

1 SOTERIA Publishable Summary

1.1 *Executive summary*

SOTERIA aimed at developing recommendations and a toolbox to leverage the positive impact that social media can play in emergencies, enabling public safety organizations (PSOs) and citizens to communicate before, during and after an emergency event.

SOTERIA researched the impact of social and mobile media on emergency management in terms of the ability of PSOs to effectively respond to emergency in the pre, during and post-event phases as well as the capacity of citizens to take an active role in the emergency response process. The critical issue for PSOs is concerned with getting timely, accurate and reliable information from citizens through social and mobile media as well as being able to communicate to citizens who are directly or indirectly affected about appropriate action of take.

Throughout its execution, SOTERIA carried out a number of tabletop and field exercises with direct involvement from first responders to identify needs, requirements and test SOTERIA proposed solutions. Applying its THEO approach, SOTERIA was able to develop sets of recommendations at Technological, Human, Ethical and Organizational levels. The project proposed a concept of operations for PSOs focused on the use of social media, assessed the impact and receptiveness of citizens to the use of social media by PSOs, developed seven applications (for citizen and PSO use) along with four tools to help PSOs identify, locate and assess emergencies.

Based on these results, SOTERIA defined a three-pronged commercialisation approach and prepared 6 business offers based on the innovations proposed in SOTERIA. A core aspect of these offers was to describe clearly SOTERIA differentiators in comparison to previous projects that have laid the ground for this project as well as from current market offers.

1.2 *Summary description of the project context and the main objectives*

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To accomplish this SOTERIA demonstrated and validated its main concepts by means of a technological platform presented to end-users in an interactive exercise – namely a prototype that was delivered according to a spiral model of system design (i.e. successful iterations). SOTERIA work was divided into interconnected work packages aiming at common project

objectives as defined in the Description of Work, and which progressed in three iterations (concept, basic and enhanced) and 6 development stages using a campaigns of experimentation approach (in months 6, 8, 18, 24 and 30).

Work Package 2 (WP2) activities had the main role in the project definition phase, analyzing scenarios and case studies, defining User Requirements and the project concept. In other words, preparing the baseline to support the work of the so called THEO work packages (Technical, Human, Ethical and Organizational).

The project looked at the ability of PSOs to effectively respond to emergency in the pre, during and post-event phases as well as the capacity of citizens to take an active role in the emergency response process through four dimensions, THEO approach:

- **Technological:** Entailed the integration of current ICT tools for emergencies and crises into the SOTERIA Toolbox in order to explore the real potential of mobile technologies and social media in emergencies and crises.
- **Human:** Comprised the citizens' perspective on the impact, acceptance and adequate employment of state-of-the-art mobile and social media communication technologies in emergencies, concerning human factor analyses, message delivery channels and message content, in full consideration of the human behavior and cognitive performance in crisis situations.
- **Ethical and Legal:** Concerned both the commitment of the SOTERIA Consortium to stand by the relevant ethical principles and legal framework when developing and ethics-by-design project approach, the ethical and legal considerations and waivers that discussions on privacy rights and public security boundaries might bring, regarding the use of new ICT tools in emergency response efforts.
- **Organisational:** Focused on the PSOs and their culture, roles, processes, competences, training and technologies to explore how social media impacts their daily activity and how to adapt these organisations to include social media in their emergency procedures and management systems, building their trust in social media platforms and thus facilitating the process of introducing the SOTERIA Prototype into the organisations' operational processes.

The SOTERIA Prototype developed during the project comprised:

- SOTERIA Recommendations, to provide guidelines and courses of action for PSOs and citizens;
- SOTERIA Toolbox, integrating emergency-related ICT tools and functionality (e.g., social media tools and mobile applications) that offer additional communication channels between PSOs and citizens and enhance high-quality situational awareness for PSOs and citizens in emergencies.

SOTERIA innovated by allowing the (i) understanding of the impact that social media entails in emergency management systems; (ii) use of multiple communication channels in emergency situations, including social media, (iii) exploitation of the ubiquity of mobile platforms to locate and effectively communicate with citizens in distress; and (iv) leveraging of the levels of shared awareness and performance of PSOs, benefiting from social media information.

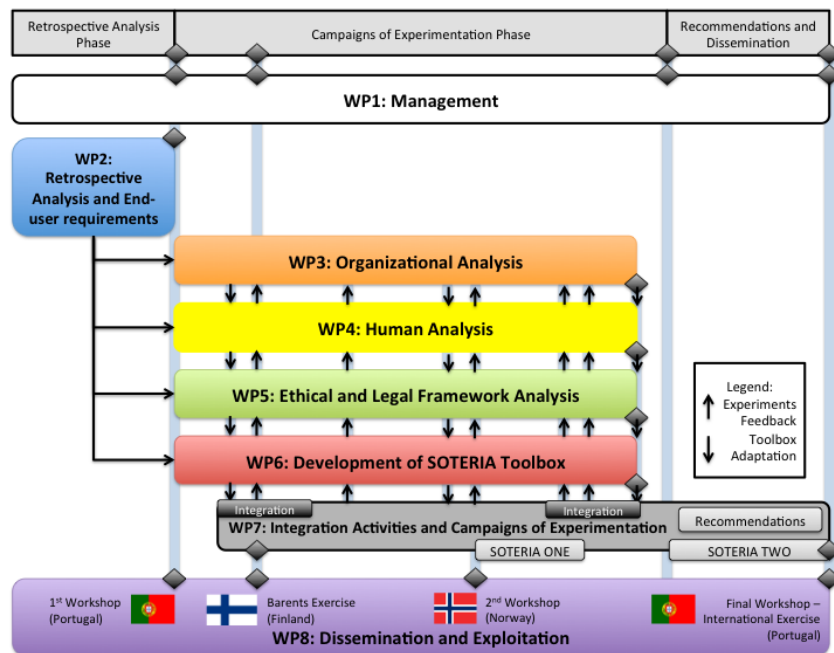


Figure 1 – SOTERIA project approach with spiral developments and campaigns of experimentation.

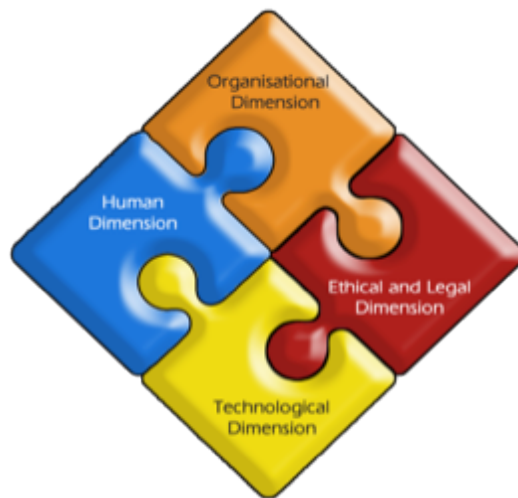


Figure 2 – The SOTERIA Project's Analysis Dimensions

1.3 Main S&T results and foregrounds

WP2 – Retrospective Analysis and end-user requirements

Towards the main objective of the first task, to collect evidence, lessons learned and best practices of emergency response services, in particular highlighting the impact of online and mobile communications, the task leader in collaboration the partners responsible for the project's THEO dimensions prepared a methodology document indicating the criteria for selecting exemplary cases to be applied by the THEO partners based on their respective subject matter expertise.

The results of this task, that aims to provide answers to the “which”, “what”, “where”, “when” and “how” questions of the impact and role of social media in emergencies, were stated in the Deliverable 2.1, which included the following elements:

- ¥ A detailed description of the theoretical/methodological approach;
- ¥ A detailed description of the incident and an analysis of exemplary cases based on the subject matter expertise of THEO dimension;
- ¥ The following Case studies were analysed from the different THEO point of view:
 - o November 2007 - Jokela High School shooting, Finland;
 - o September 2008 - Kauhajoki School shooting, Finland;
 - o March 2011 - Multiple vehicle collision in Kuopio, Finland;
 - o August 2011 - Riots in England, UK;
 - o October 2011- Dublin and East Coast flooding, Ireland;
 - o February 2013 - Attempted suicide, Nice, France;
 - o July 2013 - Vihtavuori Explosives Factory incident, Finland;
 - o August 2013 - Fire in the Gudvangatunnelen, Norway;
 - o September 2014 - CRI (Child Rescue Ireland) Alert, Ireland;
 - o December 2015 - Collision and major motorway traffic congestion, UK;
 - o December 2015 - Missing person, UK.

The consortium also examined current state-of-the-practice of PSOs and citizens in emergencies and the impact of social media, in order to establish the baseline knowledge of existing best practices and policies, as well as challenges to be surpassed. The following 112 emergency models across Europe were analysed in depth:

- ¥ Ireland;
- ¥ Finland;
- ¥ France;
- ¥ Norway;
- ¥ Portugal;
- ¥ Turkey.

In addition, small, medium and large emergency case studies were used to focus on evidence, lessons learned and best practices of emergency response efforts, citizens’ involvement and the use and impact of social media in emergencies. The evidence identified is linked to four specific dimensions (THEO approach) of the SOTERIA Project: technological, human, ethical and legal, and organizational. This research, combined with the next deliverables D2.2, D2.3 and D2.4, enabled the creation of a framework for the SOTERIA Project.

The consortium identified SOTERIA users’ requirements for both citizens and PSOs, covering the technological, human, ethical and legal, and organizational dimensions of the project, for the further development of the SOTERIA concept.

The general approach to achieve this goal was to draw user requirements from a wide range of sources, including the SOTERIA Description of Work, an online survey of citizens, reference

scenarios generated by SOTERIA partners and end-user organizations and interviews with PSOs. Please refer to the following methodology of SOTERIA user requirements definition.

Regarding the reference scenarios, SOTERIA end-users community was active in producing them in order to help draw out user requirements for both PSOs and citizens. These scenarios have been identified by end-users and end-user representatives as good examples of emergencies that a PSO would be expected to deal with, in which online and mobile communications would play an important role (are described below), the consortium has made an effort to structure them in a way that it can easily be used in the on-going activities related to the end-user community engagement. Furthermore, partners were asked to identify whether the requirement was a technological, human, ethical/legal or organisational one – or some combination of them. The following scenarios were analysed in depth:

- ¥ Water contamination;
- ¥ Animal attack;
- ¥ Multi-vehicle collision;
- ¥ School shooting;
- ¥ Missing person;
- ¥ Multiple bombing and shooting;
- ¥ Flooding;
- ¥ Train accident;
- ¥ Road traffic collision;
- ¥ Spontaneous meeting of citizens organized via social media;

The Citizen survey provided a total of 212 responses of which women made up just over half (54.59%) of respondents, 73.43% had higher education, 91.47% use the social media in general every day.

Concerning the interviews with PSO, in general, in all the countries where SOTERIA partners are involved, the major PPDR entities were interviewed and the questionnaires were collected and analysed, contributing to the quality of the deliverable D2.2. SOTERIA partners conducted face-to-face interviews with PSO, in Finland, France and Portugal as an example of the type of activities performed in each country, the following are highlighted:

¥ In Finland two different organisations Regional Rescue Departments and Police were interviewed. These provided useful information about current use of social media, limitations of its use, potential future role of social media and major challenges and opportunities faced by each organisation in relation to social media use. Among the main results from this initial requirements gathering process have been:

- o Fast and easy to use;
- o Integrates several different communications tools;
- o Allows locally targeted communications;
- o Sends push messages to people's phones;
- o Sends and receives pictures and video;
- o Includes education material / manuals for efficient and ethical use of social media;
- o Includes guidelines of using social media in emergencies;
- o Can deal with large numbers of simultaneous users.

¥ In France, a series of organisations were interviewed with representatives from the two branches of first responders – Fire (Paris and Bouches du Rhône) and one from the Police

(Yvelines). Among the main results from this initial requirements gathering process have been the following:

- o Automatically detect “in the pocket” emergency reports made by mistake;
- o Automatic translation of foreign languages (including voice calls);
- o Supports a network of volunteers who agree to intervene at an early stage during an emergency;
- o Detects false/fake emergency reports;
- o Cross-checks location of callers giving information about the same emergency to have a more precise location through triangulation;
- o Obtains information from citizens from their smartphones (geolocation, status victim/witness, authorization of video chat, pre-registered medical data).

¥ In Portugal (112.pt Operational Command) in the case of an emergency incident of any kind, citizens usually call 112. The main results of this interview help to clearly identify the key needs. Among which are: obtaining information from citizens from their smartphones and enabling two-way communication between PSOs and citizens using social media.

In conclusion, hundreds of potential user requirements were identified from these sources and to each was assigned a unique reference number. This identification allowed, linking, combined, and mapped onto a smaller number of “final” list of user requirements. The user requirements were then assigned a subjective measure of importance and categorised as a technological, human, ethical/legal or organisational one – or the combination of all four. Once more, each final user requirement was assigned a unique identification number, allowing it to be tracked and referenced throughout the entire SOTERIA Project.

Key performance indicators (KPIs) that can be used to inform the evaluation of SOTERIA on emergency and crisis management systems and services as well as beyond the term of the project particularly in relation to the exploitation phase and recommendations were defined. The consortium used the inputs of T2.1 and T2.2 to inform the definition of a series of KPI that are of use to the evaluation of SOTERIA through the Campaigns of Experimentation (CoE) (WP7) and for future use by the end-user community in order to assess the impact of social media in emergencies.

The main goal of these KPIs was to provide a basis for measuring the impact of SOTERIA or similar systems in operational contexts, which are themselves evaluated according to the SMART criteria (Specific; Measurable; Achievable; Relevant; and Time).

This work covered:

¥ A conceptual overview of the notion of KPIs and performance measurement, making the point clearly that the project was not evaluating the performance of the PSOs per se, but the added value that SOTERIA brings to their operations. Seeking to identify operational improvements brought about by the use of SOTERIA, therefore it is not simply a matter of taking existing operational KPIs as employed by such organisations and deliver them here, many of which are deliverable publically, but rather it involves consideration of how we might assess this potential improvement quantitatively and qualitatively as part of an overall operational evaluation assessment of SOTERIA.

¥ Definition of a methodological approach employed including the Activity System conceptual framework and the SCOPE framework for organizational analysis. This included a detailed albeit high-level and generalizable procedural description of how to go about performing such an evaluation with reference to the KPIs.

¥ Derivation of the KPIs from the reference scenarios in terms of their definition and measurement along with their implications for the THEO framework.

¥ Definition of an organizational change assessment tool, based on the methodology applied, to assist in the implementation of KPIs as part of an overall change-management process with respect to the integration of new tools, especially SOTERIA tools, within the CONOPS (Concept of Operations).

Final conclusions were also drawn up in terms of implications for other work packages, particularly WP3 Organisational and the role of KPIs in terms of the definition and management of emergency CONOPS incorporating SOTERIA.

A SOTERIA mockup was also developed to present the SOTERIA concept - SOTERIA Prototype and campaign of experimentations - while addressing a subset of user requirements and to collect end-users' feedback. The methodology applied to the mockup design and development included all inputs that have been considered, its approach and risks and limitations.

In the first project phase, the SOTERIA Mockup was a starting basis to the subsequent system versions of the SOTERIA Prototype that has been designed and developed. At the beginning of the process of mockup design the key requirements to be addressed were selected (from the user requirements identified within Deliverable 2.2).

The SOTERIA Mockup overall concept and particular components' and functionalities were described in deliverable 2.4, but in general SOTERIA Mockup includes:

¥ Detailed description of two parts: PSOs space components module (emergency web portal for PSOs, fusion centre, PSO Services, mobile services and external interfaces) and citizen space components module (emergency web portal for citizens, social network interfaces, existing ICT for emergencies and crises and mobile services);

¥ Detailed descriptions of the SOTERIA Mockup components: video analysis tool; TAT2 (Text Analysis Tool Tweet locator); TAT (Text Analysis Tool) crowd sourcing platforms; information evaluation; information fusion; multi-language text analytics; MORE; geolocation provisioning application; emergency command transmitter; and location application.

The SOTERIA Mockup was presented to end-users during a workshop, allowing to receive their feedback, which allowed to identify the most important functionalities (in order to meet end-users expectations, collect new ideas, recommendations as well as doubts and concerns in order to build body of knowledge).

On one hand, as a result of the workshop, PSO emphasized:

¥ Interested in collection of images as well as data processing in order to reduce the amount of data/images to be analysed, which may reduce time to response significantly (and resource allocation);

¥ Need of validation of information coming from citizens, to prevent false positives and false alarms.

¥ Need of information exchange between agencies/PSOs.

¥ When using SOTERIA Toolbox, user/citizen should agree on sharing information and use personal data for emergency response and law enforcement purposes, preventing the claims about the violation of user privacy.

On the other hand, some end-users raised some concerns related with:

¥ Charges for sending data via mobile phone during emergencies, which can prevent them from sending images and videos (especially in roaming).

¥ Legal and organizational aspects concerning differences in each country and local telecommunication and internet service providers.

WP3 Organisational Analysis

The aim of the initial activities of this WP was to analyse European Emergency Services and other PSO who provide direction and support to the principal emergency services, focusing on the use of online and mobile communication. The analysis performed addressed issues of interest that were particular to each of the countries reflecting the heterogeneity of European emergency services, by country and PSO type.

This deliverable built upon the work undertaken in D2.1, which examined the 112 emergency call system, and D2.3, which set out initial KPI for SOTERIA.

Towards the main objective of this task, Emergency services of eight European countries were examined:

¥ Ireland: Provided a broad baseline understanding of the systemic organisation of PSOs and their use of online and mobile communications. Irish PSOs provided continuous inputs to the SOTERIA CONOPS development process.

¥ Finland: The first SOTERIA CoE was undertaken in Finland. Therefore, a detailed account of Finnish Emergency Services was provided.

¥ France: An important input from French Emergency Services identifies high resource demands placed on them through the 112 calling system. This highlights the potential for partially automated systems for emergency call management.

¥ Norway: The analysed of Norwegian emergency services focuses on their communication systems.

¥ Poland: The Polish examination of emergency services communication systems addressed national level policies, programmes and examples of front line emergency services online presence.

¥ Portugal: The account of Portuguese emergency services focused on their communication systems at national, regional and local levels.

¥ Turkey: The Turkish emergency services description examined Communication Centres, and current social media practices and presented a case study of recent issues identified through the 'Occupy Gezi' protests.

¥ United Kingdom: The accounted of United Kingdom emergency services focused on their communication systems.

Through this examination and analysis of the above European Emergency Services and other PSO a number of findings and conclusions were identified that affect their use of online and mobile communications, including: policy, structure, organisations and practice of PSOs. In fact, heterogeneity within and across jurisdictions underpins many of the findings of this analysis. Some key findings are listed below:

¥ Emergency Services and PSO: the principal blue light services, includes across Europe the police, fire and rescue, and emergency medical services make up the emergency services, while in some countries other civil protection (e.g. coast guard) organisations are considered as principal emergency services, but this is not consistent across Europe, as such this has implications for the ways particular services can be contacted by the public.

¥ Tradition communications still dominate emergency services. Emergency calling relies primarily on the 112 or an equivalent system. There are vulnerabilities to the existing emergency deliverable system, particularly to call answering saturation and a high level of error/nuisance calls. Face to face contact with members of the public is also common as are

public safety advertising campaigns and traditional news media broadcasts (e.g. radio and television).

¥ There are many examples of the use of online and mobile communications by PSOs in Europe (e.g. website, social media etc.) and they are mainly used for dissemination purposes that replicate the traditional media broadcasts with examples of high level accounts of operational matters (e.g. traffic restrictions following an emergency). There is little consistency in the use of online and mobile communication technologies by PSOs included in this analysis.

¥ There is a paucity of available policy on the use of online and mobile communications by PSOs. This often reflects a lack of strategic direction or guidance from senior management or institutions that provide oversight to PSOs. This in turn has had significant implications for the uptake and standardisation of online and mobile communications by PSOs.

¥ A significant part of emergency services looked at the structures, organisation and practices of PSOs, including emergency and related services. Therefore these issues are very likely to have implications for the use of social media by PSOs.

The findings from this analysis concluded with a series of questions that are intended progress the research toward the development of a SOTERIA CONOPS. The questions address PSO organisations, particularly the activities of people within the emergency management system, and the human and organisational factors that may affect the use of SOTERIA by system actors. These questions concern:

- ¥ The fit of SOTERIA capabilities within an emergency management system;
- ¥ The SOTERIA actors, and their roles, responsibilities and potential change in light of SOTERIA;
- ¥ The SOTERIA operators, their competencies, opportunities for mutual awareness etc;
- ¥ Engagement with SOTERIA by PSOs and the public;
- ¥ The use of SOTERIA as a common information space;
- ¥ Alignment of SOTERIA with current 112 models, existing PSO technology systems, and the potential for 112 capabilities;
- ¥ SOTERIA use for emergency and non-emergency deliverable;
- ¥ Interoperability and redundancy of SOTERIA;
- ¥ Regulatory context of SOTERIA;
- ¥ SOTERIA performance evaluations;
- ¥ Human and Organisational Factors implications of SOTERIA

One of the implications from the findings of D3.1 is that the data collection tool that was being developed (and deliverable in D3.2) for the continued research activities of WP3 requires a structured methodological approach that is sensitive to the heterogeneity of PSOs. Therefore, it must be capable of capturing pertinent information including the convergence and apparent contradictions of PSO online and mobile communication activities. The tool must also be capable of supporting an examination of the emergency management system at all levels and for deliverable relationships and interdependencies affecting outcomes. To this end two methodological approaches were included in D3.2: SCOPE developed by TCD; and Cultural Historical Activity Theory (Engestrom, 1987).

A tool for data collection for the development and validation of SOTERIA CONOPS was proposed and developed. The team described and detailed two heuristics questions (adapted from the iSAR+ organisational data collection tool which explores similar problems but in a

different context - SOTERIA is more concerned with the everyday, anticipate types of events with a focus on the improvement of operational performance across organisations whereas iSAR+ has been focused more on the strategic level of social media use). The questions considered:

- o The overall process scenario of multi-agency interaction in the context of responding to a particular incident and seeks to gather information about the roles of various operational and organisational factors such as human resources and skills, information, environment and material resources, etc. This also allowed to assess the impact of such factors on the overall outcomes of the operations (KPIs);
- o The second set of heuristics was inspired by Cultural Historical Activity Theory (CHAT) and seek to place individual actors within the scenario in order to see how the different roles goals and responsibilities within emergency response converge and diverge and what the relative needs are of different personnel. This was a sociocultural perspective that allowed a view of the interactions between people, their tools, and resources.

This tool was used to develop and validate scenario-driven CONOPS frameworks incorporating the SOTERIA platform allowing for guidelines to be developed for the organisational implementation of social media tools for emergency management and the role of the CONOPS approach as a means of supporting this.

Finally, the task focused on the development of a SOTERIA concept of operations (CONOPS). In order to prepare the CONOPS an analysis of emergency services and their use of online and mobile communications in emergency management systems was carried out. The review initially examined normative emergency management literature (e.g. emergency plans, frameworks, protocols etc.) and similar official publicly available resources (e.g. equivalent online content etc.). The normative approaches proved useful in outlining the organising principals of emergency management systems such as structures, functions, roles and inter-agency coordination etc. However, we found that they make little if any reference to the use of computer-mediated communications for emergency management activities. This finding was validated by the PSOs who participated in this phase of the research. Therefore, the analysis was reoriented toward the analysis of PSOs' online and mobile communications practice and policy. This included an examination of online and social media activities of PSOs at local, regional and national level, in addition to the review of PSO and government published literature. It also examined some of the wider commentary in the literature on emergency information management and crisis informatics. In total the emergency services of eight European countries were examined. The framework offered by US Coast Guard Cutter CONOPS (n.d.), the IEEE (1998) CONOPS Standard, and the Department of Homeland Security (DHS) CONOPS Sample Template and Guidance (November, 2008) provide the means to represent the SOTERIA CONOPS conclusions.

The CONOPS considered operational capabilities, ownership and responsibilities, operating environments, users and stakeholders, policy, education and training. While the research of these issues was fundamental in preparing the SOTERIA CONOPS, it was found that due to the lack of practice rules and/or guidelines that are couched within an established policy framework PSOs were limited in how they could respond to the practical application and use of online and mobile communications. This is a critical concern for the successful implementation of online and mobile communications by PSOs. With this in mind, these findings will now be transformed to provide a set of recommendations for the implementation and embedding of online and mobile communications in public safety organisations (PSO).

Interviews with professional PSO personnel were conducted to gain a deeper understanding of PSO's view on social media use in emergencies. PSO members from several countries were questioned either face-to-face or in telephone interviews. The data gathering and analyzing of the data results were integrated into Deliverable D3.4, where a copy of the full interview schedule was provided as well. To date, assumptions of PSOs regarding social media have been reported heterogeneous and we observed a lack of empirical data. We have encountered this negative view by many PSOs, for instance in previous projects in Germany with the Federal Office of Civil Protection and Disaster Assistance. Acceptance ratings contradicted previous assumptions. It was also necessary to empirically validate previous assumptions. The multi-methodological approach was necessary to comprehensively get the PSOs' perspective on social media in width (quantitative approach) and in depth (qualitative approach). With this approach, we have implemented exactly what was planned in WP3. The results obtained helped to build an important foundation to specify the requirements for technical solutions. Based on the studies, several general and of course SOTERIA-specific findings and conclusions were obtained:

General

- Social media are already used in all PSOs, but only for public relation purposes, informational and educational purposes and for recruiting. There is no use in emergency situations so far, however, there's a pervasive positive attitude (e.g. acceptance, trust) towards this kind of use regardless of PSO members' age.
- PSO members have a very differentiated view on the pros and cons of social media: The developed category system to classify the members' responses had more categories and subcategories than anticipated based on a review of the existing literature (e.g. different forms of prevention were associated with social media use).

SOTERIA-specific

- Besides its promising potential in emergency situations, the use of social media currently faces obstacles with respect to the quantity of information provided by social media (e.g. due to several sources) and the information's quality (i.e. doubtful validity, accuracy, relevance etc.).
- In order to use social media effectively within an emergency situation, these problems have to be resolved by proper technical solutions of the SOTERIA platform (e.g. 1) integration of information from various social media, and 2) summarization and prioritization of information via software). Especially the validation of the received information is crucial. One major technical (and legal) challenge here is the knowing of people's location, since their location can be relevant for the validation as well as for a targeted sending of information (e.g. warnings).

Through the activities undertaken in the development of D3.1, D3.2 and the inputs from end-users (in France, Ireland and Finland) initial recommendations were identified. The recommendations proposed are not representational of a homogenous approach to PSOs use of online and mobile communications; instead they explore SOTERIA's potential use based on a case study approach. As SOTERIA is a research project, lessons need to be learned as to how it can inform the foundation for future use of similar systems within emergency management. The recommendations proposed allow for a more nuanced approach to the potential role of online and mobile communication technologies within European Emergency Services. They also highlight the evolving nature of these technologies and how a dynamic, fluid approach is required when imaging the potential change such technologies could potentially bring about within these organisations.

In total, around 70 recommendations for the integration of online and mobile communication within emergency management structures were given. These include: Policy and Best Practice; Continuity of Use of New Communication Channels; Managing the Effects of Automation on Communication; Managing Human Performance and Perceptions of Roles; Positioning of Online and Mobile Communications Systems within PSOs; Education and Training; Interoperability with existing PSO Information Ecologies; Interagency Coordination; Design Insights for Future Online and Mobile Communications; and Measurable Future Impact.

WP4 – Human Analysis

The overall objective of this work was to provide a classification of emergencies, in particular with regard to the impact of social media. In order to reach this goal, a theoretical driven analysis was combined with an empirical approach, assessing the state-of-the-art experiences of emergency. The empirical approach, in turn, consisted of a quantitative and a qualitative part. Namely, a questionnaire distributed among a large sample of European PPDR's (quantitative) as well as a series of interviews with PPDR personnel (qualitative). The main findings of these activities included offering a definition of an emergency, conceptually differentiating emergencies from disasters and explaining the distinction of different phases of an emergency (before; during and after), based on a review of relevant literature. It is shown that a division of emergencies into four phases is practical and helpful in order to specify the impact of social media on different emergencies. The four phases are: 1. Preparedness, 2. Response, 3. Recovery, and 4. Mitigation.

Feedback of experts was included with respect to the value and impact of social media in various emergencies and the state of the art experiences of professional emergency personnel organizations in Europe.

Finally, a comprehensive literature review was conducted to further elaborate and support the classification of emergencies into different phases. Emergencies were clustered based on different characteristics in order to analyse differences with regard to the influence, impact and use of social media.

Here, the team investigated the use of social media in the context of emergencies from a citizen perspective. To achieve this objective, three main sources of information were used in order to find out more about the interplay of social media and especially their use and acceptance within the general public: (1) the European SOTERIA citizen survey, (2) the SOTERIA experimental approach and (3) a literature review as well as results of external surveys and information.

What needs to be considered when interpreting the results of the European SOTERIA survey is the following: Due to the method of an online survey, it is very likely, that the results concerning internet use, ownership of devices with internet access, trust towards social media etc. are biased. It is important to acknowledge the fact that the SOTERIA citizen survey sample is most likely a more internet-affine audience with a more positive attitude towards technology, such as smart phones. However, what also needs to be considered is the target audience of the SOTERIA approach, which are primarily social media users and/or smart phone owners.

Citizen's survey was thoroughly analysed with respect to general media use among the public, trust towards different (social) media and information sources in emergencies, risk perception and experience of emergencies, perceived usefulness of various social media depending on the phase and type of emergency (Vignette study), dealing with Emergency apps as well as differences in age groups, gender, and between countries.

Analysis revealed that the participants of the survey stated to be well familiar with many social media channels and 80% of the participants stated to have a smartphone. Thus, data indicates

that disseminating crisis relevant information via social media is a possibility that could reach many recipients in the general public. In general, experts and scientists as well as “local authorities” were the least trusted sources, whereas medical services and fire brigade were trusted most, followed by family, relatives and friends and the police (trust being conceptualized as an overall attitude towards these sources). Further, the results show that participants indicated to trust more in traditional media (TV, radio) than social media (Facebook, YouTube, Twitter). A relatively large proportion of the participants of the survey stated to be willing to provide at least some information to first responders. This proportion increased to almost 80% when asked whether they would provide information via a special emergency app rather than via social media.

The aim of this body of work was to derive and propose recommendations from the human perspective (according with THEO approach) and integrate results from research on the PSO’s perspective as well as the citizen’s perspective. These contributions included lessons learned and best practices from the perspective of PSO personnel as well as the general public.

The results were integrated and combined to serve as a scientifically sound base for the deduction of the recommendations. The different phases of an emergency, different types of media (such as twitter, facebook, youtube, apps and SMS), various kinds of emergencies (such as fire in a building, traffic accident, thunderstorm, medical/household accident, flood and blackout/power outage), as well as potential risks and concerns (such as information validation and rumors, data protection and misuse and citizen involvement) are structuring elements, from both PSO and citizen perspective. A list of the most important human recommendations was presented:

- ¥ Get connected early;
- ¥ Build up trust by communicating with the public;
- ¥ “Match” type of social media with the phase;
- ¥ Use social media for education;
- ¥ The aftermath of an incident;
- ¥ Be aware of PSOs view;
- ¥ Utilize social medias’ diverseness;
- ¥ Communication with public vs. Communication among PSOs;
- ¥ The value of GPS;
- ¥ Create personal relevance;
- ¥ Reduce number of emergency calls through information dissemination in social media;
- ¥ Credibility /Reliability of information and data protection;
- ¥ Vulnerability due to dependency on (mobile) internet and power;
- ¥ Social media are well suited for events affecting many people at once and with the possibility to issue warnings;
- ¥ Share social media experience and facilitate Knowledge Transfer between PSOs;
- ¥ Identify existing resources within organizations;
- ¥ Planning of social media implementation within PSOs;
- ¥ Integrate multilingual Messages;
- ¥ Design of a specific emergency App;

- ¥ Emergency App must be installed before emergencies;
- ¥ Promotion and maintenance of emergency Apps;
- ¥ Creating accountability for citizens: Validated user accounts.

WP5 – Ethical and Legal framework analysis

According to article 6 (§1) of Decision No. 1982/2006/EC: “all research activities carried out under the Seventh Framework Programme shall be carried out in compliance with the fundamental ethical principles” of the European Union. This WP focused on dealing with all ethical and legal issues, namely ensuring that all data compiled during the project and all experiments were carried out with the due authorizations (both from the informed participants as well as from national data protection authorities when relevant). In addition, the consortium identified how the tools used and developed throughout the project raised ethical concerns or how the consortium should take into account privacy by design guidelines in the development of the tools. The SOTERIA consortium acknowledges that the technologies and practices involved in the project raise a number of ethical issues.

In the scope of the tasks of WP5, the consortium analysed past emergency events with the purpose of identifying the applicable ethical and legal frameworks as well as possible ethical issues and challenges raised by the situations. Six emergency events were considered:

- Sesena tire dump fire in Spain
- Bomb attack in Brussels, Belgium
- Kauhajoki school shooting in Finland
- Madeira disaster in Portugal
- Wilfire in Canada, and
- Child rescue alert in Ireland

The relevant and applicable legal legislation concerning privacy and personal data protection and processing was also mapped and analysed. In particular, the recent Regulation 2016/679 on the protection of personal data, General Data Protection Regulation (also “GDPR”) was considered the main body of rules, principles and guidelines to be complied with in the project.

The project then analysed the principles applicable to personal data processing under the GDPR and their potential impact on SOTERIA and social media. The following principles were considered in the analysis:

- Lawfulness
- Consent
- Fairness
- Transparency
- Purpose limitation
- Data minimization
- Accuracy
- Storage limitation
- Integrity and confidentiality
- Accountability

The roles of Privacy Enhancing Technologies (PETs) and privacy by design principles were also studied. Specifically, the consortium investigated how PETs could be employed and might be useful to the emergency events mentioned previously (e.g. bomb attack in Brussels, etc.) to prevent ethical issues from arising, with a potential high risk for the rights and freedoms of natural persons. A Data Protection Impact Assessment (DPIA) was carried out for SOTERIA. This assessment was carried out by an independent party to the consortium and identified the risks associated with SOTERIA tools concerning the application and compliance with the GDPR. This was complemented by a critical self-assessment of how privacy enabling technologies have been applied in SOTERIA and could be improved in the future. A tool to perform a checklist and gap analysis of SOTERIA was also created although not applied.

Finally, the consortium drafted a set of recommendations on how to improve SOTERIA in particular (with emphasis on its platform, based on the Ozono service suite, and its tools, such as MS2A, IMS, TAT2, POMOC and SOTERIA 112App) and social media projects in general to ensure compliance with applicable EU ethical and privacy provisions.

In conclusion, although SOTERIA is not compliant with the GDPR (which entered into force in May 2016, hence more than halfway through the project and after the design stage), the consortium is confident that any exploitation measures taken up to exploit and possibly commercialize the SOTERIA tools will take into account the DPIA and will be able to implement the necessary modifications to allow compliance with the GDPR from May 2018 onwards (the date of enforcement of the regulation across Europe).

All the relevant data protection approvals and ethics approvals for the executions of activities such as the CoE were compiled. When no ethics or data protection approvals were required, the informed consent forms from the volunteers involved in the campaigns were presented instead.

For the SOTERIA CoE in Finland and the Barents Rescue Exercise held in 2015, local partners sought out approval by the National Data Protection Authority for the exercise. This was deemed unnecessary by the Authority. In addition to the Finnish CoE, additional campaigns took place such as:

- ¥ SOTERIA in emergencies, command and control took place in Finland, Portugal and Turkey;
- ¥ SOTERIA in emergencies, operational (field) level took place in Finland, Norway, Poland, Portugal, Turkey and United Kingdom;
- ¥ Validation campaigns took place in Finland, France, Norway, Poland, Portugal, Turkey and United Kingdom;
- ¥ And an integration campaign, which took place in Portugal.

WP6 – Development of SOTERIA Toolbox

The SOTERIA toolbox framework architecture integrated already existent emergency services and provided interfaces to external systems, considering information from social media networks.

Under this work, the following elements for the SOTERIA toolbox framework were developed:

- ¥ Fundamental characteristic corresponding to the ability to provide several procedures to integrate tools;
- ¥ Base tools characteristics for SOTERIA toolbox definition including: Emergency Web Portal, Social Network Interfaces, Fusion Centre, Mobile Services, PSO Services and External Interfaces;

¥ Identification and description of an initial set of tools according to the category summarizing their requirements, specifications, required inputs and generated outputs.

¥ SOTERIA tools requirements, specifications, inputs and outputs were defined based on the following categories: Emergency Web Portal, Social Network Interfaces, Fusion Centre, Mobile Services, PSO Services and External Interfaces.

The SOTERIA toolbox is a set of integrating emergency-related information and communication technologies tools and functionality that offer additional (bi-directional) communication channels between PSO and citizens and improved situational awareness for PSO and citizens in emergencies. The SOTERIA toolbox aimed to:

¥ Suit PSO and citizens;

¥ Exploit the most out of mobile technology and social media;

¥ Integrate SOTERIA tools in existing emergency and crisis management systems;

¥ Incorporate existing ICT solutions, knowledge and past and current research.

The SOTERIA Toolbox was developed using the TEKEVER MORE platform (Model Once Run Everywhere™) and the Ozono service suite built on this technology. Furthermore, the process for the SOTERIA Tools management includes administration actions for the creation and removal of tools from the “SOTERIA marketplace” and user actions to install and uninstall tools. The Emergency management manages the emergency events data received from the tools which were integrated through the SOTERIA Generic API (is based on a web service architecture in order to provide a heterogeneous integration system and its main objective is to provide a standard procedure for any external tool be capable to integrate and interact with the SOTERIA system). A generic API data structure was defined for SOTERIA that includes information about emergency such as a timestamp, geolocation, source of the information, platform used and emergency data.

Finally, SOTERIA external web tools can be integrated inside the SOTERIA toolbox framework by referring to the web link of the web tool platform (can also be classified according to the integration level: full compatible, web platform, social network and custom). This procedure can aggregate several web tools inside a common interface, which can improve the acceptance of SOTERIA system.

Also, it was identified the requirements for external tools that can be integrated with the SOTERIA Toolbox and requirements for external tools that can connect to and can be connected by the SOTERIA Toolbox.

The requirements for external tools to connect to or be connected by the SOTERIA toolbox were also identified. 67 requirements were created (32 functional and 35 of non-functional – each requirement was assigned a priority matrix, according with MoSCoW methodology). The requirements were gathered using a VOLERE Requirements Specification Template. The team also developed Graphical User Interfaces and maps used to be used in SOTERIA. Finally, source codes for example interfaces definition between the SOTERIA toolbox and external tools were provided, as well as selected Social Media Networks and external tools APIs used within the SOTERIA toolbox.

These activities focused on the development of the SOTERIA tools for both citizens and PSOs. Instead of developing tools from scratch, the consortium opted for adapting and modifying existing tools from the different partners. This allowed a higher TRL to be achieved. Tools developed included:

For citizens

- OZONO SOTERIA Mobile android version and Mobile web version for Citizens supporting
 - o Messenger 112 – exchange messages with PSO command centre and PSO First Responder;
 - o First Responder 112 – application exclusive for PSOs;
 - o Report 112 – send a report of an emergency to the PSO command centre;
 - o Alert 112 – list of active alerts;
 - o Call 112 – use the device capabilities to perform a voice call to the 112
- “Pomoc” - Mobile Application for Citizens
 - o calling the emergency number 112
 - o sending GPS-based location
 - o sending additional information in the form of user profile
- Application App (APP 112)
 - o User registration and personal and medical information setting
 - o Processing 112 Call and sending location as well as the user information to the PSAP (Public Safety Answering Point) Service provider
 - o Map display
 - o Location visualization by user

For PSOs

- OZONO SOTERIA for PSO's
 - o Events management
 - ♣ Manage reports;
 - ♣ View and report on map
 - o Social media management
 - ♣ Manage social media links;
 - ♣ Social media data feed
 - o Communication PSO
 - ♣ Messenger112.
- OZONO Mobile App (PSO command centre tools on mobile device)
 - o Messenger 112
 - o FirstResponder 112
 - o Report 112
 - o Alert 112
 - o Call 112
- “Pomoc” - Desktop Application for PSOs
 - o receiving the calls
 - o displaying location on the map
 - o receiving message with the user profile.

- Application PSAP 112 App Back office
- Tools
 - o Multilingual Social Stream Analysis (MS2A) to process the text contents of posts collected from social media.
 - o Text Analysis Tool TWEet IOcator (acronym TAT2) to estimate localization of a given tweet origin based on its contents.
 - o Information fusion service
 - ♣ Semantic typing of the event,
 - ♣ Synthesis of the contents of selected event messages.
 - ♣ Information query
 - ♣ Information Evaluation
 - o Image processing algorithms to accomplish two relevant tasks
 - ♣ detection of fire and smoke
 - ♣ contextually check if any human being has been injured in accidents and is lying on the floor.

The associated deliverables detail all the capabilities and functionalities developed and explain how the tools were developed and how users interact with them.

The tools developed under Task 6.2 were integrated into an instance of SOTERIA in Task 6.3. The consortium performed two integration campaigns. The initial integration took place before the CoEs and included the SOTERIA platform web interface and mobile application, the Text Analysis Tool Tweet locator (TAT2), the POMOC application and data fusion components. This first version of an instance of the SOTERIA toolbox, which includes an initial idea of the system to be deployed was later used in the campaigns and served as a testbench to identify points for improvement.

The difference CoEs were then used to test the first SOTERIA instance and guide the integration exercise for the second and final iteration of SOTERIA tools. The tests and results of the several components comprised:

- ¥ OZONO Public Safety Suit tests and results of campaigns of experimentations performed in Finland, Portugal and Turkey;
- ¥ Mobile applications used by citizens and PSOs;
- ¥ Information mining and synthesis tests and results;
- ¥ Sentiment analysis and clustering tests and results.

Finally, the consortium drafted a set of recommendations for the technological dimension of SOTERIA in line with the THEO approach. 18 recommendations were issued in total.

WP7 – Integration activities and Campaigns of Experimentation

The recommendations of each SOTERIA research dimensions were combined into a unified perspective. At the first stage of this activity functionality, requirements, questions, doubts and technologies that require further analysing, discussion and experimentation were gathered from each SOTERIA dimensions and related work packages:

- ¥ User requirements (defined in WP2);
- ¥ Definition of a new CONOPS (addressed in WP3);

- ¥ The citizen involvement (analysed in WP4);
- ¥ The ethical and legal framework (WP5);
- ¥ The building of the SOTERIA toolbox (WP6).

These were integrated in D7.2 “Integration of SOTERIA dimensions – 1st version”, submitted in September 2015. Based on the integrated open issues the Barents Rescue 2015 Exercise was observed and feedback and inputs gathered from the end-user community. Integrated requirements, functionalities, questions and technologies coming from the four SOTERIA research dimensions were also utilized in defining the project’s CoE stage.

The specific content of the project’s campaigns of experimentation was defined within task 7.2. The concept of the CoE as a method for gathering knowledge by conducting a series of experimentations was examined and further defined in the scope of SOTERIA project. Using the SOTERIA Key Performance Indicators defined in task 2.3 as input, the conceptual model for the CoE was outlined. The conceptual model identified the variables of interest and their relationships, and for the purpose of building shared perception of the variables, their operational definitions and measurements were generated. A first version of the CoE plan that specified the Campaigns’ intent, the language and nature of the experimentations and the roles and responsibilities of the contributing entities was created. Each partner involved provided an overview of the coming experimentation activities on their behalf.

The first version of the CoE Plan was refined after the Finnish Workshop alongside the Barents Rescue 2015 Exercise. Using the observations of and feedback from the exercise as inputs, SOTERIA Campaigns of Experimentations were clearly divided into four separate campaigns. Each campaign includes a number of experimentations conducted in several countries:

1. SOTERIA in emergencies, Command and control centre level: 3 experimentations (FI, PT, TUR)
2. SOTERIA in emergencies, Operational (field) level: 6 experimentations (FI, NO, PL, PT, TUR, UK)
3. Observation Campaign: related to campaigns 1 and 2
4. Integration Campaign: 2 experimentations (FI, FR)

As each experiment built on the results of the previous ones, plans for a particular phase of the campaign could not be finalized until previous phases were almost complete. Also, as the conceptual model and KPIs changed over time, updates to the plan were required. The updated CoE Plan included the validation Campaign consisting of 7 experimentations (Finland, France, Norway, Poland, Portugal, Turkey and United Kingdom).

The first instantiation of SOTERIA was tested in the end-users’ environments, during which the impact of utilizing social media and mobile technologies in emergencies was studied. The first of the SOTERIA experimentations were part of the Integration Campaign and conducted alongside Barents Rescue 2015 Exercise. SOTERIA partners observed the exercise based on a set of recommendations, functions, doubts, questions and requirements coming from each WP that needed to be further analysed, discussed, clarified and experimented. The experimentation tried and demonstrated integrated SOTERIA tools, used by a group of end-users as a shadow of the actual exercise. The intent of this experimentation was to demonstrate and disseminate SOTERIA project and its results and to collect input from end-users on identified recommendations, functions and doubts that need further analyzing. It was also utilized in order to define the content of future Campaigns of Experimentation.

A validation campaign focusing on tool validation and issues still unclear after the experimentations during CoE SOTERIA ONE was also carried out. Through the CoE, SOTERIA was experimented, tested and evaluated by SOTERIA end users, PSOs and citizens in seven countries (Finland, France, Norway, Poland, Portugal, Turkey and United Kingdom). The aim of the Campaigns was to observe in real or realistic simulated environments how existing emergency management systems operate with and without SOTERIA tools and gather an extensive body of empirical evidence to supporting the results of SOTERIA and provide insight into future research and possible exploitation.

The body of knowledge gathered was instrumental for understanding the impact and role of social media in emergencies as well as the production of recommendations on the efficient and effective ways to incorporate mobile technology and social media into emergency response efforts.

In addition, evaluation of the added value that the enhanced SOTERIA tools can offer for emergency management was of interest. Hands-on testing of the tools with experimentation participants was encouraged in order to receive feedback on usability and accessibility of the tools. Partners organizing experimentations were asked to discuss with PSO participants the SOTERIA toolbox approach and the possibility to pick specific tools from the selection, test sending push alerts from PSOs to citizens based on their location, including exact location information on social media updates and multilingual support.

This task established educational and training manuals of emergency management tools designed and implemented to assist on the usage of SOTERIA. Experiences and inputs from the experimentations helped define the content of the manuals that will be used in future training and education activities of PSO officers. A draft of the content and form of the educational and training manuals was created. SOTERIA partners building the SOTERIA toolbox provided material for the manuals regarding the use of their tools.

At the first stage of the project this manual assisted project participants on the usage of SOTERIA during the project's CoE phase. The educational and training manuals were updated based on the experiences and findings derived from the experimentations. Towards the end of the project, the educational and training manuals were edited and finalized for future training and education purposes to explain how users can make the most of SOTERIA.

Taking into account the THEO approach it was important to compile and summarize all the recommendations of SOTERIA for each of the dimensions considered in the project (technological, human, ethical and legal and organizational). Furthermore, it was considered relevant to create roadmaps explaining how to pursue the implementation of said recommendations. This was the purpose of this activity.

The consortium developed roadmaps for each dimension, providing target timelines for each roadmap. Finally, a unified roadmap combining the recommendations of all dimensions analysed was also provided. The unified SOTERIA roadmap explains the steps to be pursued to achieve adoption of SOTERIA in particular and social media tools in general by 2020.

With this effort all recommendations were consolidated and actions required to bring about the adoption of SOTERIA by 2020 can therefore be easily identified.

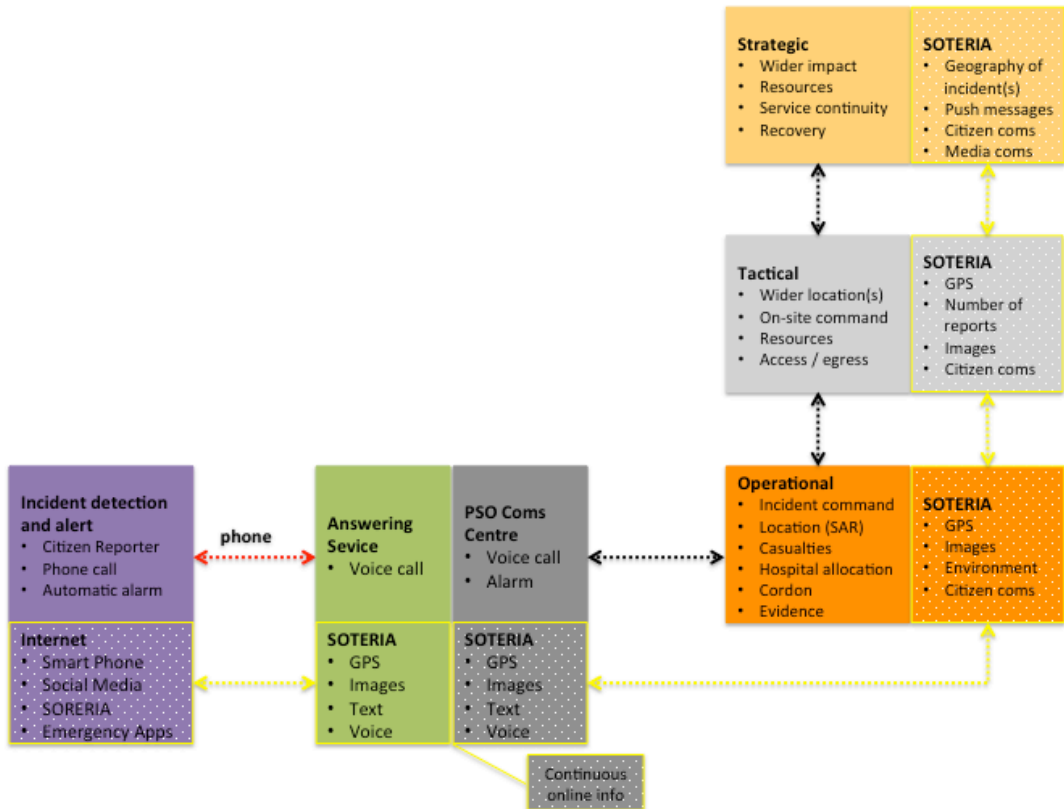


Figure 3 SOTERIA CONOPS Structure

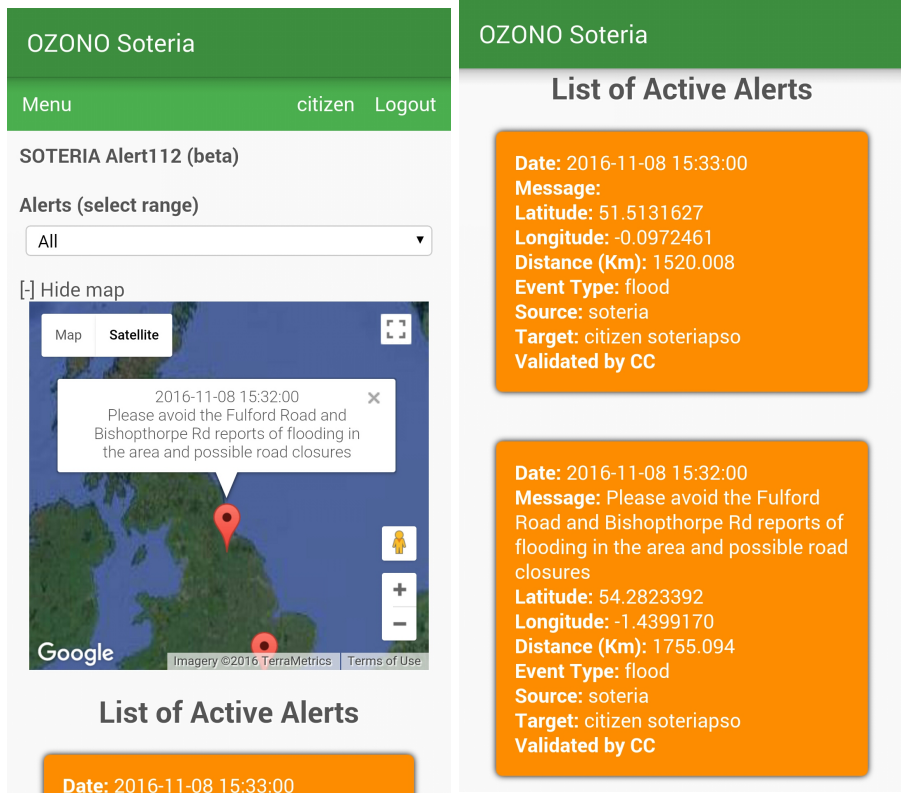


Figure 4 – Citizen OZONO mobile version Alert 112 alert messages on map and details.



Figure 5 - “Pomoc” Graphical User Interface – following screens

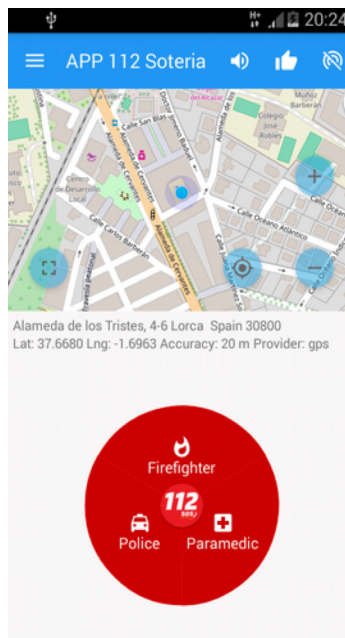


Figure 6 – SOTERIA App112 Main screen

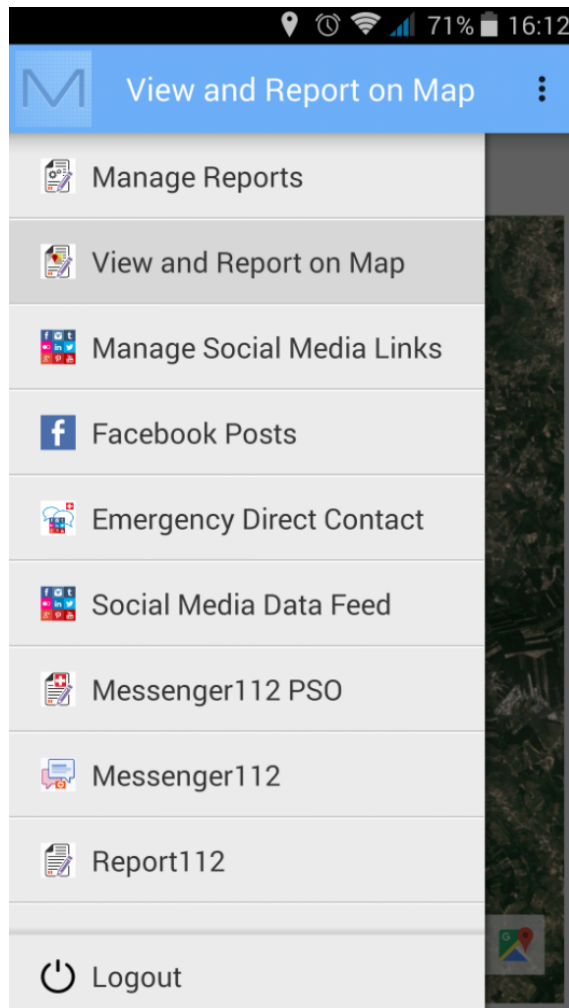


Figure 7 – SOTERIA mobile PSOs command centre

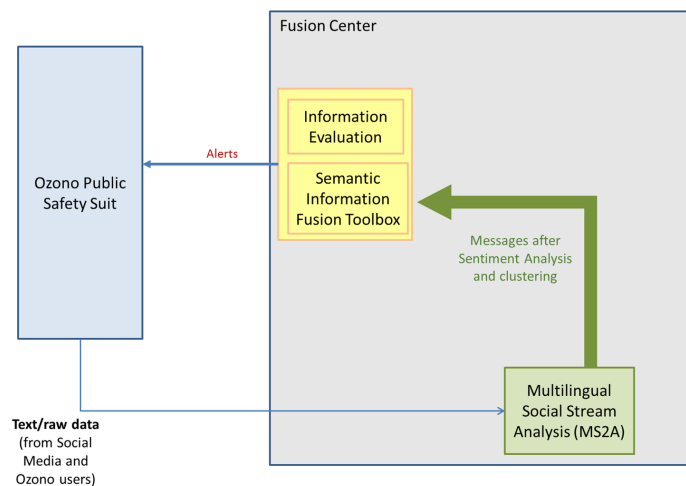


Figure 8 – Excerpt of the SOTERIA platform architecture, showing MS2A in context

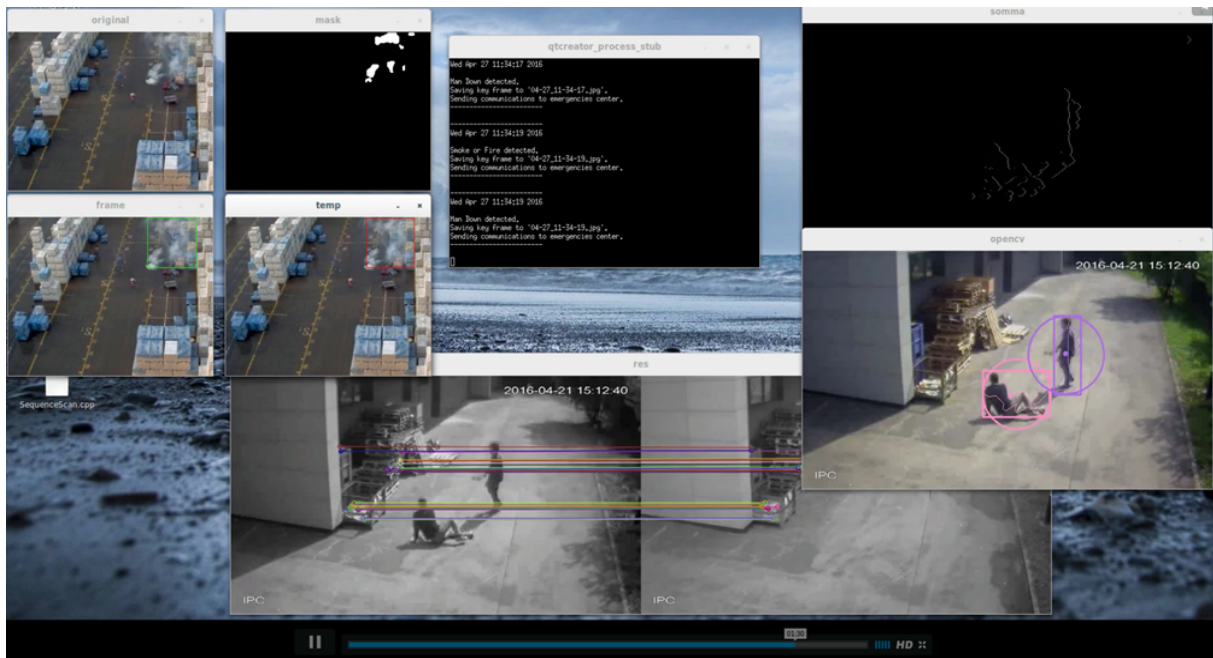


Figure 9 – Video and Image processing

1.4 Potential impact

Throughout its duration, SOTERIA carried out multiple dissemination activities. The aim of these actions was to communicate to the audience as widely as possible the project results, the SOTERIA Recommendations and associated Toolbox, through a variety of channels.

Over 70 dissemination actions were undertaken during the project's lifetime (e.g. 21st Nordic Research Conference on Safety, NoFS 2015, KriSu 10 –seminar, Safety 2016 World Conference, EENA 2017 Conference, Social media and mobile technology in crisis communication lectures). These included posters, flyers, lectures, presentations to specialized audiences (PSOs), general public, conferences and interviews with media and discussions with policy makers. In addition, 19 publications in journals, magazines and conferences were made (e.g. Journal of Applied Communication Research, The Journal of Social Psychology, Injury Prevention, 2016 International Conference on Systems and FUSION 2017, 20th International Conference on Information Fusion among others). Overall, the consortium believes it has achieved a solid awareness of the project, its objectives, approach and results.

In addition to these actions, the project partners organized a SOTERIA workshop to present and discuss intermediate/final results as well as requirements and expectations with end-users community (PSO, Citizens). This initial SOTERIA Workshop was divided into the following sessions:

- ¥ Session 1 - Welcome and general introductions;
- ¥ Session 2 - General Requirements – requirements derived from DoW and Case Studies analysis;
- ¥ Session 3 - Key Performance Indicators – project's concept, work breakdown structure and schedule;
- ¥ Session 4 - Technological Capabilities – technologies available for SOTERIA and initial mockups;

- ¥ Session 5 - Discussion with end-users;
- ¥ Session 6 - Next steps – project next steps and closing workshop.

The results of this workshop two main objectives were successfully achieved: dissemination within SOTERIA partners and with the end-users community. This was followed by a discussion between partners and end-users to refine the results of SOTERIA first phase, which allowed the clarification of identified requirements and the definition of future areas of research, namely:

- ¥ Sharing of information between PSOs;
- ¥ Apply automatic filter on the image received from Citizens with the possibility to stop image transfer in case of misuse of the communication channel and bandwidth;
- ¥ Apply automatic filter to prevent false positives;
- ¥ Boundaries between privacy and security/safety needs;
- ¥ Costs of communication: how to support them? For example, cost of data communication related with emergencies for end-users (messages, photos, videos, audio and others), including roaming costs;
- ¥ Usability: the application shall be very easy to use for both PSO and Citizens.

A second SOTERIA workshop conducted alongside Barents Rescue 2015 Exercise in Finland to discuss with and collect input from end-users on identified issues was also implemented. SOTERIA partners observed the exercise and some of the SOTERIA tools were experimented and demonstrated with a group of end-users as a shadow of the actual exercise. Findings from observing the exercise and experiences on using the SOTERIA tools were then discussed in the first part of the SOTERIA workshop. The latter part of the workshop was used for defining the next CoE phase of the project.

A final workshop including the project's final exercise and field trial was also carried out. Although external entity attendance was low, the field exercise was successful, having been able to show the functionalities of the mobile platform. It provided the end-users with the possibility to evaluate the concept of SOTERIA and assess whether a product based on this idea would support their operations and bring them advantages. An efficient method leading to good information dissemination for decision support was demonstrated.

SOTERIA online presence was realized through a dedicated website and various social media channels. In order to do this, appropriate online channels were launched and maintained. Public website: <http://soteria.i112.eu/>; SOTERIA Facebook page: SoteriaEUProject (<https://www.facebook.com/SoteriaEUProject>) and SOTERIA Twitter account: SoteriaEU (<https://twitter.com/SoteriaEU>). The content of the website and social media pages was regularly updated.

Concerning exploitation of SOTERIA results, the consortium carried out a number of activities focused on the analysis and identification of possible products based on project technologies and potential markets for these. The characteristics of the emergency communication market and its trends were defined and analysed. Existing competitors of SOTERIA were also mapped.

Although the emergency response market is expected to grow to \$131.62 billion in 2019 and the global incident and emergency management market is estimated to reach \$93.39 billion in 2018, SOTERIA focuses on a specific segment of this market, namely Emergency

Communication Systems also known as Mass Notification Systems (MNS). This segment is estimated to grow from \$3.81 billion in 2015 to \$8.57 billion in 2020. In Europe, the mass notification market was valued at \$795.9 million for 2014, and is projected to reach \$2,177.7 million by 2019, at a CAGR of 22.3% from 2014 to 2019.

Mass notification solutions providers (and hence SOTERIA competitors) include companies such as IBM Amatra, Honeywell International, Siemens AG, AtHoc, Eaton Corporation, Everbridge, xMatters, Metis Secure Solutions, Omnilert, and MIR3. Most of these companies focus on messaging/alerts and one-way communication solutions, with a few offering two-way communications. SOTERIA differentiates itself substantially by offering these same features, as well as social media information collection tools, all built on a truly multi-channel architecture; in this regard it also competes with social media management and monitoring solutions such as Hootsuite or Musterpoint.

The SOTERIA consortium also compiled and prepared a set of business models for SOTERIA results. These took into consideration the different types of partners of SOTERIA and the fact that each type of partner provides different types of output that could be combined to provide an adaptive and efficient answer to different needs of the emergency communication market. The benefits of using an SOTERIA like tools have been highlighted as:

- Key personnel and population can be notified in minutes, and large numbers of nonessential but affected personnel can receive critical information about relevant events.
- Management can focus on critical decision making and exception handling, rather than message delivery.
- Human error, misinformation, rumours, heightened emotions and distractions — which often are present during a crisis — can be better managed and corrected.
- A documented notification audit log can be provided for real-time and post event management.
- Messages can be sent that are tailored to different target audiences, based on their role and relationship to the stakeholders.

The actors taken into consideration in the SOTERIA business models comprised:

- ♣ Consulting Company
- ♣ Technology provider
- ♣ Academic partner
- ♣ System integrator
- ♣ End-User

The commercialization approach developed for SOTERIA is a three-pronged approach: The first will be to license individual tools to customers that may only need one of the many solutions being developed in SOTERIA, such as the capability to filter and derive meaningful information from a large aggregate of social media posts or messages. The second will be to combine several of the resulting tools in customized sets, which are most useful to certain customers, and then license those sets of tools to those customers. The third and final approach will be to integrate all the SOTERIA tools into a comprehensive system, which could be licensed to customers who need the full suite of tools for the management of emergencies or crisis.

Business offers from the different SOTERIA partners and their solutions were prepared. The business opportunity created by the project for a company were described in the following way:

- The offer toward a specific market was defined, in terms of technology or service;

- The market barriers were identified;
- A sketch of the business case was defined. Its objective was to size the cost of an issue that could be reduced by the partner's offer. This does not mean that the partner would transform 100% of this opportunity into cash, but more realistically gives an insight on the business field on which the partner would operate.

In total 6 offers were prepared and the innovations proposed in SOTERIA in comparison to previous projects that have laid the ground for the project as well as its differentiators from current market offers were enumerated.

In addition to the above, the consortium identified a set of actions required to implement a sustainable business strategy and operations for the Project's prototypes, services, algorithms and Intellectual Property Rights. As such, the difference between actions that are common to the consortium that bring value to the community of the industrial partners and actions that are specific to a particular business partner was identified. A go to market process was defined for SOTERIA containing the following phases:

1. Understand customers (which includes understanding the end-users needs);
2. Competition analysis;
3. Segment the market;
4. Prepare the market: raise the awareness of an issue and develop various value propositions for the market segments,
5. Define/refine the business model and pricing strategy,
6. Refine the offers;
7. Run the commercial forces.

The pursuit of the SOTERIA go to market strategy befalls on the partners after the project's lifetime as it is impossible to ensure adequate implementation of commercialization actions during the project lifetime (more resources, time and further maturing of the project results would be necessary before a product offer consistent with market expectations can be made available). Finally, the target customers for SOTERIA solutions were identified and this will be important for partners actively pursuing the exploitation of their results:

- Public safety organisations: PSOs are the main target of the SOTERIA project;
- LEAs and other Government Institutions: A more efficient management of crisis and emergency situations is certainly within the mandate of LEAs and other public institutions;
- Private commercial companies: Different kinds of private companies could take advantage from tracking and analysing customers' posts on social media, so to identify unsatisfied needs and feedbacks about what is currently offered by the market and by the company itself.
- Intelligence: Intelligence agencies may be interested in social media monitoring in order to improve their OSINT capabilities;
- Finance: Analysts seeking to forecast market movements may be interested in including social media's spread sentiment in their analysis.

1.5 Contacts

For further information on the project or questions, please visit <http://soteria.i112.eu> or contact:

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