, there were some great quality products available.

Discussions with technology providers:

What are the obstacles to R&D in fire safety and how to overcome them:

- There is the need for a European approach to the problem, the only way to bring out a critical size of industry in our field, which makes it possible to amortize the often, high R&D costs for only a few units produced, often within the framework of the national market.

- Like the beginnings of the European industry cooperation, which has been established since the end of the 20th century with the creation of Airbus, it seems necessary to have a coherent European scheme, endowed with resources on a continental scale and multi-annual programs which should promote the emergence of a real European sector for Civil Protection, and even Humanitarian Action which calls for comparable equipment.

- This European sector, which will have to be proactive and be available in "mission" mode, will be able to facilitate the concentration of R&D resources in this sector and justify their use in terms of volume of outlets. It is also important to have sufficient time adapted to the time scale of researchers and industrialists.

- Enough to make European SMEs evolve towards the critical size of ETI, say from 1,500 to 5,000 employees, also allowing them to compete better in the world against the behemoths that are rooted in emerging and growing countries

9. APPENDICES

FIRE-IN National Hubs

FIRE-IN National Hub - Greece

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Workshop: "Civil Protection and Challenges – FIRE-IN national Hub – Greece – The Greek Agenda"

Introduction

This document describes the organization and the results of the FIRE-IN National Hub – Greece, a workshop on civil protection gaps and challenges in Greece. The Hub was organized and moderated by the Center for Security Studies - KEMEA (WP3 leader) on the 30th of September 2022 09:00-11:00 during the conference SafeThessaloniki 2022, 9th International Conference on Civil Protection & New Technologies.

The aim of the organization of the National Hubs is to overcome:

A) the obstacles and limitations raised by the COVID-19 pandemic and
B) the language barrier often appearing in situations of networking with people from many countries and different cultures.
C) To provide recommendations for the future standardization and research agenda for Greece.

SafeThessaloniki 2022 belongs to the series of SafeGreece conferences which are organized yearly in Greece since 2014. SafeGreece conferences provide the chance for ad hoc meetings, scientific discussions on all types of disasters and interaction among Hellenic stakeholders (civil protection, scientists/researchers and practitioners) covering, at the same time, similar to FIRE-IN topics, purposes and needs. Moreover, the language barrier is eliminated, as oral discussions were held in Greek while presentations were delivered in English.

The workshop was addressed to practitioners, local and regional authorities, civil protection agencies, research and academic organizations, industry and standardization bodies. It was organized and moderated by the Center for Security Studies, partner of the FIRE-IN project and WP3 leader.

The agenda of the workshop included a brief presentation of the project results, presentation of recent natural disasters events and a discussion on current and future capabilities on incident command organization, community involvement and risk reduction. These capabilities were discussed from the point of view of:

- Disaster management challenges in Greece
- Solutions related to these challenges
- Priorities recognized.

The overall goal of the workshop was to create a "Hellenic Agenda" with the needs and opportunities of the disaster management community and to deliver it to the European Commission for future research programming, harmonized with the needs of other EU countries.

The workshop agenda was the following:

09:00 - 09:15: Greetings

09:15 – 10:00:

- Opening presentation: FIRE-IN National Hub – Greece – The Hellenic Agenda (Vagia Pelekanou and Georgios Sakkas, KEMEA)
- Recent experience from Greece: Lessons learned from the megafire of Northern Evia in summer 2021 (George Eftychidis, Satways ltd)
- Recent experience from Cyprus: Arakapas Wildfire Incident – Lesson to be Learned (Nikolaos Kamakiotis, Associated FIRE-IN expert)

10:00-11:00: Open discussion

The invitation to the workshop and a brief description of it are available on the workshop agenda (snapshot is provided in Figure 1) and also on a dedicated blog for FIRE-IN in the conference website.

Figure 1: Snapshot of the SafeThessaloniki 2022 agenda depicting the FIRE-IN National Hub workshop.

During the open discussion, various topics related to the previously mentioned capabilities and challenges were raised regarding all types of natural hazards and CBRN-E working groups, despite the fact that the presentations focused on the working group of landscape fires.

In order to facilitate the discussion and collect inputs that could be further analyzed to address the main topics of interest for the Hellenic Agenda, a brief questionnaire, in Greek, consisting of eleven questions, was distributed to the participants both in paper version and in Slido tool. The questionnaire together with a short informative document about the FIRE-IN project where delivered in printed format to the participants.

In total, 27 persons participated in the workshop from all over Greece, representing various types of organizations / stakeholders. The questions translated in English are provided in the following chapters along with the results gathered.

Event description

Following the agenda, the moderators presented the FIRE-IN project, current status, results and outcomes. The focus was given on the results of the third cycle, on specific results per TWG and on overall topics that are presented and raised in deliverable D3.4 – Results of the Request for Ideas: mapping RTOs and industry potential, response and trends related to FIRE-IN CCC/FCCCs #3.

The FIRE-IN presentation was built in a way to raise specific topics related to recent Natural Hazards events in Greece in order to pinpoint issues of high interest, to demonstrate a connection between all the various risks and to start triggering the interest of the participants for the second part of the workshop, live interaction, and discussions with the participating stakeholders.

It was specifically pointed out that the scope of the workshop was not to focus only on wildfires but to discuss any issue related to the crisis and disaster management that stakeholders in Greece face or may face in the future. The topics that were mentioned, specifically as trigger elements for discussion, focused on the following civil protection challenges in Greece:

- the case of earthquakes in Greece as a "good example" and best practice and how this can be used as the basis for other natural hazards,
- recent extreme weather events,
- the use of new technologies,
- places for shelters and evacuation routes and guidance,
- the use of 112 and further improvements,
- the use of social media and the training of citizens, culture and education on risk,
- risk awareness and communication issues and,
- related policies.

Figure 2: Civil protection challenges in Greece. Indicative photo collage of the respective presentation.

The presentations that followed, focused on recent wildfire of Evia island 2021 in Greece and the Arakapas wildfire in Cyprus in 2021. Several aspects on disaster management have been discussed as well as lessons learned from these important wildfire events. The two presentations provided valuable input for the evolution of the wildfires, raised issues on the prevention actions and the role of forest services and local communities, the preparedness and response efficiency of the fire service, the awareness and training of citizens and the evacuation and incident command organization.

In addition, as stated previously, a questionnaire written in Greek, was shared with the participants using the online Slido tool and in a printed format as well. The participants were invited to fill in the questionnaire at their own pace during the discussion session. The questionnaire was used as a means to collect information related to participant's expertise, their opinion on new technologies and issues related to preparedness, response and in some extent to the restoration phase (e.g. engagement of citizens, command and control, risk perception and reduction). It must be mentioned that the questionnaire was anonymous and did not contain any information that may be used for the identification of the respondents. The questions and results from the analysis of the answers, are also presented herein in English.

Questions and results

The questionnaire, shared with Slido and distributed in hard copies, is presented below. In total, 27 completed questionnaires were collected by the participants. Following the questionnaire, the results are presented in the next sections.

Questionnaire

Question 1: What type of organization do you represent? *Select from the list below.*
- Research/Academics
- Local and regional administration, including local/regional civil protection
- Central administration (ministries, central civil protection)
- Practitioners
- Other (please describe): ….

Question 2: Which type of hazard (natural or man-made) from the ones mentioned below, do you consider as most important in Greece, for the next 15 years? Please select maximum of two hazards.

- Earthquake
- Landslides
- Tsunami
- Volcano
- Wildfires
- Floods
- Extreme weather events
- Technological accidents
- CBRN-E (e.g., COVID-19)
- Combination of natural hazards and technological accidents
- Terrorist attacks
- Other (please describe):
    ………
    …

Question 3: To which of the following topics **related to prevention and preparedness**, would you focus more on the future? *Select maximum of three options*.

- Training of the general public in understanding and facing risks
- Reinforcement of volunteering organizations.
- Training of first responders
- Provision and use of new technologies
- Risk assessment studies
- Improvement of emergency response plans
- Improvement of critical infrastructure
- Use of lessons learnt from past cases
- Improvements in the use of 112 emergency response number
- Reducing vulnerabilities (e.g., reinforcing buildings, reinforcement of slopes, cleanup of public and private land)
- Use of commonly accepted and standardized methods of training
- Creation and communication of evacuation plans, routes and places to the general public

Question 4: To which of the following topics **related to response**, would you focus more in the future? *Select maximum of three options*.

- Use of new technologies (e.g., use of drones, real-time risk assessment, …)
- Establishment and/or improvement of specialized forces (e.g., on foot forces for wildfires, special units for responding to disasters)
- Provision of new equipment (mechanic, personal protective equipment)
- Reinforcement of teams of volunteers with the necessary equipment
- Improved centralized coordination between the stakeholders during a crisis (e.g., better central coordination bodies)
- Policy for evacuation
- Provision of aerial means (e.g. firefighting airplanes)
- Reinforcement of command and control centres (mobile, local, regional, stationary)

Question 5: According to your opinion and expertise, which is the biggest challenge in organizing procedures for managing crises and disasters in Greece (please describe in a free text format):
………
………
………
………………

Question 6: The engagement of citizens and volunteers is crucial for:
- Prevention & Preparedness
- Response
- Restoration

Question 7: What do you think is necessary in order to engage actively more citizens and volunteers in the disaster management?
- Communication and awareness

- Special training to respond to incidents in their area.
- Organization in official groups of volunteers.
- Training programs in schools.
- Other (please describe):

…….

…….

Question 8: Which of the following technologies do you think that contribute/can help to risk reduction? Please select a maximum of three options.

- Mobile applications for awareness purposes of local residents.
- Mobile applications for data collection from local residents and tourists (crowdsourcing) during incidents.
- Mobile applications for data collection from local residents and tourists (crowdsourcing) for preventive actions (e.g., fallen trees, cleanup of private and public land, various issues in water streams, etc.).
- Mapping applications (GIS) for local organizations.
- Use of drones (UAVs).
- Use of ground robots (UGVs).
- Early warning applications.
- Risk assessment applications.
- Other (please describe):

……

Question 9: Which policies do you consider contribute the most to risk reduction? (form the options below you can select multiple ones).

- Development of regulations (e.g. building codes, laws).
- Citizen awareness.
- Establishment of groups of volunteers and incorporate them to the civil protection mechanism.
- Continuous training of citizens and professional practitioners.
- Continuous upgrade of available equipment.
- Integration of new technologies.
- Other (please describe):

………

Question 10: According to your opinion, which topic of the disaster management should be funded more/given priority **in the short term**? Please write down a small phrase (e.g., education and planning of evacuations, ….).

Question 11: According to your opinion, which topic of the disaster management should be funded more/given priority **in the long term**? Please write down a small phrase (e.g. education and planning of evacuations, ….).

Results and analysis

According to the results of the first question (*Figure 3*), the majority of the participants are first responders and researchers. More specifically, researchers represent 41% of the sample of participants, while practitioners and civil protection sum up to 48%. Also, critical infrastructures and other organizations represent the rest 10% of the sample. Industrial representatives are covered to an extent from critical infrastructures, in terms of needs but not in terms of solutions.
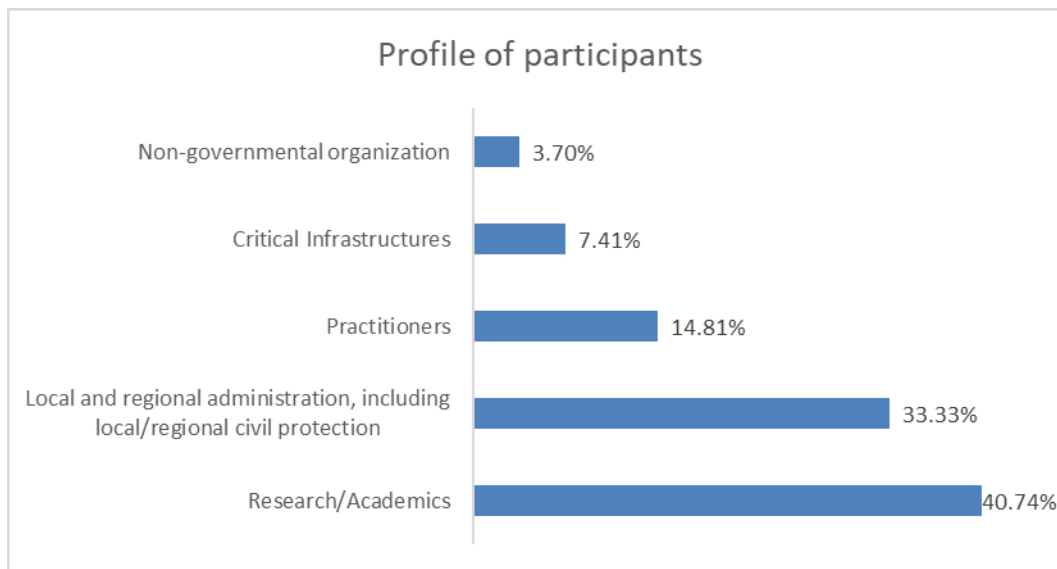
Figure 3: Profile of the participants in the Hellenic National Hub.

Regarding future risks in Greece (*Figure 4*), wildfires is the most voted risk with 33%, closely followed by earthquakes with 31%. This is an expected outcome, at least for the case of Greece, as the three most usual risks are earthquakes, wildfires and floods. Earthquakes can occur any time of the year while wildfires have a seasonal character. It is quite interesting though, that extreme weather events scored third among the various risks. This could be explained to a large extent due to recent weather phenomena in winter, such as snowstorms even in the capital of the country, and extreme heat events during summer Floods are not considered of high risk mainly because they are concentrated in smaller areas, despite the fact that climate change plays a key role in such kind of phenomena. For the other types of risks, the percentage is again very low (2%) which is more or less expected.
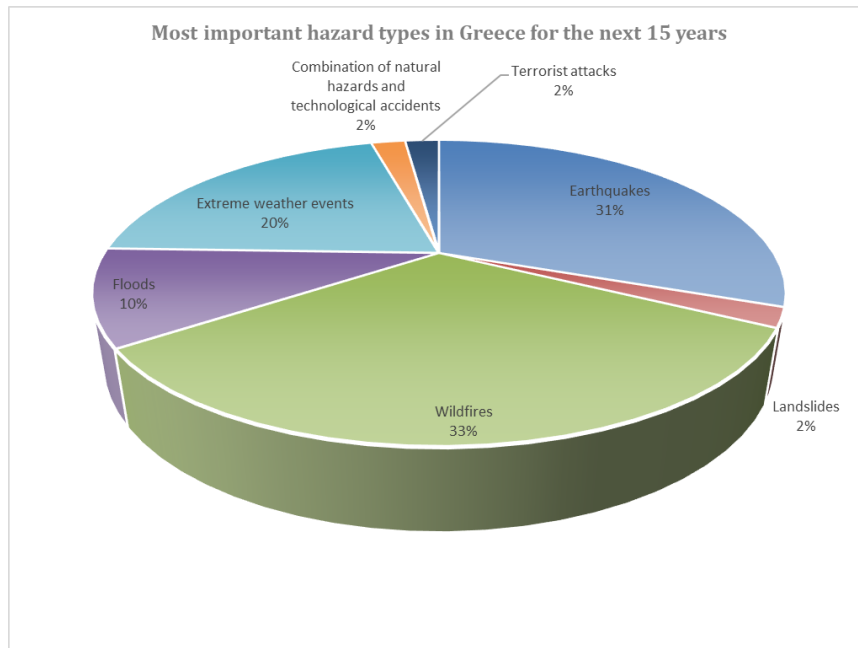
Figure 4: Hazard type (natural or man-made) considered as most important in Greece, for the next 15 years.

According to participants' opinion (Figure 5) training of the public for understanding and facing risks is by far the most important topic related to preparedness, to focus on in the future. Training of first responders is important as well as risk assessment studies and the provision of new technologies.

For issues related to response (Figure 6), the use of new technologies in the response phase has the highest score (24%), followed by the need for improved coordination between the various stakeholders during a crisis or disaster event (19%). Moreover, the establishment of specialized forces is crucial for the future response (17%). Other topics, such as the reinforcement of volunteers are also in the agenda related to the future response. It is also important to note that the reinforcement of command-and-control centres and provision of aerial means are not high in the agenda.
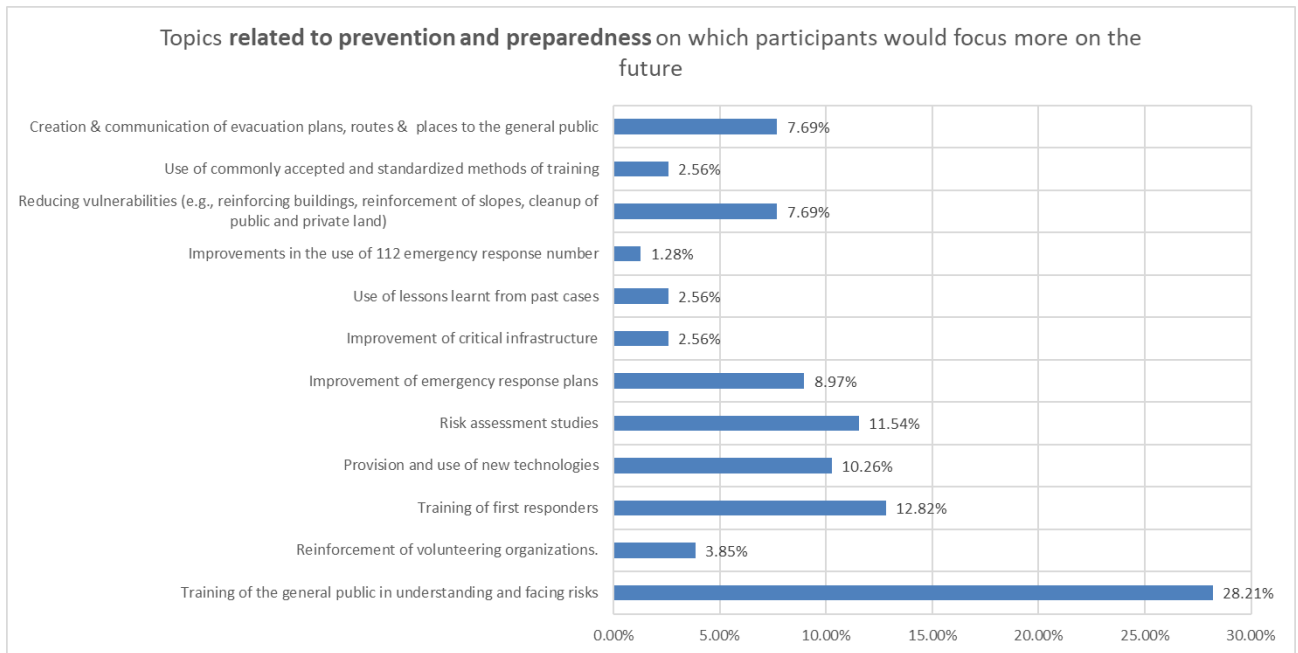
Figure 5: Topics related to prevention and preparedness focus more on the future.
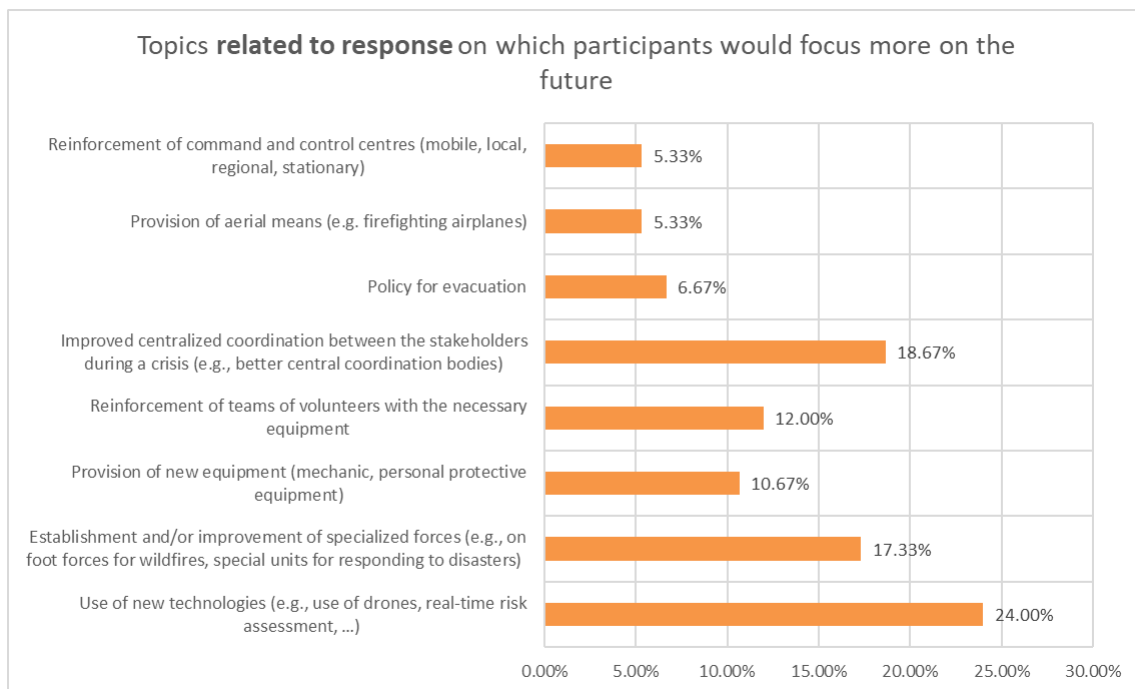
Figure 6: Topics related to response and preparedness focus more on the future.

Responses to the form of free text in question 5 on the biggest challenge in organizing procedures for managing crises and disasters in Greece, the coordination among the involved stakeholders, regardless of the level of administration and type of the organization is most probably the most difficult issue that

has to be achieved in Greece during the next years (Figure 7). This is a logical aftermath, since efficient coordination and interoperability between different organizations and countries is already highlighted by FIRE-IN.

Regarding the engagement of citizens and volunteers (Figure 8) it is considered more crucial for the prevention and preparedness phases (approximately 48%) and less during the response phase. It is also important to note, that the participants highlighted the role of the citizens during the restoration phase as well.

In order to engage citizens (Figure 9), the following means have been proposed to make them more active:

(a) communication of risk and awareness,

(b) special training to respond to incidents and

(c) training programs at schools.

It is very interesting that special training to respond to incidents scored almost equal to risk communication and awareness issues.

Regarding technologies that could help risk reduction, it is quite interesting that risk assessment applications, early warning applications, GIS applications and data collection for prevention through mobile applications have similar scores (Figure 10).

Regarding policies that contribute to risk reduction, it is clear that continuous training, development of regulations, standards, use and integration of new technologies to current procedures and citizen awareness are the key factors to new strategies and policies (Figure 11).

Figure 7: Cloud of words depicting the question on what the biggest challenge is in organizing procedures and managing crises and disasters in Greece.
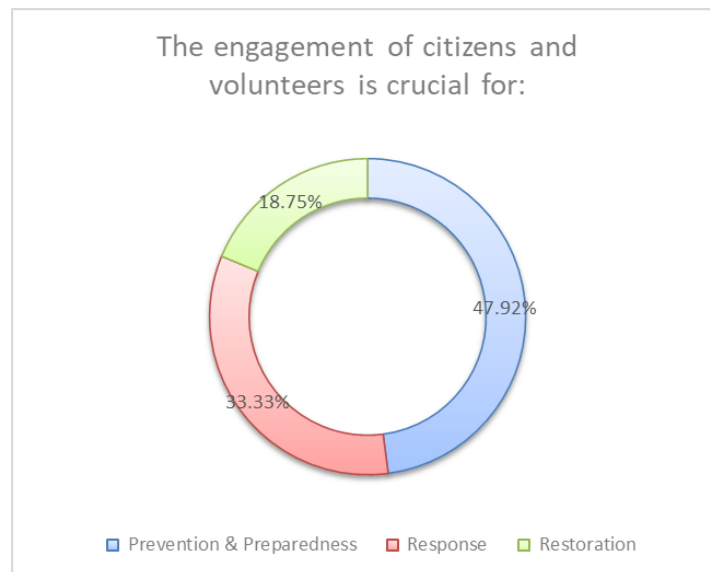
Figure 8: What is crucial for the engagement of citizens and volunteers.
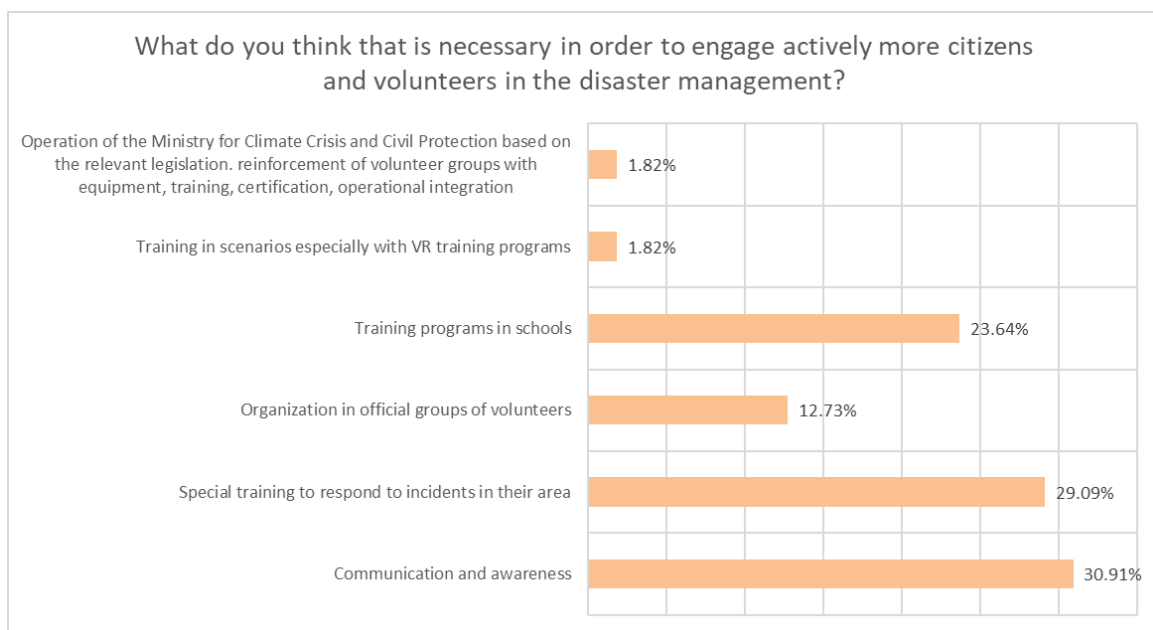
Figure 9: Necessary actions for the active engagement of citizens and volunteers what consider as most necessary according to the participants of the workshop.
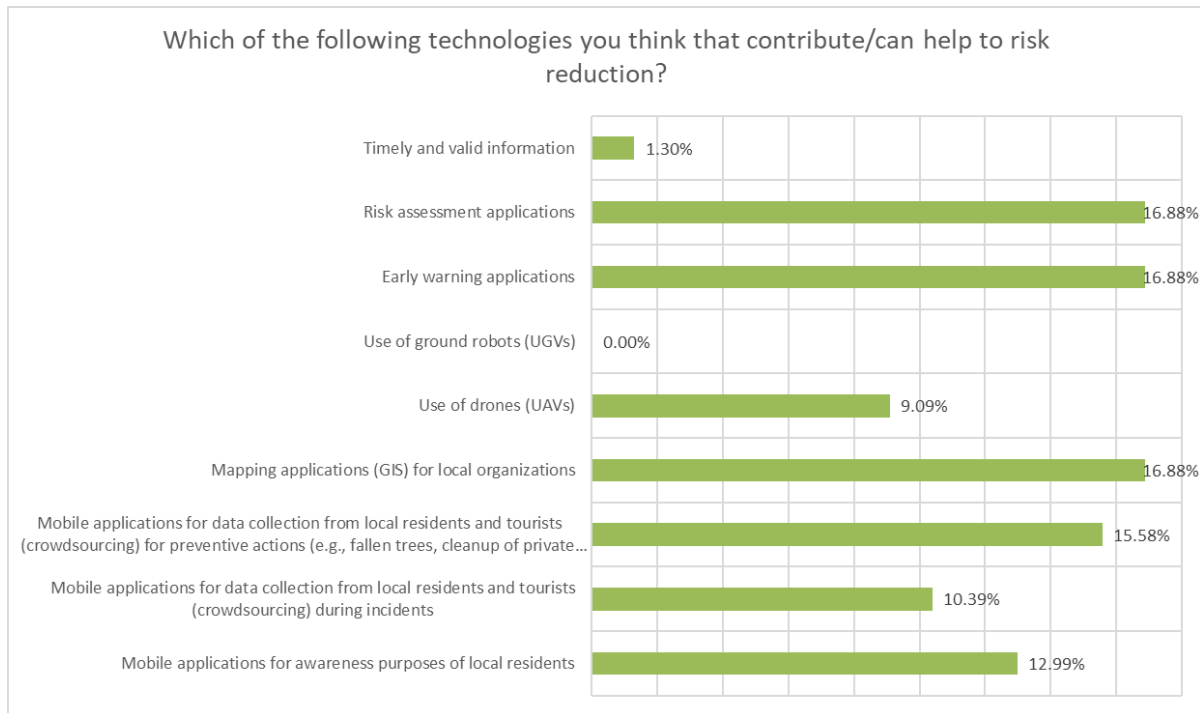
Figure 10: Technologies that can contribute to reduce risk.
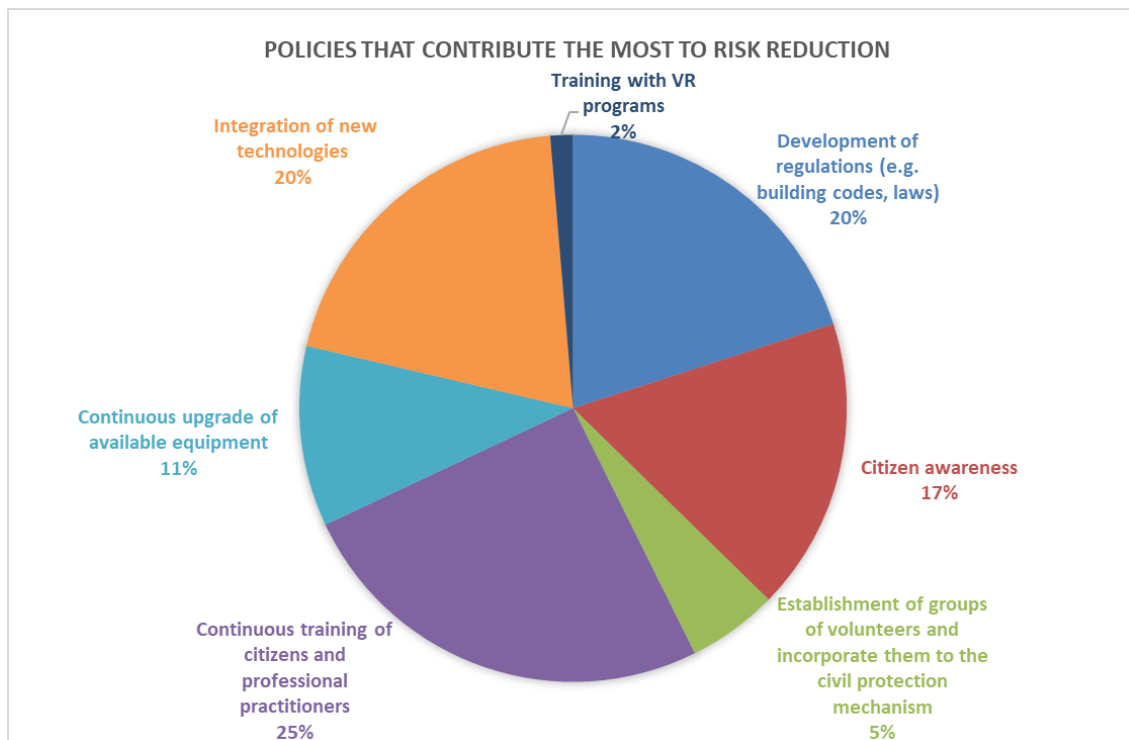
Figure 11: Policies that can contribute more to the risk reduction.

Finally, from the answers to questions 10 and 11 regarding which topics should be given priority and/or more funding in the short and long term, respectively, the answer is straightforward and without any

doubt. Training of citizens and first responders, and prevention are the two main topics that dominate these two questions. This is very well depicted in a cloud of words of Figure 11 and 12, respectively.

Figure 12: Disaster management short term focus according to the participants opinion.

Figure 13: Disaster management long term focus according to the participants opinion.

Open discussion

During the discussion all participants had the chance to express their opinion freely, based on their experience, and to propose any type of measure for all kinds of risks that were put to the table. In

general, it must be stated that the participants of the workshop actively provided their opinion and the workshop was extended for approximately two more hours. The scope of this workshop was to reveal and document the main topics that are of concern for disaster management stakeholders and also to provide recommendations regarding where future research could focus on, in order to provide opportunities to fill these gaps to the maximum possible extent and increase safety, reducing the adverse impact of natural hazards.

Earthquakes represent the natural hazard phenomenon with the greatest risk in Greece. Large earthquakes such as the 1978 event in Thessaloniki, the 1980 event in Almyros and the 1981 event in Alkyonides, triggered the need of creating a public organization that deals with the planning of an anti-seismic policy in Greece. Thus in 1983 the Earthquake Policy and Protection Organization was founded (OGG 52/A/25-04-1983). Since then, its main goal is to develop policies, to train citizens and professionals in seismic response and to create a culture against earthquakes. In parallel, risk communication, citizen awareness actions and training programs for the general public and especially in schools have created a culture that is related to earthquakes. Greeks have learned to live with earthquakes and the improvement is continuous. Moreover, Greece, as all European countries, is harmonized with the respective Eurocodes (Eurocode 8) which have become legal documents. Unfortunately, regarding other risks in Greece, the situation is not the same. Nevertheless, a centralized organization/institute, especially for the wildfires (*Figure 4*) has been a topic for discussion considering the importance and impacts of wildfires in Greece.

Other risks have not received the attention of earthquakes due to their lower probability of occurrence or their limited impacts. Tsunamis and landslides are considered as secondary events and are examined only in relation to earthquakes and not as separate hazards. Especially for tsunamis, in Greece, planning and jurisdiction can be found mainly in the earthquake Action plan with the code name "EGKELADOS" or in the Action plan for floods with the code name "DARDANOS" as response to tsunamis is considered similar to that of coastal floods.

Nevertheless, although tsunami is a type of risk triggered by offshore earthquakes, onshore or offshore volcanoes, onshore or submarine landslides, its management at prevention (with building laws), preparedness or response phases should differ, also due to its dynamic character.

In addition, the Hellenic National Tsunami Warning Center is a unit under the supervision of the Institute of Geodynamics of the National Observatory of Athens and is based on Standard Operating Procedures published by UNESCO. Its operation is identical to other national and regional centers, thus enhancing its validity. This highlights the fact that standardization is crucial for alerts and is an example that could be used to other risks as well.

In general, it was pointed out from the participants that each risk is unique, a risk assessment culture must be developed and each risk has to be studied both independently and in the context of multi-hazard approach.

A significant issue raised by the participants is the fact that the lesson of geology in secondary education does not exist since the late 1990s.

Another interesting topic raised is the issue of communication of the magnitude or size of wildfires in objective/standardized terms. For example, earthquakes are reported with commonly accepted measures and even for a non-earthquake expert, it is easy to get an understanding of the size of the earthquake as a hazard (e.g. small, moderate or large). For wildfires or other hazards, there are no specific criteria for the characterization of a fire, that can be widely recognized and used.

It is interesting that currently Greece among the European countries holds the first position of deaths, , due to lightning. Nevertheless, self-protection measures are not widely known among the general public.

The issue of risk communication to citizens has been thoroughly discussed. Regarding wildfires, despite the fact that from time-to-time campaigns through media are organized, especially during summertime, these are not consistent and systematic. The use of social media may be beneficial for the exchange of direct information among citizens but miscommunication or even panic can be easily spread should proper caution is not taken. In this respect also self-protection measures for wildfires, floods, tsunamis, landslides, volcanoes and CBRNE events, although existing are not well communicated. One very good example of this situation is the case of the 2020 Samos earthquake. The offshore earthquake produced at least two tsunami waves. Residents of Samos Island, instead of moving inland and towards higher ground, stayed at the coastline filming the sea invading the island. Only, when they realized that the water invaded inland more than usually, did they start moving to higher ground. This is the typical example of the Sumatra 2004 earthquake and tsunami, when the shoreline receded, tourists went to the submerged areas instead of moving to higher grounds. This is a clear lack of knowledge and risk awareness. On the contrary, self-protection measures for earthquakes are more well known by the Greek people.

Training of citizens, risk communication and the role of the educational system towards this direction has been highlighted. An example, pointed out during the workshop, is the case of road safety. Unfortunately, Greece had a negative high in deaths and accidents on the roads. Since the late 1990s when more than 2,000 persons died in road accidents, through a program for informing people on road safety and the improved infrastructure, the number of deaths has decreased to approximately 600 in 2021.

The General Secretariat for Civil Protection has issued guidelines for various risks in eight languages. Unfortunately, the majority of the general population is unaware of these guidelines and so are tourists.

The use of 112 service is another topic discussed and especially its frequent use for evacuation in the case of wildfires. Strong objections have been raised, especially for the case of the Euboea 2021 wildfire and the way that the authorities have used "evacuation" as a means to protect the public. Despite the fact that there were no casualties during the Euboea 2021 wildfire, the forests of North Euboea are almost completely destroyed thus affecting not only the environment but also the local economy. Many residents that denied to evacuate and decided to organize unofficial volunteer response teams, managed to save their properties and villages. On the other hand, the villages, which were evacuated by all the residents after receiving the 112 service messages, were totally burned. Although the relevant legal framework of evacuation in Greece describes an organized structure and way of transferring people away from unsafe areas. 112 messages were sent to the citizens for immediate evacuation with light information on which area they should move and sometimes through specific roads but without prior knowledge and guidance on evacuations. Thus, raising also, a matter on how well prepared these evacuations were. Another important issue was that even though evacuation is not mandatory by the law, the people who decided to stay and protect their properties were forced to move away.

In some cases, evacuation routes and places for shelters are well communicated. For example, according to the input provided by the workshop participants, in Chania, Crete, Greece, the local authorities have made public the places for shelter in case of earthquakes in the bus stops. Also, in

Thessaloniki, Greece, local authorities distributed maps with the respective shelters. However, for the majority of municipalities places for shelters have been planned but these are not well communicated.

Another example that has to be mentioned is the fact that despite Greece is a country with 15,000 km of coastline, signs for evacuating in case of tsunami simply do not exist.

Volunteers is another issue for Greece. Volunteers may be divided into two classes, the ones that are registered to a volunteer organization and the spontaneous ones. The latter case is more frequent in Greece, especially for emergency cases, such as wildfires. Currently, for a volunteer organization to be recognized by the General Secretariat for Civil Protection, it is mandatory to be registered to the national "Civil Protection Volunteering Register" (Law 4662/2020). Issues regarding the operation of this registry have been mentioned. In addition, the training of the volunteers is a challenge as well, despite the fact that this is regulated by the respective law (Law 4662/2020). Overall, the use and management of volunteers prior to and during a forest fire/wildfire does not seem to work properly.

In the case of wildfires, preventive measures for settlements are not practically followed. Safe zones around settlements have not been created and in many cases, settlements invade the forests creating the so-called Wildland Urban Interface (WUI) areas or mixed zones of settlements and forests without any preventive measures. Safe zones are not necessarily bare zones but can be green zones consisting of vegetation that is difficult to be burnt. Additional measures may be applied such as safe zones with water supply.

Planning, especially for the case of wildfires, must be made in collaboration with local organizations and residents as they are the ones that know the area better than anyone else. This is valid for all hazard types but for wildfires and extreme weather is more crucial.

The "daily fire risk" map of the General Secretariat for Civil Protection is a useful tool, but it is not enough to deal with violent, extreme and scale-dependent phenomena. The "daily fire risk" map is being used as a national basis for alert and standby, however improvements are required.

Jurisdiction and incident command organization is inefficient during large scale and difficult incidents. These events require deep tactical and operational knowledge by the first responders, a common operational picture for the involved stakeholders and common procedures for all the relevant authorities. At this point, and especially for the coordination part a gap exists, something that has been noted by many participants. Connection and coordination between the central administration and local/regional one must be improved.

Moreover, lack of collaboration between public organizations in the prevention and preparedness phase strongly exists. Data may exist, but these data may be "closed" under one organization without the willingness of being shared with others. In addition, sometimes, specific fees for data and information sharing even between public organizations may exist, making the process even more difficult resulting in disasters. This is the case, especially for land use management and ownership management by the various involved stakeholders.

The collaboration of first responders with scientists for prevention/preparedness, response and restoration is crucial in order to minimize the impacts of the various risks. Nevertheless, this is not the case and this collaboration must be enhanced. Some of the risks that Greece faces require a deeper knowledge by the personnel that manages these events.

Fire bans is an issue that was mentioned extensively by the workshop participants. The question raised is the following: "Are fire bans a proper measure to protect our forests in cases of high winds and high temperatures?". In Greece, bans and restrictions of people in forested areas applies when the

conditions are favoring for a forest fire. However, arsonists still find ways to enter forests and light up a fire. Participants claimed that these bans are used from stakeholders as a way of disclaimer and transferring of the liability. Instead, it is proposed that these bans should be avoided since residents that simply make a walk in the nearby forest act as a patrol unit that discourages arsonists.

Jurisdiction and responsibilities are a hot topic in case of wildfires in Greece. In general, the change of jurisdiction of firefighting in forests is not working in favor of the forests. Fires in forests must be confronted during the first minutes in order to maintain control of the fire.

A common opinion between the participants is that aerial firefighting means such as airplanes and helicopters are not a panacea for combating and suppressing wildfires. Aerial means should exist in collaboration with other tools, such as citizen engagement, risk awareness and the existence of specialized teams.

Safety and security are a way of thinking and a cultural issue. The culture of safety must be embedded in the citizens' perspective. The "expect the unexpected" phrase must be cultivated to the citizens.

Finally, harmonization and standardization are also a key issue. Again, earthquakes are a good example as standardization exists for many years. For example, the various soil types used for seismic studies are based either on the European standard of Eurocode or the American (USA) classification. Data regarding the vegetation of an area are not common among forest offices in Greece. Standard classification could be used by all forestries, not only in Greece but across Europe. For example, CORINE classification could be a starting point for common land use management. Other classifications used by esters could be used but the goal is all to use the same.

Overall conclusions and recommendations

Based on the discussion made during the workshop and the responses to the questionnaire it became clear that challenges, current and future, related to civil protection issues in Greece are similar to the ones that have been identified through the FIRE-IN project, thus having a European perspective. Climate change has made clear that some of the incidents that we may face may appear more frequently and violently than usual. Nevertheless, each country faces its own problems that are based on the structure and system of the country.

The following recommendations are provided as an outcome of the FIRE-IN National Hub – Greece and priorities for the future (short and long term):

- **Enhance citizens awareness, risk communication and citizens training**:
  The understanding of risk, of natural phenomena and other incidents must be inserted in the national educational system from pupils up to the higher education levels.
  Classes and lessons for Geology and Natural Environment and similar ones must be included in the educational program in schools. The recent international experience from COVID-19 is a risk that we must learn to face for the future.
  Training for response in case of emergency must be organized at schools. For example, earthquake exercises are being conducted in schools. Such programs must be extended to more schools and more hazards.
  Gamification tools and methods can be designed and used for training and risk perception improvement.
  Awareness campaigns through media must be enhanced and become more systematic.
  Actions, such as "researcher's night" must be boosted or even "researcher's days" must be created. Schools must be urged to follow such events.

The International Day for Disaster Risk Reduction must be a day of relevant activities at schools.

- **Enhancement of volunteers and improved organizational structure of volunteer organizations**:
  Volunteers must be well equipped and trained.
  Other measures must be applied such as motives to become a volunteer and safer working environment for volunteers.

- **Risk assessment**: hazard identification, all-hazards and multi-hazard approach must be embedded. "Expect the unexpected" not only for the citizens but for all levels of administration and first responders

- **Improved coordination**: clear roles, changes in the structure and establishment of standard operating procedures common for all involved stakeholders with a cross-organization and cross-level approach. In addition, the cross-border aspect has to be considered before establishing new procedures.

- **Establishment of specialized forces**: specialized forces capable of operating under difficult circumstances must exist. Existing forces must be enhanced, new forces must be created. For example, in firefighting, aerial means are not the sole solution. Aerial means are just one piece of the puzzle and not the whole. Forces that are capable of going deep into the forests must be created. A first step has been made with the announcement of creation of such teams for firefighting.

- **Use of new technologies**: new technologies gradually enter the civil protection system but the rate of adopting new technologies must be increased. Also, the proper use of these technologies must be planned, through proper and recurrent training and understanding of the problem, which may be different each time. For example, new technologies may be used to improve coordination, to obtain a common operational picture and to warn and alert people and responders. Proper use is critical.

- **Upgrade of equipment**: existing equipment must be well maintained and new equipment must be used to increase efficiency. But only focusing on aerial means is not the solution.

- **Continuous training of first responders**. Training should be based on traditional but also on innovative tools. All types of exercises can be an efficient tool for improvement.

- **Earthquake management must be used as a guide for other hazards as well**. The establishment of an organization similar to the Earthquake Planning and Protection Organization is important for the other hazards well, starting with forest fire hazard.

FIRE-IN National Hub – Italy

SFO 2022

The CNVVF, partner of the FIRE-IN project, as part of the activities as a national HUB carried out in the week from 3 to 7 October, in the experimental Training centre of Montelibretti (Rome), an event of demonstrations of innovative solutions in five operational areas of first responders, also emerged during the three FIRE-IN cycles.

Demonstrations and tests have interested the following types of systems, technologies and

equipment:

1. Innovative radio telecommunications technologies

2. Improved vision in the opaque and night environment

3. Individual safety of the firefighter operator

4. Recovery interventions of persons who have fallen into small wells

5. Augmented and virtual reality

Companies were also invited through the FIRE-IN website. Among the participation proposals received, 30 companies were selected who presented 40 products, tested in 9 operational scenarios by 25 first responders divided into 4 teams.

Took part in the activities as guest representatives of Val d'Aosta Fire Brigade, Bolzano Fire Brigade, Trento Fire Brigade, Italian Army, Italian Civil Protection Department and Vatican State Fire Brigade.

The outcomes of the tests conducted were evaluated by approximately 70 observers from the area facilities and 25 "experts" operators who directly employed the equipment themselves.

The evaluations were collected through pre-coded forms referring to each equipment/device tested.

The main objectives of the event can be summarized as follows:

- Direct evaluation of existing equipment, devices, and systems on the market to identify new technologies to be purchased centrally or locally

- Possible development of technologies deemed of interest, including through collaboration with institutional partners such as Universities and Research Organizations and other administrations

- Development of collaborative synergies with other Agencies and Administrations, useful in complex interventions (e.g., rescue in small diameter wells)

- Acquisition of information about the potential use of proposed technologies to Fire Services activities. , with particular reference to augmented/virtual reality.

Recommendations:

- Some technologies tested, as Radio communication accessories, such as cranial microphones or laryngophones that facilitate communications for the operator by implementing safety (cranial microphones or laryngophones), are already on the market, and provide a good response to the needs of first responders. In this case, drills allow you to channel several similar products into the same scenario and test them simultaneously to learn which ones are best suited under different operating conditions.
- Other products on the market do not yet provide a good answer to the needs of first responders, but the technologies are promising. Tests conducted by experienced personnel enable to provide guidance to companies to make the necessary changes.
- Other technologies alone cannot provide an adequate response to the needs of first responders, but combined with other technologies they can provide the basis for developing promising solutions. This week also fostered contact between research organizations and companies useful for the development of further research into solutions.

- In conclusion, the creation and support of national hubs may be the most important solution to continue the work done so far in the three project cycles. Further step can be provided by the creation of a coordination of the national hubs.

FIRE-IN National Hub- Germany

Summary prepared by Prof. Dr. Markus Bresinsky, Prisca König, Johanna Schröder (Ostbayerische Technische Hochschule Regensburg) and Lindon Pronto (Pau Costa Foundation / European Forest Institute)

October 2022

INTERFORST exhibition Munich – Workshop "Future challenges of forest fires in Germany" (as side event) June 17, 2022

Summary
The Pau Costa Foundation, coordinator of the FIRE-IN Thematic Working Group "Landscape Fire Crisis Mitigation" in cooperation with the European Forest Institute, coordinator of the Waldbrand Klima Resilienz (WKR) project with the Forstliche Versuchs- und Forschungsanstalt Baden-Württemberg, and the Ostbayerische Technische Hochschule Regensburg (OTH Regensburg) developed a workshop to estimate the likely major challenges for landscape fire management in Germany in the next 10-15 years which took place on July 17, 2022. The aim of the workshop was to on the one hand establish what solutions-providers deem as relevant in the coming years and on the other hand cross-reference these estimations with those of thematic experts working on wildfire management in the German context. The workshop was part of a series of Fire-IN National Hub events which place in different countries in 2022. The FIRE-IN project (2017-2022) 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 standardization programs supported by the European Commission. In addition, FIRE-IN aims to share the knowledge on best practices and already available solutions in the field of Fire & Rescue.

The workshop was designed by the teams from the PCF, EFI and the OTH Regensburg to encompass three parts; in the first part – the input phase – three speakers gave short presentations on current challenges in wildfire management. Following this initial warm-up, the participants were asked on part two to complete a SWOT-analysis on fire management from their respective organization's point of view. Finally, the results of the previous analysis were discussed and developed into specific requirements and needs for the future.

The following organizations participated:

- Pau Costa Foundation (PCF)
- Ostbayerische Technische Hochschule Regensburg (OTH Regensburg)
- Technisches Hilfswerk (THW)
- Fraunhofer-Institut für Naturwissenschaftlich-Technische Trendanalyse INT
- European Forest Institute (EFI)
- Forstliche Versuchs- und Forschungsanstalt Baden-Württemberg
- Prepared International
- Feuerwehr Erlangen & Forst
- Staatliche Feuerwehrschule Regensburg
- Draeger
- OroraTech - Luft- und Raumfahrtunternehmen
- Bosch
- Versicherungskammer Bayern
- Ministerium für Ernährung, Ländlichen Raum und Verbraucherschutz Baden-Württemberg
- Kuratorium für Waldarbeit und Forsttechnik
- Skyseed
- Wahlers Forsttechnik

Part 1: Presentations
The initial presentations served two main goals: first, to place the workshop in the context of the FIRE-IN project and second, to stimulate the participants for increased cooperation and more active work phases planned in the context of Germany's wildfire challenges. The following topics were presented:

1. "FIRE-IN Future Fire Response Challenges in Europe", speaker: Lindon Pronto (PCF/EFI)
This presentation placed the workshop within the FIRE-IN project (2017-2022). It 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 standardization programs. In addition, FIRE-IN aims to share the knowledge on best practices and already available solutions in the field of Fire & Rescue.

2. "Waldbrand Klima Resilienz", speaker: Alexander Held (European Forest Institute)
This presentation introduced the Forest Fire Climate Resilience (WKR) project (2020-2023). It aims to enhance wildfire management capacity in Germany by adapting internationally available best practices to the German context. WKR promotes awareness of integrated fire management and the need for effective cross-sector and cross-disciplinary cooperation to achieve safe communities and resilient landscapes.

3. "Schnappschüsse aus einer bundesweiten Waldbrandbefragung: Umgang der Forstwirtschaft mit Waldbrand", Speaker: Dr. Christoph Hartebrodt (Baden-Württemberg Forest Research Institute)

In the presentation, the results of a nationwide forest fire survey of the forestry sector's handling of forest fire are presented. These show that district managers and private forest owners from all federal states deal with the topic of forest fire and take measures for prevention and preparation. However, activities vary within each state. Measures implemented for forest fire prevention mainly include infrastructure, silviculture, communication and forest fire monitoring. Silvicultural measures are often not primarily motivated by the goal of forest fire prevention, such as enriching deadwood or increasing the proportion of deciduous trees. Approaches based on fire load reduction are less common so far. Preparatory measures are taken less frequently overall than prevention measures.

Following the three presentations, Prof. Dr. Markus Bresinsky (OTH Regensburg) briefed the participants on the agenda for the remaining two phases of the workshop. He also gave a short introduction to his laboratory as well as the links to EFI and the FIRE-IN project. The OTH Regensburg team with the help of various experts on forestry, fire behavior, and many other related fields had previously developed three scenarios on how the wildfires would impact Bavaria over the next three to five years. The summaries of these scenarios were briefly outlined to the audience, as one of these three scenarios would be the basis of each of the three groups the participants were asked to join.

Wildfire scenario 1: Trend (own illustration)

Wildfire scenario 2: Plausible Alternative

Summary

Forest fire risk in Bavaria increases significantly:

- **distributed:** area-wide increase of forest fire danger
- **interconnected:** increasing international, inter-organizational cooperation
- **interlinked:** increased occurrence of cascading effects

Development by categories

Fire cause & behaviour	Economy	Society	State	Prevention/ combatting
more small fires	overstrain of private forest owners	more damage in settlements	endangerment of critical infrastructures	increasing data stocks
more intra-urban fires due to grassy areas		strongly increasing frequentation of the forests	increased communication and cooperation	lack of expertise and experience, but increasing build-up
more fuel		more endangered hikers		better technology, but lack of personnel
behavior more difficult to control				lack of stamina of emergency personnel

Wildfire scenario 2: Plausible Alternative (own illustration)

Wildfire scenario 3: Out of Order

Summary

Forest fire risk in Bavaria increases dramatically:

- **explosive:** high speed, urgency and speed of propagation
- **overload:** fires and their consequences exceed the capacities of the emergency forces
- **extreme:** extremely far-reaching consequences, very high intensity

Development by categories

Fire cause & behaviour	Economy	Society	State	Prevention/ combatting
multiple forest fires				overstrain of the crisis units
more uncontrolled alpine fires				shortage of fire water, especially in northern Bavaria
more frequent large-scale fires				emergency forces themselves affected
increased risks due to consequential damage				more local fires out of control
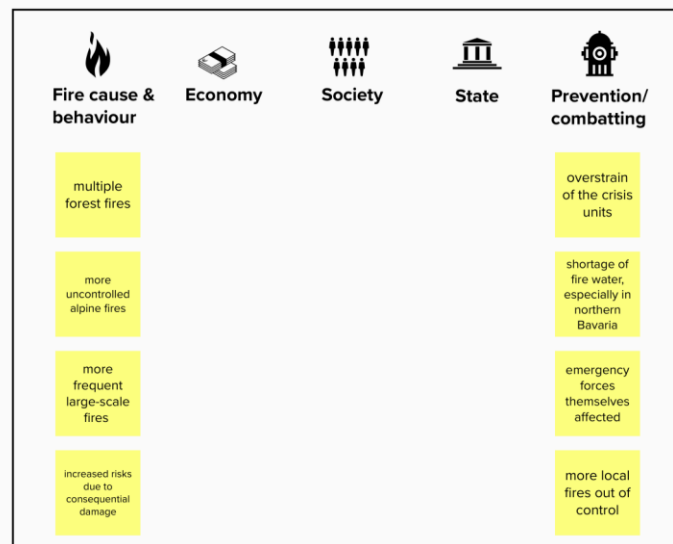
Wildfire scenario 3: Wildcard (own illustration)

The audience then split into groups; PCF and the OTH Regensburg had previously allocated the participants so that each group could benefit from the insights of different actors. Posters with the

respective scenario were made available to all groups, which gathered in different corners in the room(s), so that they could refer back to the summaries they had just been presented with.

Part 2: SWOT-Analysis

The aim of the second part (the first working phase) of the workshop was to get the participants to reflect on current capabilities or challenges regarding the prevention and fighting of wildfires.

Previous presentations had already given a stimulus on the many different aspects and domains of firefighting that had to be considered. To make the most use of the different actors present during the workshop, each participant was asked to silently complete a traditional SWOT-analysis from their organization's point of view using only pen and paper. The SWOT-matrix focused on the following questions:

- **Strengths**: What are the strengths shown by my organization related to the wildland fire issue now and in the next 10-15 years? What is already going very well?
- **Weaknesses**: What are the weaknesses shown by my organization related to the wildland fire issue now and in the next 10-15 years? What is not going well and where do we have difficulties?
- **Opportunities**: What are the external (i.e., cannot be influenced by my organization) opportunities for the wildland fire issue in the next 10-15 years?
- **Threats**: What are the external (i.e., cannot be influenced by my organization) risks or challenges for the wildland fire issue in the next 10-15 years?

The participants from each group answered the above questions keeping in mind their group's respective scenario. After five minutes (and every two minutes thereafter), each participant passed on their SWOT-matrix clockwise to the workshop member next to them, who then got to comment and expand on what had been written in the matrix before. This process was repeated until each group member had their original matrix back in front of them. After some time to read through the comments on their matrix, the participants were given time to discuss their thoughts.

SWOT: Scenario 1 (own illustration)

SZENRIO 2
-Plausible Alternative-

SWOT: Scenario 2 (own illustration)

SZENRIO 3
-Außer der Reihe-

Extern

Chancen

- Vorbereitung auf Ereignisse
- maßgeschneiderte Produkte mit fachlicher Begleitung
- Netzwerkarbeit, Thema Innovation
- Notwendigkeit Strukturwandel Bevölkerungsschutz
- größere Bedeutung v. Experten
- Umgang mit Informationen: richtiger Umgang durch Schulungen, Training
- Offenheit f. externe Stimmen
- Finanzierung folgt Katastrophen
- Reset: systematischer Aufbau, Wahrnehmung
- neue Ordnung
- Lessons learned
- Technologie muss Fragen beantworten und will neue aufwerfen, zB. disaster Management sollten Teil der Entscheidung sein
- FW-Management
- Vernetzung Technologien
- Verständnis, dass Zivil- & Katastrophenschutz in D unterentwickelt
- deutlicher Weckruf f. Politik
- Handlungsdruck auf Akteure fordert Innovation & Kompromiss-Bereitschaft
- Zusammenarbeit mit anderen Technologieanbietern (Kameras, Sensoren, Drohnen) --> über Konkurrenz hinweg?
- Netzwerkarbeit, Kooperation, Diskussion
- Blick nach Außen & von anderen lernen
- Ressourcenteilung (Materialeinsatz f. andere Zwecke)
- Öffentlichkeitsarbeit
- Bewusstsein ist vorhanden
- Feuer mühsam am Boden ausgemacht, besser es brennt gar nicht
- Schmerzgrenze (wie viel Panik?)
- Innovationstransfer, -synergien
- Crowdsourcing & Datenverifikation trainiert Algorithmen

Risiken

- FW fehlt Nachwuchs
- FW überfordert
- Zentralisierung FW
- Innovation muss genutzt werden
- mehr Technik = mehr Fehlerquellen
- mangelnde Vorbereitung
- pay for it, Kommunen vs. Einnahmen - Menschenleben, Gesundheit, Existenzgrundlage
- andere Bedeutung finden, zB. über Emissionen Brände
- Spezialisierung ggf. nicht möglich
- Resignation & Stagnation, Risikoakzeptanz zu hoch
- fehlendes Bewusstsein Bevölkerung
- Akzeptanz statt Handeln
- Bewusstsein ohne Panik schaffen
- Ignoranz Kampagnen
- wollen vs. können - wie bringt man Akteure zusammen
- Verantwortlichkeit
- Politik
- richtiges Maß an Druck
- Umgang mit den Informationen
- Umgang mit den Informationen (Fonds, Fehldispositionen, falsche Handlungsempfehlungen), Gefahr falsche Entscheidungen & Mitbewertung nur damit schnell gehandelt wird
- ausreichend Ressourcen vorhanden?

Intern

Stärken

- PSA
- Atemschutz
- Wärmebildtechnik
- Schulung u. Ausbildung
- Fachexpertise
- Netzwerk, gemeinsames Lernen
- Bewusstsein und Strukturen schaffen
- gesunder Menschenverstand
- rechtzeitiges Auseinandersetzen & Vorbereitung
- Zusammenarbeit Akteure
- Akteure wollen handeln
- Energie bündeln & lenken
- Vielzahl Projekte & Innovationen
- taktische Ebene
- Satelliten-basierte Überwachung immer verfügbar, bei einem oder 100 Brandherden zentral gebündelt
- Schwerpunkt Finanzierung

Schwächen

- bekannte Unbekannte - unbekannte Unbekannte --> Blinder Fleck
- Kommunikation & Akzeptanz Fachwissen
- Arbeiten im fremden Feld
- "ich will keine Hilfe"
- Lernen durch Schmerzen
- Vollkasko-Mentalität schafft wenig Unterstützung
- fehlende Ausbildung & Kenntnisse
- Machtsucht & fehlendes Bewusstsein f. Vernetzungs-Notwendigkeit
- fehlende Finanzielle Mittel durch Politik
- Response statt Prävention
- Geld nur an FW statt systematische Finanzierung
- System nicht angepasst
- Kommunikation
- regimespezifisch
- Präzision & Geschwindigkeit noch nicht optimal (mehr Satelliten)
- Feuer mühsam am Boden ausgemacht, besser es brennt gar nicht
- gute Prävention braucht keine Satelliten mehr (Idealfall --> wir brauchen kompletten Blumenstrauß an Maßnahmen)
- wie viele Organisationen wurden tatsächlich getestet?

SWOT: Scenario 3 (own illustration)

The results of the SWOT analyses overlapped and coincided in many points. Particularly highlighted among the strengths were the presence of readiness, capabilities, technology, and knowledge, as well as the existing collaboration among the various stakeholders in wildland fire operations. Weaknesses, on the other hand, represented interorganizational collaboration. Collaboration between sectors and

domains is heavily influenced by organizational cultures and "silo thinking". In addition, the technology and equipment are often already available, yet need to be better utilized. The analyses particularly emphasized that technology alone is not sufficient, nor is it always operational. Another weakness identified is insufficient political willingness and understanding of the issue, as well as the existence of too many regulations. The relevance of practical deployment experiences needs to be shared and illustrated with political actors. Short-term thinking and strong individual interests instead of cooperation were also identified as weaknesses. In addition, there is a lack of operational and technical personnel and an overly strong focus on reaction instead of prevention. More investment is needed in prevention and in closing conceptual gaps in post-fire response and prevention. Only in this way can the associated dangers of cascading effects be avoided.

According to the experts, the opportunities lie in the recognition that civil protection in Germany is underdeveloped. The relevance of the wildfires in the summer of 2022 represents a wake-up call for policymakers and the public. This momentum must be used for forest restructuring and investment in better prevention measures. Other opportunities for participants include innovation transfer and synergies between sectors through networking, collaborations, and discussions.

Identified threats lie in insufficient prevention measures and the fact that innovation must actually be used. Furthermore, it was discussed that an increased deployment of technology also always represents an increased risk for sources of error. Furthermore, it is essential to continue to create awareness for the topic amongst society and politics, without stirring up panic.

Part 3: Future Requirements
In the next phase, participants thought and discussed extensively about their organization's strengths and weaknesses in wildfire prevention, suppression and innovation, as well as the general opportunities and threats (risks) associated with this. This final part of the workshop was aimed at deriving a collection of requirements (personnel, capability, and material needs) to better tackle wildland fires in the future.

To better structure the analysis and the subsequent discussion, participants were asked to consider requirements across the following domains (while still focused on their group's respective scenario):
- Tactics, strategy, guidelines, and concepts
- Personnel
- Material
- Organization (process and structural organization, planning, implementation)
- Education and training
- Facility (physical facility)
- Other

Following a ten-minute individual brainstorming, participants were asked to come forward, add their ideas to the pinboard and discuss them with the group. The following results stood out in particular:

Tactics/Strategy/Guidelines
- Nationwide and overarching guidelines for all organizations are required
- Lack of (organizational) competence centers

Personnel
- Communication experts and advisors in science, organizations, and institutions
- Personnel must be motivated, available, trained (specialization), and operational
- Exchange and communication between actors

Material/Technique

- Suitable, available, modern, combined, and specialized
- "Association of weapons ": collecting all resources available (firefighters, forestry, etc.)
- Materials management vs. cash cow

Organization
- Establishing specialized units with expertise
- Central coordination office at federal and state level
- Wildfire as a staff unit

Education/Training
- Basic trainings for all forces, specialized (at firefighting schools and external institutions) for some
- Compatibility across municipal, state, federal borders
- Training for citizens

Facilities
- Training facility for forestry and firefighting
- Competence centers at federal and state level
- Network/coordination office/control center above organizations

Other
- Coordinated public relations work at all political and spatial levels & sensitize population
- Coordination, Leadership, Inspiration/Vision
- Knowing each other and building trust

In conclusion, the PCF-OTH-EFI Regensburg workshop at the INTERFORST exhibition in Munich on 19 July 2022 served as an effective exchange platform for practitioners, representatives of the industry, and researchers alike. Practitioners got to share their concerns with industry partners, who may use these insights to develop solutions that can help practitioners tackle these challenges in the future. At the same time, the OTH Regensburg as an academic institution benefited from these inputs across different perspectives, which contributed to validating and expanding on the scenarios on the future of wildland fires in Bavaria. Similarly, FIRE-IN profited from the exchange of views across sectors and responsibilities during the workshop to identify and harmonize gaps, prioritize R&D efforts, and explore solutions.
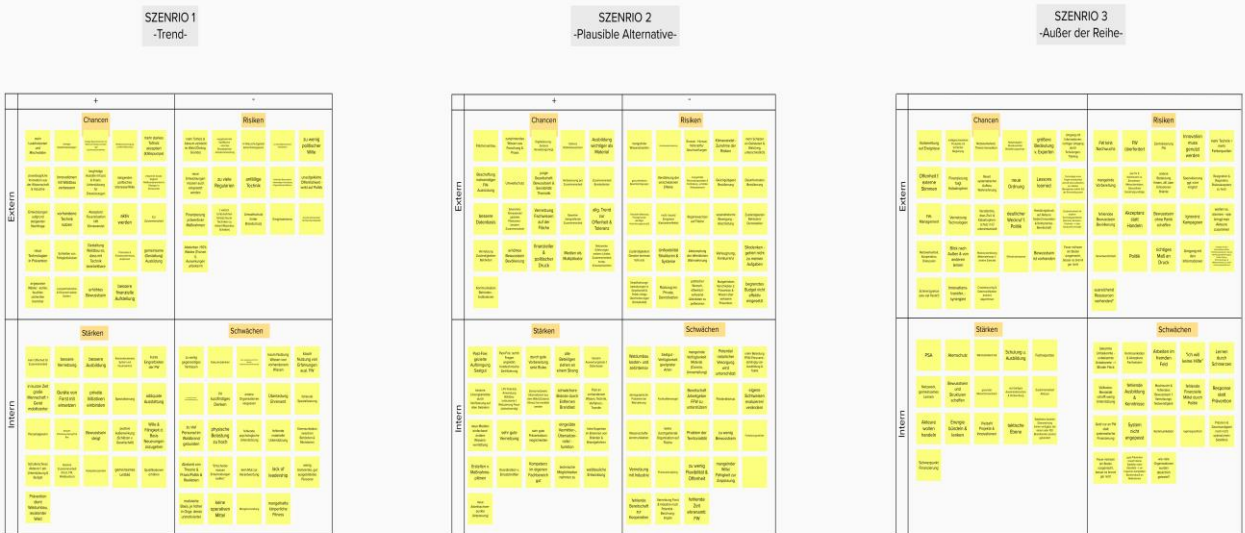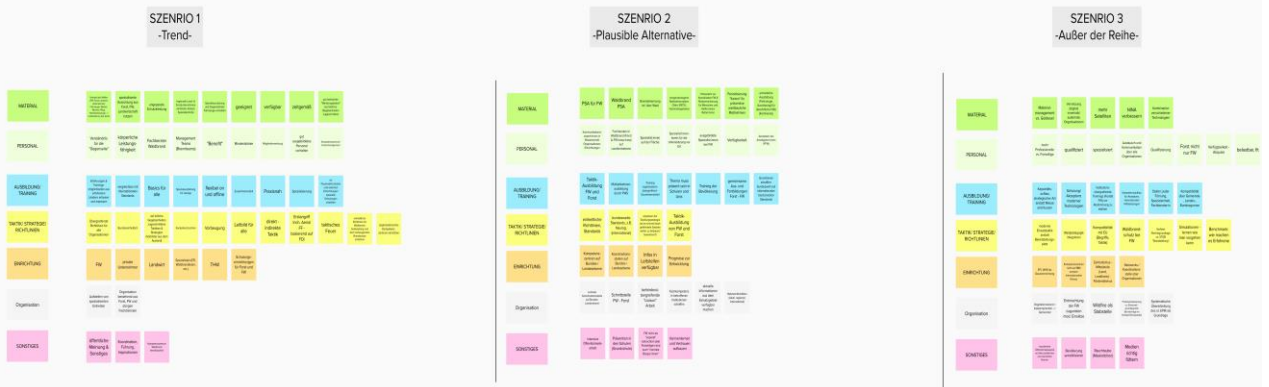
Overview results workshop (own illustration)

FIRE-IN National Hub- Poland

The Polish National Hub event organized jointly by SGSP and CNBOP which took place on April 13, 2022 involved a list of presentations and three discussion panels. Presentations were focusing on issues like general Fire-IN project results dissemination, standardization, technologies in international missions, new technologies developed in Poland for fire and rescue, use of drones and robots in fire and rescue, trends in buildings, construction and design involving new technologies.

FIRE-IN Dissemination event
Innovation and new technologies in rescue and fire protection
13th April 2022
Online: SGSP/CNBOP

PROGRAMME

	Title	Speaker	Afiliation
9:00 – 9:05	Opening of the event, opening speech	Piotr Tofiło	SGSP/CNBOP
9:05 – 9:15	Fire-In project results	Piotr Tofiło	SGSP
9:15 – 9:30	Standardization - real needs	Joanna Sadowska	CNBOP
9:30 – 9:45	Strengths and weaknesses of technologies used in international missions.	Rafał Sołowin	KGPSP
9:45 – 9:55	Firefighting activities from the practitioners point of view	Zena Chahine	OSP Lebanon
9:55 – 10:10	Mobile turbine rescue and firefight-ing system.	Tomasz Węsierski	SGSP
10:10 – 10:25	EU-SENSE project	Magdalena Gikiewicz	SGSP
10:25 – 10:35	Discussion – capability and gaps-current and future, challenges, lessons learned		
10:35 – 10:45	Coffee break		
10:45 – 11:00	AirDron – air condition monitoring	Paweł Matczak/Mateusz Kozłowski	SofBlue
11:00 – 11:15	"Command Suitcase" the solution created as a result of a real need	Wojciech Górecki	OSP Niegoszowice
11:15 – 11:30	Mobile robots for firefighting interventions	Artur Soszyński	PIAP
11:30 – 11:40	Discussion - challenges, lessons learned		
11:40 – 12:00	Lunch break		
12:00 – 12:15	Fire risk analysis in buildings using Monte Carlo simulations	Adam Krasuski	SGSP
12:15 – 12:30	Firefighter Intervention in tall timber buildings - a critical element of structural fire safety	Wojciech Węgrzyński	ITB
12:30 – 12:45	The use of simulation techniques in the teaching process for crisis management.	Rafał Jakubczyk	ETC PZL
12:45 – 13:00	Extinguishing and cutting high pressure fog system with additional fittings.	Dariusz Stachlewski	CutLanca
13:00 – 13:15	Discussion - challenges, lessons learned, events		
13:15 – 13:30	End of the conference		

Conclusions and recommendations from event:

- The use of new technologies in the area of safety, with particular emphasis on firefighting, increases the operational awareness of firefighters. This is valuable information for those in charge of rescue operations and the analysis teams appointed as part of the staff.
- In the case of search and rescue operations, an invention is the use of the integrated systems like a "Command Suitcase" device, which allows to coordinate search teams and analyse the image obtained from drone systems.
- The advantages of using modern technologies such as: unmanned aerial vehicles (data obtained during the flight are valuable information for the head of the rescue operation or the analysis team appointed as part of the staff), mobile robots for firefighting interventions, and a mobile turbine rescue and firefighting system are discussed. The presented technologies include in the integration of European innovative activities in the field of Fire Safety and Rescue. MRSRG can be successfully used during fires of large industrial facilities, forests, chemical events and other situations where a large amount of water fog is needed. The presented system also has the ability to introduce a stream of powder into the combustion zone.
- A positive trend in rescue operations is to ensure the safety of firefighters by performing firefighting activities remotely (a firefighter can be outside the building on fire and administer pressurized water after breaking through the wall with a lance), also using mobile robots in case of emergency explosives.
- So it is reasonable and was underlined by participants to carry out works aimed at developing standards and recommendations regarding cooperation between professional and volunteer fire brigades and the possibility of providing access to modern (especially remote or unmanned) technologies and technological solutions.
- It is worth for producers and technology providers to show the possibilities of their solutions and technologies during exercises, trials, workshops, demonstrations organized by emergency services and scientific entities, first responders, in all weather conditions, in various scenarios according to the developed - in cooperation with scientists – methodologies/procedures.
- It was concluded that it is of vital national importance to connect and match civil security practitioners (responders, civil security administration) & solution providers: (businesses e.g. start-ups, SMEs, technology parks, centres and networks, researchers and academia)
- During the event, attention was also drawn to the presence of toxic substances that can settle on the clothes of special firefighters and penetrate the body through the skin. Hygiene for the prevention of occupational diseases consists in designating appropriate zones in the rescue and firefighting unit, cleaning clothes using special washing machines, etc.

Survey results

During the event a survey was conducted. The questionnaire was of an evaluation nature and its role was to indicate the most appropriate directions for the EC's activities in the area of fire safety and rescue. The areas identified in the survey are indicated in the D3.6 project document. Preliminary analysis of the survey results shows that the respondents paid special attention to the area of standardization. The need to break the barriers of practitioners in the use of modern technologies was also indicated as an important area. This process requires constant awareness

raising, involvement of practitioners in testing innovative solutions and joint exercises with the use of these technologies.

The survey asked opinions about different priorities in different areas. Respondents were given the task to use a three-point scale:

- Strategic priority,
- Important priority,
- Is not priority.

1- *Interoperability and standardization.*

Standards make things typical and common to everyone. Standards can cover technical topics, data and information exchange, procedures and planning, inside or between organizations (cross-organization communication, planning and response), or even between nations (cross-border communication, planning and response). Even, in the form of guidelines, standardisation is extremely important from practitioners' point of view. The issue of practitioners' access to standards is important. Changing various standard operating procedures to formal or widely accepted guidelines would also be a solving factor that would ensure a standard method across nations and even continents. Interoperability is solved only through standardization. Common data formats are a pure standardization topic either for formal or professional standards. Interoperability is the main key to an easy step to integration.

Respondents defined their attitude on the subject of Interoperability and standardization. The vast majority (77.8%) of respondents indicated this topic as their strategic priority, and almost every fourth indicated that it was an important priority for them. The importance of this topic is also emphasized by the fact that none of the interviewed end-users considered it as a non-priority topic.
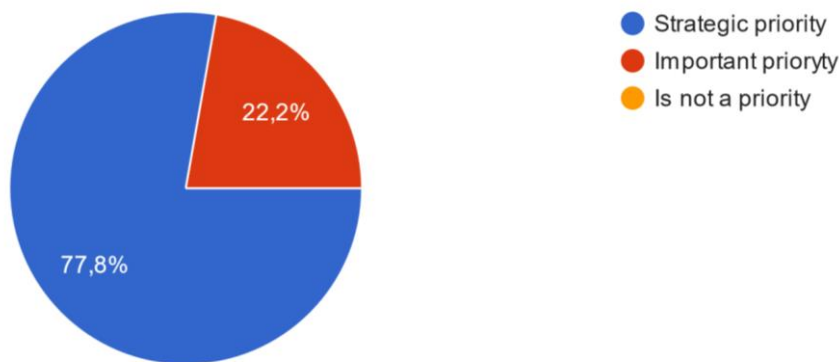
(9 answers)

Figure 14 End-user responses to their attitude to interoperability and standardization.

2- **Risk awareness is a key point.**

Another significant topic that was raised irrespective of technology was risk awareness. If, as a society, which includes both practitioners and citizens, we do not have a good understanding of the potential risks and threats, then many technological tools may be totally useless (or perceived as such).

When asked whether end-users believe that awareness-raising should be prioritized. 62.5% of respondents indicated that it should be an important priority, and more than one in three believed that it was a strategic priority.
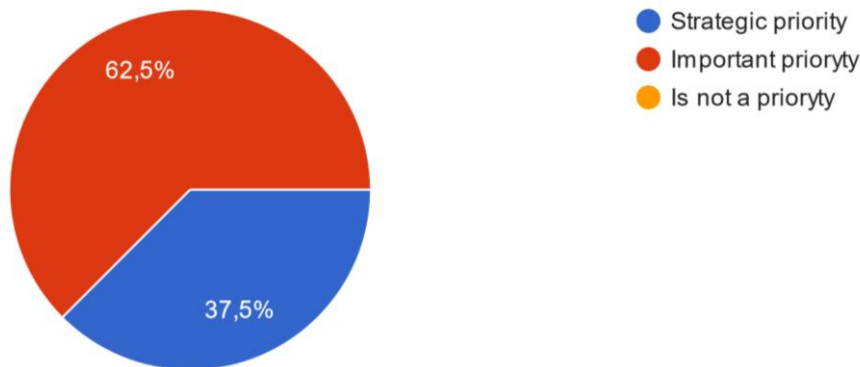
(8 answers)

Figure 15 End-user responses to their views on public awareness of risks

3- *Conservatism of practitioners to use new technologies.*

This is an issue pointed out by technological suppliers. There is no simple and straight answer, but this is something that must be taken into consideration in the future. What prevents practitioners to adopt solutions that are available? Procurement issues? Costs? Lack of information for valuable technology? How friendly is a new system/technology to a practitioner? Trust specific large suppliers? This conservatism may be in relation to the general access of practitioners to technologies and standards. Is it simply the costs and the procurement issues? Is it problems of bureaucracy inside first responders' organizations? Is it a problem on the high level/strategic level of first responders? It seems that practitioners do not follow technological progress when suppliers try to cover their needs. This is, without a doubt, an issue related to limited access to technologies and standards and possible conservatism. This could even be something simpler. Nowadays, in the high levels of the hierarchy of practitioners, there are people who grew up in different times without having too much technology and in our era, the overloading with new technologies may pose difficulties and credibility issues.

This question received mixed responses from end users. Despite the fact that more than half (55.6%) believe that the conservatism of practitioners to use new technologies should be treated as a strategic priority. It is worth noting that over 3 out of 4 respondents consider this aspect a priority, while 22.2% do not consider it a priority. It seems that they may constitute a new, younger generation that is much easier to adopt new technologies and are able to use them more easily.
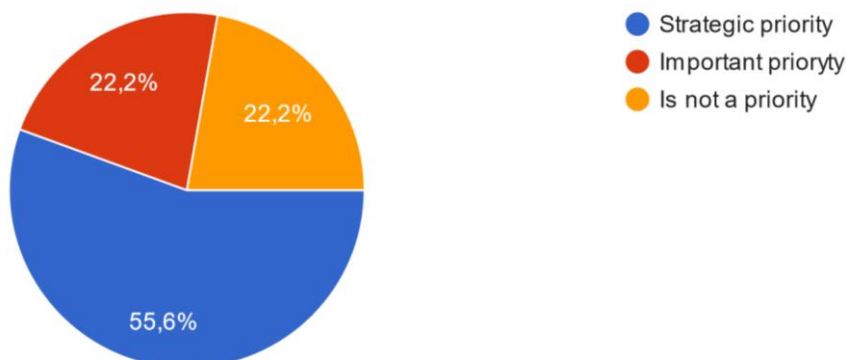
(9 answers)

Figure 16 Evaluation of the significance of the priority "Conservatism of practitioners to use new technologies".

4- *Isolation or fragmentation of technologies.*

As described earlier technologies are already available. The problem does not focus on the existence of technologies but on how the various technologies and their integration is applied. Technologies must integrate within each other and be interoperable with old, legacy systems and new systems as well. Currently, various projects deal with that, but the overall results are demonstrated in pilot cases usually, and more time is required to see it operationally applied in the field. Besides time, other topics are also important for new technology to be widely used. These issues can be issues of acceptance, permission, legal framework and support, as well as safety issues. Integrated solutions also exist but these are usually from individual suppliers and, usually, the solutions can "speak" to each other but not with other products from other suppliers.

Another question was to get end-user feedback on their views on isolation or fragmentation of technology. As many as 2 out of 3 respondents indicated that it is an important priority for them, and almost every fourth (22.2%) indicated a strategic priority. Only 11.1% of the respondents did not treat this aspect as a priority. It seems that end-users are aware of more and more serious and widespread disasters that can be mitigated with the cooperation of other units, e.g. from other countries. Certainly, some problems during rescue operations could be solved by using compatible technologies.

(9 answers)
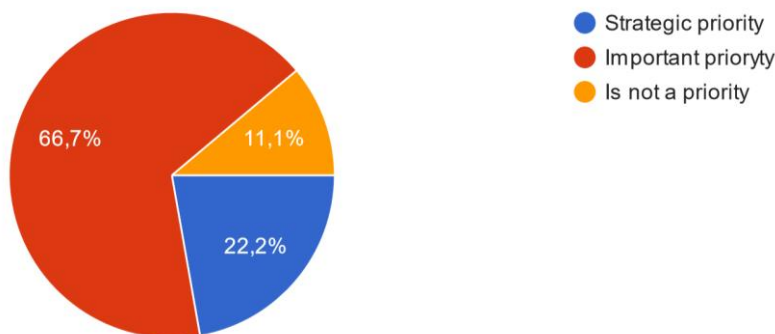
5- *Experience and training help to take the right decisions and filter the information.*

 Practitioners must be trained frequently. Too much information can be even more confusing than little to even no information at all. Only through training and experience, practitioners can have the ability to filter properly the information received.

This area is given priority by all surveyed end-users. 55.6% of them treat it as an important priority, and the rest as a strategic priority. Answers to this question indicate the constant necessity and need to conduct training for rescuers in order to practice decision making and skillfully filter information.

9 answers
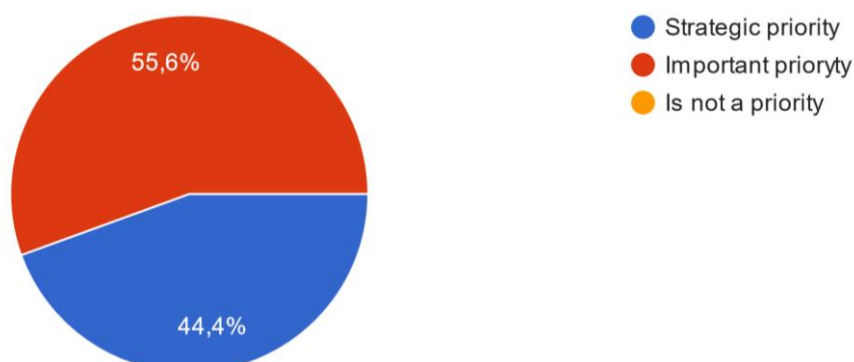
6- Openness in data, data formats and source codes is another topic.

Open data boost research outcomes and make technologies adapt more functionalities faster. Nevertheless, all these data must be valid, so filtering and validation, especially from open data, is extremely important as well. Open data formats and common data formats are important and helpful in exchanging and sharing information between various sources. At the same time, open-source codes may help the transition from traditional tools to more high-tech tools. Nevertheless, issues such as credibility are extremely important in this case, as practitioners need credible and reliable software, hardware and materials built with high quality standards.

The responses to this question indicate that two out of three respondents consider this area a priority, of which 22.2% consider it a strategic priority, and every third person does not treat this area as a priority. The distribution of the respondents' answers is surprising, especially when analysing the answers to question 4- Isolation or fragmentation of technologies, where nearly 67% indicated an important priority in this area. The cooperation of various devices from outside one company will not be possible without openness in data, data formats and source codes
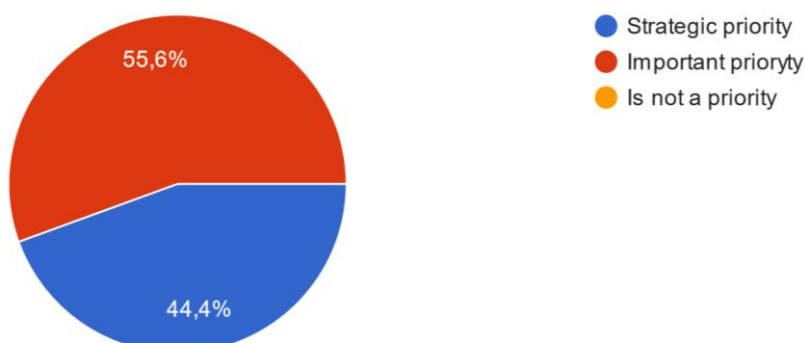
9 answers

- Strategic priority
- Important prioryty
- Is not a priority
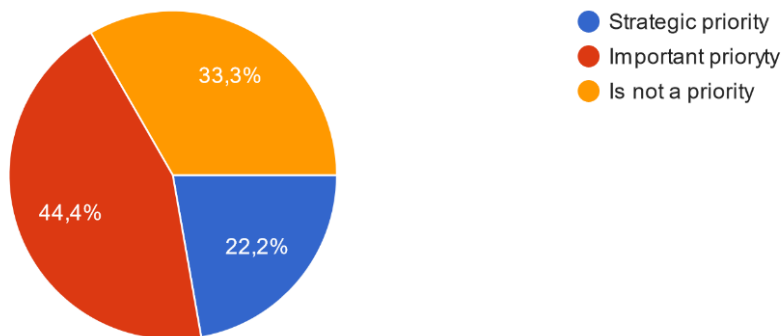
7- Data, data quality and proper sharing of the information.

Data was, is and will be crucial for all phases of crisis/disaster management. To have the proper information, to the right people, at the right time, is crucial, especially for proper response. Moreover, this information, of any kind, must be reliable.

Most of the respondents participating in the survey, as much as 55.6%, assessed this area as very important. The rest of the respondents indicated the direction of "data" as strategic. None of the respondents considered this area as a non-priority.

9 answers

- Strategic priority
- Important prioryty
- Is not a priority

8- If you have not found a strategic priority in the above topics that you would like to indicate, you can add it here.

1 answer

„Practitioners with different backgrounds should find a common ground to understand the technical and professional methodology and it might need continuous trainings and tests."

Additionally, respondents were asked if they had found other areas that they would consider strategic for the future. One area is indicated which addresses the collaboration of practitioners at different levels of knowledge and experience through appropriate training and testing

Summary of survey
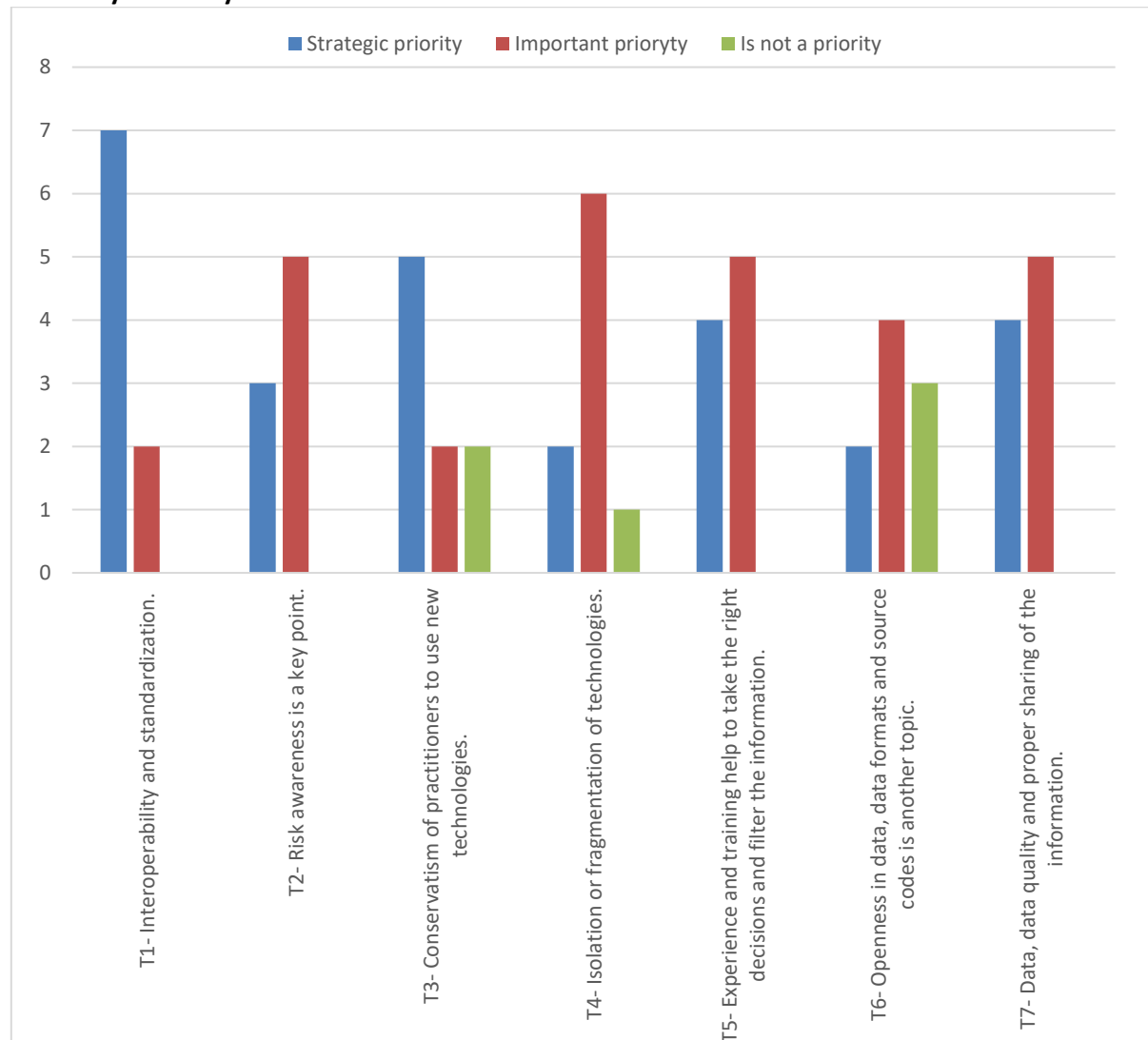
Most respondents rated the most strategic area as No. 1 - Interoperability and Standardization. Second in this respect, according to end users, was an area no. 3 - Conservatism of practitioners to use new technologies, and the third in this respect were ex aequo areas 5- Experience and training help to take the right decisions and filter the information and 7 - Data, data quality and proper sharing of the information.

In the case of an important priority, this answer was most often given in the fourth area. It is worth noting, however, that in the areas of:

2 - Risk awareness is a key point,

5- Experience and training help to take the right decisions and filter the information and

7- Data, data quality and proper sharing of the information,

there was only one less answer.

The lowest number of these responses was recorded in the following areas:

1- Interoperability and standardization,

3- Conservatism of practitioners to use new technologies.

However, the not a priority response were not recorded in the following areas:

1- Interoperability and standardization.

2- Risk awareness is a key point.

5- Experience and training help to take the right decisions and filter the information.

7- Data, data quality and proper sharing of the information.

The least important area was 6-Openness in data, data formats and source codes is another topic, where the answer "Is not a priority" constituted 33% of the votes.