

### beAWARE

Enhancing decision support and management services in extreme weather climate events

700475

## D8.10

## **Overall Impact Assessment Report**

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#### Abstract

The document aims to present the overall impact of beAWARE project. Firstly, the impact of the project is examined against the expected impacts of the call and how the project has covered these expected impacts based also on the results of the evaluation process that it was followed during the implementation of the three pilots.

Furthermore, the impact of beAWARE project on other areas like scientific community and innovation is also described.

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### **Executive Summary**

This deliverable presents the overall impact assessment report of the beAWARE system. It reports how the system has met the expected impacts of the call as well as its impact in society and other areas.

In the first introductory section we provide a brief description of this document and the steps that were followed for its completion. This is followed by a presentation of the beAWARE project, its background, goals and target groups.

In the second section we provide a detailed analysis of how close the final system is to meets the expected impacts of the call, based on the demonstrations and evaluation results of the project pilots.

Finally, the impact that the system has in other areas, like scientific community, safety is also presented. The societal impact is also analyzed in specific target groups, like governmental Authorities and first responders, in order to demonstrate the system's further value.

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### Abbreviations and Acronyms

AAWA	Alto Adriatico Water Authority
CERTH	Center for Research and Technology Hellas
DoA	Description of Actions
DSS	Decision Support System
FBBR	Frederikssund-Halsnaes Fire & Rescue Service
FMI	Finnish Meteorological Institute
HRT	Hellenic Rescue Team
IBM	IBM Israel – Science and Technology Ltd
IOSB	Fraunhofer Institute of Optronics, System, Technologies and Image Exploitation
ΚΑΡΙ	Open Centre for Elder Protection
MSIL	Motorola Solutions Israel Ltd
PLV	Valencia Local Police
PSAP	Public Safety Answering Point

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### 1 Introduction

After three years of progress, the beAWARE project has achieved a significant impact in the fields in which it is involved. In order to achieve this, the platform and the mobile application had to be tested against real-life conditions, which had been demonstrated through the 3 pilots, heatwave, flood and fire and evaluated based on the interaction with the technology that the end-users experienced during each pilot differently.

This procedure allowed the Consortium to gather precise information, data, and feedback from different target groups. All the end-users' perspective was taken into account and helped the continuous evolution of the platform and the mobile application. The evaluation results of this process are presented in D2.4, D2.6 and D2.8.

One of the general main criteria expressed was the simplicity of the system in order to make it as user-friendly as possible and to give trustworthy data to the operator/user. Moreover, the continuous feedback from end-users to the technical partners gave the ability to make adjustments in order to fulfill their requirements based on the three scenarios. To add more, the results of each evaluation were taken into account in order to support further development of the system and to take corrective actions wherever required. The course of the of the system's development along with its technical evaluation and evolution are presented in the deliverables of WP7.

Requirements and needs of the end users where recorded and re-examined throughout the development process, in an attempt to maximize the impact of the system to end users. Initial documentation of the User Requirements is presented in D2.1, which were later updated in D2.10, following the development of the system.

This process together with the support of the end users of the project, allowed the consortium to increase the impact of the system and to meet the expected impacts of the call, as it is described in section 3 of this deliverable. However, the impact of the project is not limited in these expected impacts since the project can also have impact on areas like the scientific community and safety, as described in the .=following sections.

To sum up, the overall impact of the project, has shown the ability of the system to support authorities and first responders in the management of events related to extreme weather conditions, both as a stand-alone solution and as complimentary to legacy tools, demonstrating an overall value for further exploitation. All evaluation results of the pilots of the project that were derived from the feedback of the participants, supported the continuous evolution of the system which in turn increased the system's impact in the management of events related to extreme weather conditions, showing and exploitation potential of the system as this is presented in D8.14.

### 2 beAWARE Project background

As it is stated in the Description of Action of the beAWARE project, in every disaster and crisis, time is the biggest enemy, as also the need to get the most accurate information, about the incident, its extent and impact is really critical in order to create an effective response and recovery standardized procedure for Search and Rescue Operations.

To provide support and accurate information on time before, during and after an emergency incident is the main goal and approach of the beAWARE. The triangle of coordination and communication between authorities, first responders and citizens is a crucial one in order to have a successful operation.

Based on the above-mentioned triangle, the beAWARE project offers a specific approach for all the "players" creating a Command and Control platform and a mobile application in order to monitor and tackle the three extreme weather events that were tested at the pilots.

With those elements in mind, beAWARE project has been developed in order to fill the gaps between all the participants during a disastrous event, relative to extreme weather conditions, from citizen up to Command and Control Operator and Decisions Support operators/governmental authorities. In such a way, beAWARE aims to impact the overall management of such events by providing a more holistic approach. **beAWARE**<sup>①</sup>

### 3 Overall Impact of the beAWARE system

### 3.1 **Contribution to expected impacts of the call**

As mentioned in the DoA, beAWARE aimed to tackle *ambitious objectives in order to address the challenge of rapid response during a crisis*. beAWARE aims to support the whole lifecyle of an emergency relative to extreme weather conditions, from an early stage, when an event is imminent up to the completion and passing of a phenomenon. These objectives are presented and analyzed in section 1.1 of Section B of the DoA and are realized through system's functionalities and tools.

#	beAWARE System tools and functionalities	Relative WPs	Relevant Objective
1.	List of Requirements	WP2	Objective 1
2.	Multilingual Text Analysis	WP3	Objective 2
3.	Automatic Speech Recognition	WP3	Objective 2
4.	Early Warnings and Real Time Monitoring	WP3	Objective 3
5.	FROST, geoServer	WP4	Objective 3
6.	Drones Platform	WP3	Objective 3
7.	Social Media Analysis	WP4	Objective 3
8.	Visual context analysis	WP3	Objective 4
9.	Crisis Classification	WP3	Objective 5
10.	Knowledge base, Semantic Integration and Reasoning	WP4	Objective 5
11.	Multilingual Report Generator	WP5	Objective 6
12.	Main Public Safety Answering Point	WP6	Objective 7
13.	Mobile Application and User Interfaces for KB, FROST,	WP7	Objective 3,
	geoServer, Drones		Objective 7

#### Table 1. beAWARE System's functionalities

Below, there is an analysis of how beAWARE has managed to meet the expected impacts of the call, as they are stated in Section 2.1.1 of the DoA. As expected, the functionalities of the tools (*see table 1*) developed for the beAWARE system contribute towards more than one impact of the call. More specifically:

## **Expected impact (Call):** - more effective and faster emergency responses to extreme weather and climate events; Faster analysis of risks and anticipation;

beAWARE, through the development of early warning mechanisms, which are based in various sources of data and analysis of those data, is able to support a faster response from the authorities and first responders to upcoming events. Weather data analysis provides a weather forecast which is combined with the crisis classification module. As a result, beAWARE provides information to the authorities regarding an upcoming event as also

### **beAWARE**<sup>①</sup>

information about its progression during the event's lifecycle. Moreover, information from sensors also support authorities if fast decision making process. Additionally, analysis that is provided to information that is derived from social media, especial when coming from citizens who are in proximity to an event, allows authorities to provide a more effective and faster response to an event.

This is based on the fact that information reaches authorities faster and it is analysed quicker and in relation to specific thresholds offering at the same time authorities a visual overview of the situation. beAWARE's DSS mechanisms which are based on reasoning, together with a PSAP which supports a visual overview and analysis of a situation, strengthen the overall situational awareness capabilities of the authorities in order to act faster and more effective.

To support the above statements, the evaluation results for the real time data demand was rated from good to excellent during the pilots of the project. Moreover, the clustering of information from similar events and the deletion of irrelevant ones coming from social media, allows the faster analysis of information and therefore of potential risks during an emergency supporting authorities to focus only on relative information. This was also something that was pointed out by participants in the 3<sup>rd</sup> and final pilot of the project, which demonstrated the final version of the system. All the evaluation results that support this claim are presented in deliverables D2.4, D2.6, D2.8.

**Expected impact (Call):** - publicly available online now- and fore-casting systems for disasters triggered by (extreme) weather conditions; - improved coordination of emergency reactions in the field, including the use of adapted cyber technologies;

As has already been mentioned in the previous periodic report, beAWARE is not restricted in traditional voice communication but also takes into account other channels, like social media, and analytics which assist a PSAP operator to assess the validity of information as well as the weather forecasting update through the crisis classification module that has been developed during the project. All incoming information from various sources, like weather data and sensors, is analyzed by the crisis classification module of the system in order to provide visualized information to the PSAP and the authorities in relation to the progression of an event. The incoming weather forecasting together with the crisis classification module, depending on the predefined threshold, trigger the early warning mechanism of the system alerting in this way the authorities for an imminent event. In general, the crisis classification and the weather forecast provide the base for the first action during a crisis that is caused by events related to extreme weather conditions.

The weather information can be provided by sources that are publicly available and can be used as an input to the system. For the purposes of beAWARE, the input of weather data was simulated and supported with data provided by FMI.



Furthermore, beAWARE supports efficiently the coordination of emergency reaction in the field though the use of cyber technologies. As it was stated by first responders who participated in the pilots, beAWARE allows overcoming various issues noticed with legacy tools inside the city, such as bad radio signals, interference, and misunderstanding in operational procedures caused by miscommunication. beAWARE has proven that it supports the flow of communication between authorities and PSAP on one side and first responders who are on the field on the other, through the use of a mobile application that provides targeted information to relative target groups. Moreover, the functionality of task assignment and the overall task management of first responders through beAWARE's PSAP, also improves coordination of emergency reactions. The operator of the PSAP is able to see the location as well as the status of each first responder team on the field in real time and simultaneously for all field-teams and at the same time is in a position to assign tasks to specific teams and receive feedback from them relating to information from the field, thus improving the coordination on the field. This feedback, is not limited to written or speech communication, but it can also be an image or a video sent from first responders who are on the field, to PSAP and the authorities so that they (authorities and PSAP operators) have a direct knowledge of how the situation on the field is, as well as on how an event is progressing, hence being able to coordinate field teams more productively.

To support the above, participants in the flood pilot, including the decision-makers at the PSAP, first responders on the field and citizens as well, pointed out that the value that the continuous flow of data and information, before during and after the event, supports effectively the coordination and communication requirements. Additionally, effective coordination between the different groups was stressed on several occasions by participants in the fire pilot hence supporting the fact that beAWARE can be useful in this regard. A more detailed presentation of the evaluation results of the flood and fire pilot that support the above is included in deliverables D2.6 and D2.8.

## **Expected impact (Call):** - improved capacity to provide adequate emergency responses to extreme weather and climate events; - shorter reaction time and higher efficiency of reactions;

beAWARE provides information to the authorities regarding an upcoming event as also information about its progression during the event's lifecycle. All information is analysed and presented to all parts involved in an emergency, like governmental authorities, PSAP operators and first responders in such a way that it is easy to comprehend and extract the core of what is happening. The overall goal is to *improve the capacity to provide adequate emergency responses* faster and *more efficiently*. The information flow of the final system is demonstrated in D7.8.

Due to the fact that potential end-users of the system may come from different fields, from volunteers up to civil protection authorities on any level, beAWARE was developed with in a flexible and adaptive way, in order to support their different approaches, requirements and



needs. More specifically, the layout of the PSAP can be modified in order meet the requirements of any operator and pop-up windows offer different level of information. This allows an operator to adapt the system to his needs and not for the operator to adapt to the environment of the system, supporting at the same time the strengthening of the operators' capacity to manage emergency responses using all beAWARE tools.

Furthermore, all beAWARE functionalities that support the decision making process help an organisation to improve its capacity to provide adequate emergency responses to extreme weather and climate events. More specifically, the early warning mechanism provides an alert even from the stage when an event is imminent. Additionally, the analysis of images, videos, texts as well as information that is derived from social media, allow an organisation to gather and analyse quickly and effectively information from various sources, which are also used by other tools like the Crisis classification Module in order to provide specific and analysed information to the authorities in relation to the management of a weather related event. Also, the developed drone platform that can be used from field teams and the analysis of information that are gathered through its use, like the analysis of images and videos, significantly increases the capacity of first responders on the field to manage various events. It is worth mentioning that beAWARE tools can be used also as separate solutions, offering to a potential end user the possibility to increase its organization's capacity by adopting only the tools that the organization requires.

A statement that was made by almost all participants in the pilots and demonstrates the impact of beAWARE in the increase of an organisation's capacity is that beAWARE is a great complimentary system to existing legacy tools, already used. This means that it does not require from an organisation to change and abandon the tools that this organisation uses but it can adapt beAWARE system and use it in parallel with existing systems, supporting this way the increase in its capacity without forcing structural change. Needless to say that beAWARE is also a stand-alone solution; however it is recognised that it not limited to that approach.

Increase to an organisation's capacity is also supported by shorter reaction times and higher efficiency of reactions to extreme weather and climate events, an impact that beAWARE also supports. Constant flow, analysis and evaluation of information that beAWARE supports, allows an organisation to react faster and more efficiently when managing an extreme weather related event.

As reported in the evaluation of the pilots, policymakers and PSAP operators gave increasingly positives opinions (>75%) for the continuous data flow and analysis of information, and especially the provision of real-time data on demand, supported them to take faster and more accurate decisions during all the phases of the crisis, relative to an extreme weather event.

Furthermore, to support this impact that beAWARE had, during the evaluation of the pilots, the vast majority of first responders (83%) also expressed an increasingly positive opinion due to the fact that they also had shorter reaction times, better data quality, from PSAP, a



significant improvement of communication between them and the PSAP, which resulted to an increase in efficiency when operating.

**Expected impact (Call):** enhancement of citizen's protection and saving lives. The action is expected to proactively target the needs and requirements of users, such as national law enforcement agencies, climate and weather services, civil protection units and public and private operators of critical infrastructures and networks.

As stated in DoA and in the first periodic report, beAWARE aimed to *take emergency services* response even further by developing a framework that will organise and manage more efficiently the crisis, by enhancing the situational awareness and the early warning mechanisms.

beAWARE covered that impact by making citizens a more active part of the chain of information. The social media analysis tool, analyses, identifies and clusters all relevant post made in social media and that are relevant to an ongoing event caused by extreme weather conditions. The system identifies key words in posts made during a crisis and clusters them if they are located in proximity area with each other.

Through that process, authorities are in position to spot among others, whether citizens are in imminent danger and take appropriate actions danger. Moreover, information that come from citizens though social media and which are sent from a specific incident (e.g. specific posts) and are found by PSAP and authorities through beAWARE, may also result in taking actions for helping citizens that are in danger.

The text analysis and the speech recognition tools that beAWARE supports, allow citizens to communicate with authorities in more ways that the traditional phone and alerting them about critical situation and even if they are trapped in a dangerous situation and require assistance. This functionality was demonstrated during the pilots of the project were authorities received voice messages, text messages and social media posts that informed authorities to take appropriate actions. A good example of how beAWARE supports that impact is the evacuation of the school that took place during the final pilot of the project, resulting in getting a lot of people away from a dangerous area.

Furthermore, through the mobile application, beAWARE delivers public alerts to a specific area in order to inform citizens if an event is in proximity to their location and also sends specific instruction for citizens to follow in order to distance themselves from danger. This action which takes even at the beginning of an event and can be done whenever authorities believe that is required results in citizens getting informed at an early stage in order to take appropriate actions. This process and mean of communication between authorities and citizens is further enhanced due to the fact that citizens do not only receive but are able to send information to the authorities through the mobile application, offering them information about an event that may result to actions that save lives.



All the above have been demonstrated during the pilots of the project and were reported in the evaluation results. All citizen-actors reported that the overall information that they received was from good to excellent as were the instructions that they received through the mobile application. Furthermore, the important role of citizens in sending information before the arrival of emergency services was also mentioned. Additionally, all participants expressed the importance of this platform for citizens, since in this way emergency managers obtain richer information than through other traditional means, while it takes less time to analyse this information thanks to the clustering of similar incidents, reporting, and omission of irrelevant information that is derived from social networks.

The call's expected impact however is not limited to the enhancement of citizen's protection and saving lives, only by directly influencing citizens, but through targeting the needs and requirements of users, such as:

- national law enforcement agencies,
- climate and weather services,
- civil protection units,
- public and private operators of critical infrastructures and networks

beAWARE's aimed to impact the operations of all users. All user requirements, both on a technical and a functional level were formulated in the beginning of the project. The consortium's end users, along with other stakeholders that were approached by the partners, formulated all user requirements for the system. All partners used their network to support the process and to cover as wider range of users as possible.

All end users and primarily first responders and civil protection authorities have as a first goal the protection of citizens and the saving of lives. Therefore by covering their requirements, beAWARE develops into a system that supports that goal, hence protecting citizens and their lives.

In order to achieve that and to fulfil the expected impact, beAWARE tested the system and the level that all recorded requirements were met in three separate stages through pilots that simulated real case scenarios, with three extreme weather related events, heatwave flood and fire. The pilots was also part of the development process, where technical partners and end users had the opportunity to test the system and take corrective actions while developing it further to its next version. In the pilots, apart from the end users of the project other stakeholders participated as well, either as observers or players. In the end of the pilots, discussions on the way and level that beAWARE system meets the end users' requirements were held. In all pilots, the value and impact of beAWARE was recognised since it was generally evaluated as good or excellent system that it complimented legacy tools. Moreover, an evaluation on the level that the user requirements were met after each pilot was held. After the completion of the third and final pilot, beAWARE had met almost all recorded user requirements, covering the expected impact. By covering the user requirements, beAWARE

proved its value as a crisis management operational system that can support the management or events related to extreme weather conditions and that it also supports end users by covering their desired requirements in order to help save more lives.

However, beAWARE does not only limit its impact to the impacts specifically referred to the call. Throughout its implementation it has demonstrated its impact in other areas as well, like science and innovation. Furthermore, since the core objective of beAWARE is to support all the phases in a crisis management sequence, its impact in the society is also important.

The overall impact of the beAWARE solution, establishes a well-taken investigation of a wide range of exploitation prospects, the potential for their wider use and of course their impact on the economy as also the society, locally, nationally and in Europe. The evaluation methodology was mainly based on the user perspective, such as PSAP operators, first responders and citizens, and was mainly focused on the impact of the beAWARE solution in life-saving, protection of infrastructure and property, reducing response time and lowering costs. The impact of the system was evaluated by comparing the management of an emergency before and after the implementation of the beAWARE system. This comparison between existing technologies and the beAWARE solution in all three pilots gave the opportunity to identify and record the impacts of the beAWARE system in order to maximize the dissemination actions.

In the following sections the overall impact of the system in various areas is also analyzed

#### 3.2 Scientific and innovation impact

The development of a new system that combines various technologies that answer different requests from end-users' perspective resulted in a noted scientific and innovation impact of the beAWARE technology which is presented in various scientific conferences and research papers. Additionally, innovation elements were highlighted and noted after the pilots upon discussion with the participants.

Moreover, beAWARE had achieved to give effective and faster emergency responses to extreme weather and climate events, with faster analysis of risks. In the three pilots, beAWARE decision support services for crisis management had proven to act with great efficiency answering all different tasks for the three scenarios. In addition to that, beAWARE system successfully improved the coordination of emergency reactions in the field, to address extreme weather events thanks to the combination of reliable and updated meteorological data, provided in our case by FMI as also AAWA's AMICO model and the DSS that was developed by the technical partners. The trigger mechanism that beAWARE developed for the 3 extreme weather events tested in different periods of time for each one (before, during and after the event) resulting in codified messages from the platform to the mobile application,

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upon Authority decision and request proves the abilities of the platform to assess the validity of information. This combination of technologies and reliable data was proven during the pilots and mentioned at the evaluation sheets and during the discussions (hot debriefs) with the pilots' participants.

In combination with the above ones, beAWARE addresses and the expected impact of shorter reaction time and higher efficiency on reaction due to extreme weather and climate events. This was achieved firstly, thanks to beAWARE KB that estimates the emergency level of the situation in order PSAP operators and first responders to act accordingly. Secondly, due to the fact that beAWARE can continuously receive and analyze data, such as meteorological, sensor (water), video, image, audio, social media (twitter), it gives the ability to decision-makers, PSAP operators and first responders to have higher efficiency on their decisions and calls as also their actions on the field depending on the situation. It is worth to mention that UPF developed an extended text analysis module that can handle not only inputs from its own mobile application but also social media (Twitter) inputs related to the three scenarios, in English, Italian, Spanish, and Greek. To add more, CERTH's automatic support recognition system, image, video, drone and traffic analysis helped in the overall creation of the beAWARE system. Supporting the above functionalities, IOSB provided a mobile application and a SensorThings API which were filtered and notified by the M2M/IoT platform through open and standardized interfaces resulting in the overall formation of the system.

To add more, from the perspective of technology providers and industries as mentioned above, a large positive impact of the beAWARE took place from participation in scientific conferences such as ISCRAM 2019, SmartResilience, Sayso\_H2020 EnviroInfo 2018, TRECVID 2018, COWM 2018, European Meteorological Society: Annual Meeting (EMS) 2018, SafeKozani 2018, SemEval-2017, The Tel Aviv Coastal Forum workshops such as CAP Workshop 2019, IEEE Smart World NVIDIA AI City Challenge, The First Multilingual Surface Realisation Shared Task (SR'18), CAP Workshop 2019, Infoday Regional H2020 and many more, but also 43 publications giving an overall boost to science in this field. This large and through the years positive impact that was given for the beAWARE system from different fields of science helped the overall impact as also the dissemination strategy of the project.

Furthermore, beAWARE with its provided geolocation system not only allows for PSAP to view the exact location of the event but also inform first responders or citizens to head to a specific location with coordinates and of course citizens to give exact location with its coordinates of an event, without being at the spot, if their life is in danger. In all this effort MSIL integrated all the above data, creating the PSAP platform, supported by IBM's communication bus, cloudbased messaging service, based on standards and upon cooperation with the rest of the consortium.



Finally, cooperation between end users and technical partners throughout the whole process for the development of the system, allowed end users to support the development of an innovative solution through the fulfillment of their requests. Additionally, technical partners had direct access to the wills of the end users which offered them the ability to make scientific progress and support innovative solution based on actual needs of potential end user of the system

### 3.3 **Economic impact**

The economic impact of the project is not easy to measure, since it can be derived only indirectly from the outcomes and the benefits of the project and without properly set and test the beAWARE system for a well-accepted period of time. Nevertheless, various participants noted that beAWARE can be a very useful and supporting tool that can coordinate multiple resources such as national and volunteer first responders, instantly and accompanied with the existing legacy tools (VHF/UHF radios) resulting to a better coordination and management of these resources. As a result, the effective management of all resources can reduce the economic impact of managing an extreme event. For instance, by having from the area of the event, analyzed data of each incident, PSAP can dispatch specific and dedicated units reducing the cost as also the time of each operation.

Leading from the above, the positive impact for the economy is that thanks to the beAWARE system, the time of the operation is reduced resulting in lower operational costs. To add more, by having full knowledge of the situation, and the available resources, more sophisticated and dedicated personnel can be dispatched to its incident, resulting in better management of the crisis and reducing the overall costs of the operations.

#### 3.4 Safety impact

Safety impact is very important, from decision-makers to citizens. From governmental representatives and PSAP operators that will take the proper decision to dispatch specific first responders or national authority to answer the call, to citizens that are in danger. Safety played a vital role in the development of beAWARE. For that reason, data acquisition and analysis reached a high level in order to address the call with safety and minimize the danger of the citizens, with special alerts, as also of the first responders with analyzed data from the incident that are dispatched.

Finally, beAWARE system successfully answered the expected impact of citizens' protection and saving lives, targeting the needs of users, from different authorities such as national and local law enforcement, climate and weather services, volunteer organizations of civil protection mechanism as well as private operators. This combination of different end-users



gives a significant added value to the beAWARE because it answers different approaches and needs from all end-users perspectives from different countries of Europe.

### 3.5 Training impact

beAWARE system can help PSAP operators, decision-makers, first responders and citizens to use it and in training events in order to maximize their efficiency and be more effective in order to tackle more success incidents in real life. beAWARE has already set a well-established procedure having a detailed script based on specific Use Cases and User Requirements for each pilot, external participants and an evaluation methodology contacted after each pilot. This procedure that beAWARE consortium followed can be used as a guideline for future training exercises from organizations or authorities that want to use beAWARE system in order to carry out exercises to meet their needs and increase their operational capacity.

### 3.6 Societal impact

beAWARE project has a different impact on each target group in the society. This is easily understood because there are different needs and requirements of each target group. From the target groups mentioned in other WP8 deliverables, e.g. D8.1, the impact on PSAP operators, policymakers and government representatives is positively large. This can be proven from the evaluation results and from the fact that beAWARE enables them to be able to prepare, and interact directly with citizens and first responders before, during, and after an event enhancing the communication and flow of information between all parties involved.

On the part of first responders and citizens, the impact of beAWARE is also positive here. Those groups are directly connected with the PSAP through the application and exchange important data from the event. Moreover, they also inform at any time their position, their situation and any changes that may take place in the area. Citizens are given the opportunity to participate in the overall crisis management system, giving information about the phenomenon and the various risks they identify. In the following sub-chapters the view of the target groups is cited that strongly support the positive impact of the beAWARE system at their group.

#### 3.6.1 **Governmental authorities / PSAP operators**

Governmental Authorities that are responsible to operate PSAPs, such as police, fire brigade, or generally the civil protection mechanism of a country have certain requirements in order to operate a PSAP at their station. The most important thing for a PSAP is to be easy to use, to handle incoming information smoothly and to allow outgoing commands to be sent as quickly and easily as possible, as well as understandable to the sender and to the recipient. In



addition, it is important to consider that the PSAP may need as few operators as possible and therefore equipment to operate and be flexible in its management.

To add more, the representatives from governmental authorities stated that "beAWARE is a very interesting tool and will help in managing situation, as a support system", "it can be a useful tool for us", "has many potentials", "it has a good and constant flow of data", "platform map has good interaction time". Those expressed opinions of the players showing that generally, beAWARE system, can be a supportive tool next to their already established decisional system.

Thanks to the continuous feedback to the technical partners from the end-users and the pilots' participants, the final beAWARE platform that was created meet their needs and requirements. The main PSAP screens, which are the task manager screen and the main event map screen, offers the opportunity to the operators to have a clear view of the entire area of the event, different map layers and information that are required and to have the ability to assign tasks to the field rescue teams and inform citizens for an imminent danger. As a result authorities can manage risks more productively and take appropriate decision affecting first responders and citizens in order to reduce their exposure to danger.

#### 3.6.2 Policy Makers

Policy Makers and Governmental Representatives in general, who are involved in crisis management as well as in search and rescue operations are mostly interested to receive reliable and as comprehensible as possible information on time, in order to take action and make decisions as correct as possible. In addition, as it was extracted from the questionnaires and the discussions with the participants from the pilots, it was noted that governmental authorities need to be immediately informed of any change in the situation. This is very important, due to the fact that everything should be clearly presented on the platform, in order proper decisions and actions take place depending on the situation of the event. Finally, the processing of digital information coming to PSAP should be fast in order to properly evaluate the situation and if necessary make appropriate adjustments again.

Additionally, the project's partners in order to promote the project to policy makers and strengthen its impact, made a lot of meetings with national authorities or entities to inform them about beAWARE project and its abilities.

As described in D8.3, various meetings with representatives of local, regional and national authorities (*see D8.3 table 2*), even from countries outside the project's consortium, took place in order to promote the beAWARE system and its potential to support the Crisis Management mechanism in each respective area.



In all those meetings, beAWARE system was presented in each different stage, to representatives from various entities and authorities. Politicians especially, recognized the need for tools like beAWARE risk management and all have recognized and confirmed the great impact of beAWARE system to Citizens and the Community. To add more, it was stated that since this system can be easily customized and integrated on existing systems, it can upgrade and enhance existing operations and services. In addition to the above meetings, consortium members made significant efforts to disseminate beAWARE project with well-established media coverage, such as publications in local newspapers, interviews in radio broadcasts as well as in their social media accounts resulting to positive interaction, visibility and impact for the project.

beAWARE platform, through the pilot exercises and online presentations after each pilot, has succeeded in proving that fast processing and analysis of digital information is possible. Data such as meteorological info, photos, videos, audio messages, texts from twitter are processed, analyzed and presented on the platform without long delays. This gives the ability to the policymakers to take decisions, faster, more accurate and in the correct directions as also to receive crucial information from the field, even from citizens.

Last but not least, as it was demonstrated in the final pilot of the project beAWARE system can be potentially used to connect a local or national emergency with the EU civil protection mechanism, potentially with an easy and direct way of communication. However, having that in mind, it is too early to estimate the potential impact on EU policies from the use of such a system and if in the future such a feature will be adopted. Nevertheless, the system can be adapted with little efforts to new crisis scenarios (such as heavy storms, snowstorms, etc.) beyond those covered in beAWARE offering an adaptable solution to policy makers that can used in different crisis regardless the scenario.

#### 3.6.3 First Responders

First Responders from public authorities or voluntary organizations, which are mainly involved in SAR missions in the field, act as the intermediary between the PSAP and citizens in need. The primary concern of first responders is to get the right and necessary information from the PSAP as soon as possible in order to know the exact location of the area of the event, what's the event about, and in general acquire as much information as possible. In addition, interactive communication with the PSAP and the ability to send information quickly and immediately is a very critical and crucial need for first reposnders. Additionally, one of the biggest problems in rescue operations is the difficulty of the continuous online communication because of the "blind" spots from which rescuers cannot send or receive data with new information about the event, due to lack of mobile coverage.



beAWARE platform and mobile application that have been tested in all three pilots, have proven to be able to send and receive a large amount of data from the PSAP to the field rescue teams and vice versa. As a result, the system can support exchange of information among first responders efficiently.

To support that, some statements that first responders made during the evaluation of the pilots were:

- "beAWARE app could be a great support to the radio but not a total replacement",
- "detailed information and time saving",
- *"useful supporting tool with high quality of data",*
- "a good assisting tool"

Those positives feedbacks from the first responders signify that beAWARE can assist them before and during an operation in order to maximize their efficiency.

Additionally, in all three pilots, the participants noted down that the mobile application menu is easily understandable, all the actions that should be taken can be achieved without problems and the data upload procedure was very familiar for them. Moreover, it is easily handled and offers only the required information without any unnecessary or irrelevant information that may cause unwilling concerns and queries. Finally, the majority of the first responders reported that the beAWARE mobile application can easily work seamlessly with existing technologies such as VHF/UHF communication, whereas the beAWARE mobile application was overall a good one and the overall reactions and use of it was in a satisfactory level.

It can be easily understood that the impact of a system such as beAWARE, to First Responders can be significantly high, especially taking into account the fact that the system can be used both as a stand-alone system and complimentary to legacy tools. It can support operation management in a productive way, which allows First Responders to be more efficient of the field.

However, it is worth mentioning that national services such as fire brigade, civil protection and police authorities besides their positive opinion for the system, state that in order to integrate such a system in their own mechanism, a political decision is required. Therefore the impact on policy makers and authorities is crucial to the adaptation of the system by first responders.

#### 3.6.4 General Public (Citizens)

In a state of emergency, the main concern of citizens is to be able to transfer the information as quickly and easily as possible to emergency services that they or other people are in danger.



In addition, they want to transfer as much information as possible regarding their location, and if a photo, video or audio can be sent so as to make rescuers' work easier.

Through the continuous communication of technical partners with end-users to create a userfriendly and easy understandable mobile application, as well as the continuous improvements and changes that took place after each pilot thanks to feedback from pilots participants, the final version of the application that was created fulfill all the requirements of the participants based on the existing technology. Thanks to the beAWARE mobile application citizens can easily be informed of dangerous events and the affective area.

Additionally, the ability to attach files such as photos, videos or voicemails to send information to PSAP and rescue teams about and an emergency is easy and understandable based on the participants' opinion after the pilots. Last but not least, is worth mentioning that participants with the role of the citizen stated that beAWARE mobile application makes them part of the participative process of emergency management, as they contribute with their information, such as a photo, video or a voice message of the area of the event, while today they are almost totally outside of this process.

To add more, societal impacts were also noted and documented in all three pilots by the participants, especially citizens. As previously mentioned, when citizens participate in all the crisis management systems, especially when they send the important data (photos, videos or voice-calls) to the PSAP, feel that they too are involved in solving the problem and are a very important link in the rescue chain. Additionally, citizens when they know that PSAP and first responders have a combined coordinated system that will be used to support them, feel safer and more secure because operations will be organized and methodologically prepared and executed. Moreover, social media analysis by beAWARE adds and promotes another way of communication between citizens and authorities. Knowing that relevant posts are spotted by authorities it is safe to assume that citizens might increase the use of social media during an emergency, in order to support the crisis management mechanism as well as to provide information to the authorities even at a very early stage of the event.

Moreover, adding another form of communication which offers modern tools such as photo/video or voice-messages exchange between citizens and PSAP, gives the opportunity to crisis management operators to have useful analyzed data from the area of the event that can be proven important for the operation.



### 4 Conclusions

The impact of a project is the project's "legacy". More specifically, how a project affects the environment that it exists and the people with which it interacts directly and indirectly. beAWARE being a project that aims to enhance the ability of authorities to manage events that are related to extreme weather conditions, hence to enhance the safety of citizens, provides a holistic approach to support decision-makers though out the management of such an event.

beAWARE successfully met all impacts referred to the call through all the separate tools that were developed that provide a holistic approach in the crisis management of events related to extreme weather conditions. The system has demonstrated through the execution of three pilots that it can support more effective and faster responses with faster risk anticipation by using forecasting and analysis of various data with the use of cyber technologies in order to improve the coordination of responders on the field. Additionally, beAWARE has also demonstrated its capability to improve the capacity of first responders and the efficiency of their reactions, all in the support of the overall goal to protect citizens by meeting the needs and requirements of all potential end users and decision-makers.

However, the impact of beAWARE was not limited only to decision-makers but it expanded to the scientific community. With the publication of 43 papers and participation in more than 60 events in order to promote the project and its results, the dissemination of the outcomes was extensive and reached various audiences. Dissemination to the scientific community was also supported by various events, most notable the workshops that took place during ISCRAM 2018 & 2019, that allowed to further influence the scientific community with the developments made during the implementation of the project by putting beAWARE in the center of discussions.

Furthermore, society and citizens were a major target of beAWARE. The system allows the involvement and faster notification of citizens during an emergency event that could potentially support the saving of more lives. Since the system proactively targets to meet the requirement of all responders that are involved in an emergency situation related to the management of extreme weather-related events, it increases the capacity and the effectiveness of first responders.

Additionally, beAWARE system supports and improves the coordination of first responders improving the efficiency of existing resources and therefore better management of an event. Taking also into account the fact that beAWARE does not aim to explicitly replace legacy tools rather than operate as an additional tool whenever and wherever necessary, the impact in managing events and thus the impact on society as well as first responders can be significantly positive.

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Moreover, beAWARE support authorities and first responders to improve their capacity through task management and better use of resources, offering an indirect impact in the economic aspect to the emergency management. beAWARE supports quicker reaction time through its early warning system and its crisis classification module that supports a more holistic approach to emergency management as well as shorter reaction time and higher efficiency of reactions.

Finally, the impact on policymakers is worth mentioning as well. Through face to face meetings as well as the participation of policymakers in the project's pilots, set the ground for beAWARE to disseminate its results and present its operational impact to those that make the decisions leading to perhaps changes in policies towards managing events related to extreme weather conditions.

To support all the above mentioned activities and in order to strengthen its impact, beAWARE implemented an overall dissemination plan that addressed different audiences from national and local authorities, first responders, PSAP operators, citizens to the scientific and industrial community. This address was made in 3 periods. In the first period, the project awareness was created by addressing targeted audiences and beginning communicating and recruiting users that were important to support the project. In the second period, there was an active invitation of the user groups to participate in the project's events and continuous engagement and training of the users. In the third period and until the end of the project, there was an attempt to produce a first business interest to potential customers, and generally promote the beAWARE solution.

Furthermore, the use of social media and the production of online and offline communication material allowed beAWARE to spread its message and to increase the awareness for the project and its objectives. Additionally, other dissemination products such as the project website, online newsletters, press releases in newspapers, audio-visual material, publications, workshops, networking and direct communication with potential users or clients and finally with relevant projects and initiatives took place in order to maximize the positive the overall impact of beAWARE.

Throughout its implementation, it can be argued that the overall impact of beAWARE can be characterized as positive to various parts of the society and specifically the defined target groups of the project. Taking that into account, this positive impact allowed and even pushed the consortium to formulate an exploitation plan after the project's duration in order to invest on that. The impact is such that an end user of the project, PLV, will continue to operate and support the development of the system offering at the same time a real demonstration show case of the use of beAWARE in a real environment. Local authorities welcomed that approach which set the ground for the development of beAWARE system to continue beyond the



project's duration. Moreover, technical partners recognized this opportunity and agreed to support the system the period after the project in order to enhance the efforts of further exploitation of the system.