How situational awareness can be improved by using real-time video? Case: simulated natural disaster at the Viksu 2014 camp

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***Abstract*—**Public safety authorities all over the world have recognized that the lack of interoperability of information and communication technology (ICT) systems limits the effectiveness of rescue operations. Whether natural or man-made, catastrophes can happen at any time, and with no warning. This creates major problems for public safety agencies set up by governments to provide for public protection and disaster relief (PPDR). The ability of these agencies to cope with unexpected disasters and emergencies of any scale is dependent upon the infrastructure and support that they have in place for their day-to-day operations. Need of overall situational awareness has increased during the past decades. Research data of this case study consists of a literature review, interviews, on-field observations and discussions during an exercise, where a technology providing live video was tested during simulated natural disaster at the Viksu 2014 Young Firefighters Camp. The results of the study indicate that watching real-time video ties persons down and they cannot participate in operational action at the same time. Different departments has their own situation centers, which means that the same real-time picture has to be available for every organization involved. The amount of situation centers affects the distribution of resources, organizing and forming of the situational awareness. A command center requires more than one person to manage situational information flow. Responders are usually carrying their own smartphones on the field. Used solutions enable PPDR officials and partners install and deploy applications easily. Applications might allow first responders to use their own smartphones for emergency communications in situations where communication with primary network becomes difficult. Decision-makers must establish priorities for response in large-scale disaster when the total demand for rescue services is greater than the PPDR organization´s capacity to respond. Distributed real-time video improves decision support systems by allowing command center to allocate resources in the right proportion.

***Keywords*—**public safety, command and control management, decision support systems, real-time video, situational awareness

I. Introduction

THERE has been unexpected disasters e.g. a major earthquake in South Asia, a shocking tsunami in the Indian Ocean, flooding and forest fires in Europe. Also disasters due to human activities, such as terrorist attacks or industrial accidents, happen all too frequently around the world and threat of military presence is rising. It has been seen that a military threat in Eastern Europe has come back as crisis in Ukraine have raised military tensions.

A human is still the decision-maker at the scene of the accident, although different kind of decision support systems have become a part of decision-making. Rescue manager makes the decision based on gathered information. View of the situational awareness is inevitably partly subjective. Therefore, more accurate situational picture makes the conditions less ambiguous. Situational centers allocate resources based on the situational picture. Decision-makers share information of the accident from the command or situational center to the rescue workers on the field.

Therefore, organizational structures are significant when evaluating the advantages of the decision support systems. If organizational structures are incompatible or complex, sharing the right information to the correct authorities becomes more difficult. The information available must correspond to the required knowledge. In a case of a disaster there might be a need for emergency accommodation or food supply, but different authorities do not receive information on available aid from volunteer associations. According to Rajamäki et al. [1] and Hanni [2], there is a need to ease situational awareness and decision making by using cameras and sensor information.

Singular decision support tool does not integrate all the information systems used by involved organizations. There is also still confidential information that must be kept within one authority. Likewise, there is information that is publicly available for everyone but does not reach the authorities. Whether the situation is caused by human activities or natural disaster, it can expand to larger areas and even cross-border. This emphasizes the meaning of both co-operation between situation centers and compatibility of the information and communication systems. Sharing resources also involves the availability of required services and their usability. Expanding operational cooperation aims practical co-operation and mutual interaction between public safety actors, which will improve the situational awareness [3].

In this study, situational awareness was studied by evaluating new technologies during a simulated natural

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Fig. 1 Natural disaster rehearsal.

disaster that was performed at the Viksu 2014 [4] camp area in Pori, Finland. The Viksu 2014 Young Firefighters Camp was an international youth camp, where young voluntary firefighters met and practiced rescue skills. Laurea University of Applied Sciences, Laurea UAS's students, Ajeco ltd., Airbus defence and space ltd. and Eye Solutions ltd. participated on the camp where rescue exercise was based on a downburst hitting the camp (Fig.1). Laurea's partners Ajeco and Eye Solutions provided a field operation platform with various telecommunication possibilities for the Viksu 2014 camp.

First responders are often the first people at the scene of an emergency. They may be fire fighters, border guards, or people with similar responsibility for the safety or well-being of the community. Although criticized of its dogmatism [5], the first hour after the onset of out-of-hospital traumatic injury is commonly referred to as the "Golden Hour". Patients who are in the operating room within one hour of injury have a much higher survival rate [6]. This is one example, why quickly offered and reliable situational awareness and real-time picture is necessary for emergency responders and decision makers.

The case belongs to the multinational Multi-Agency Cooperation In Cross-border Operations (MACICO) project [7, 8]. The MACICO project's goal is to develop telecommunication solutions that are viable in various complex and demanding public safety incidents.

The objective of this case study is to research the added value of real-time video in simulated natural disaster and compare the results with different user needs. The aim was also to find out what kind of added value used a situational awareness communication model brings to all public protection and disaster relief authorities.

The paper is structured as follows: after introduction we describe the theoretical framework, which consist of similar technologies and the used terminology, followed by more detailed description of the MACICO projects empirical target and technologies developed within the project. Then we explain the applied methods and the research project and the results collected during evaluating these technologies. Finally, discussions section reflects on what kind of benefits situational awareness model brings to different actors and how it could be utilized in new ways.

II. Theoretical Framework

A. *Public Protection and Disaster Relief Functions*

The term 'public protection and Disaster Relief' (PPDR) is used to describe critical public services that have been created to provide primary law enforcement, firefighting, emergency medical services and disaster recovery services for the citizens of the political sub-division of each country. These individuals help to ensure the protection and preservation of life and property. Public safety organizations are responsible for the prevention of and protection from events that could endanger the safety of the general public [9]. Such events could be natural or man-made. According to [9], the main public safety functions include law enforcement, emergency medical services, border security, protection of the environment, fire-fighting, search and rescue and crisis management.

One major challenge in defining a classification of public safety organizations at the European level is that, due to the non-homogenous historical development of public safety, similar organizations have different roles in different countries [9]. A certified first responder is a person who has completed a first aid course and received certification in providing pre-hospital care for medical emergencies. The majority of public safety organizations' personnel are also certified first responders.

Second big challenge relates to structure of organizations. Emergency response center administration has six regional emergency response centers. Different departments has their own situation centers. Situation centers tasks are not clearly defined. There are no precise regulation or indication for the activities of the situation centers [10]. For example in Southwestern Finland Police Departments' situation/command center answers to reporters calls 24 hours per day [11]. The Emergency Response Centre Administration provides emergency response center services throughout Finland. The duty of the Emergency Response Centre Administration is to receive emergency calls from all over the country for the rescue, police and social and health services; handle communications relating to the safety of people, property and the environment; and relay the information they receive to the appropriate assisting authorities or partners.

Currently real-time situational picture from the scene of the accident is rarely distribution to command center. Real-time situational pictures are tested in the field, but there is no permanent common real-time situational awareness system, that could be used to enhance situational awareness [12-14]. For example fire brigade and police have been using different camera-solutions at occasional situations, but there is no proper real-time situational awareness system in use.

B. *Decision support systems for PPDR*

Decision-support systems are used to track key incidents and the progress of responding units, to optimize response activities and resources, and to act as a mechanism for queuing ongoing incidents. Each aspect of the above process is part of an ongoing cycle, in which assessments, decisions, and interventions at one point in time produce implications for subsequent response activities [15].

1) *Situational awareness in this context*

An important factor for using live-video technology in emergency response work is the ongoing trend to improve situation awareness. In this context situational awareness means the ability to have a sense of control of what is going on and what might happen in the future and its implications on operative and strategic levels to allocate public protection and disaster relief resources.

2) *Command & Control Systems*

Most new digital services for the PPDR sector are supplied via stand-alone systems without built-in interoperability. There is a real lack of a coherent system that would coordinate the various technologies and improves the system's accuracy and usability. According to Frost's and Sullivan's study, the need for interoperability between services is the key market driver with regard to first responders' communications, command and control and the intelligence (C3I) market [16]. The main market restraints are fragmented decision-making and budgetary allocations [16], as illustrated in Fig. 2.

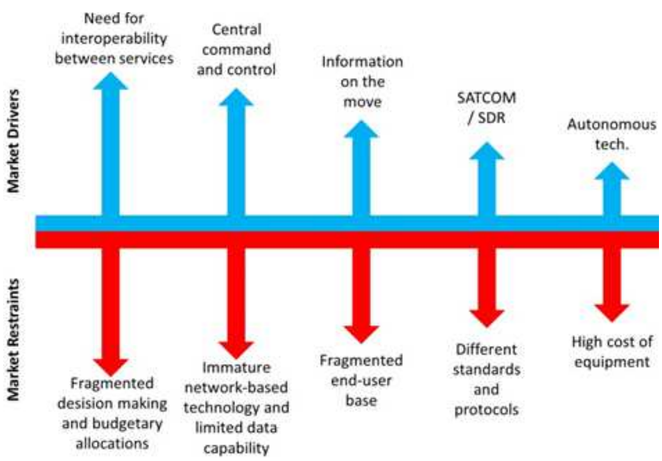

Fig. 2 Key market drivers and restraints of first responder´s communications, command and control and intelligence market.

Remote operation means the control and operation of a system or equipment from a remote location. In systems engineering, monitoring means a process within a distributed system for collecting and storing state data. A PPDR monitoring station is a workstation or place in which sensor information accumulates for end-users who need it. Monitoring systems include information collection, analysis and provision for end-users, which is front-deployed knowledge.

For example most important data system for Finnish police field operations is the POKE field command system. It consists of different kinds of maps, including aerial photos, patrol tracking, messaging, activity logs and information sharing. The system has access and enquiry facilities to various databases, and it includes resource management and dispatching as well as reporting applications .KEJO project means that Ministry of the Interior's ICT Agency HALTIK and the National Police Board are developing a common Field Command System for all public safety actors, because the main need is a common field- command system for all PPDR actors. [17]

3) *Video Surveillance*

Video surveillance has been used in many public events for years and there is a large variety of products available. Video surveillance cameras are often categorized by their viewing direction, which means that the cameras are either fixed (a camera that has a fixed viewing direction once it's mounted) or panoramic cameras (they provide a 360 degree field of view). Older generation video surveillance systems are usually focused, meaning that they provide a view to a single direction. Newer cameras are often panoramic, meaning that they can provide a view of 180 or 360 degrees and they also provide better quality, most often 720p or 1080i. Some camera models also provide more advanced features, such as motion detection, audio detection and tampering alarm [18].

Often the cameras are fixed, but for example a mobile video surveillance system that could easily be moved around the venue could be beneficial in larger public events. One of these mobile surveillance units is Pro-Vigil's Virtual Guard Station. There are a number of companies that provide similar mobile surveillance applications in the market; however, most of the companies in the business are located outside Finland. Examples of such applications include Wireless CCTV and Axis Communications.

III. EMPIRICAL TARGET

The capabilities of PPDR organizations across Europe have been considerably improved with the deployment of new technologies including dedicated TETRA (Terrestrial Trunked Radio) and Tetrapol networks [7]. Security organizations increasingly face interoperability issues at all levels (technical, operational and human) as they interact with other national, regional or international organizations. PPDR organizations have to benefit from interoperability functions in their day-today work [7]. The MACICO project aims at developing a concept for interworking of security organizations in their daily activity. The main goal of the MACICO project is to address on a short-term perspective, the needs for better systems, tools and equipment for radio communication in cross-border operations [7]. The main key is to concentrate on an operation which takes place on the territory of other member states. One example of above mentioned situation is a high scale civil crisis operations or complex emergencies where the authorities need support of public safety services from other member states.

The MACICO project is a Celtic-Plus project with nine project consortium partners from Finland, France and Spain. The project started at December 2011 and its duration was 30 months. However, the Finnish consortium continued until the end of the year 2014, because of all the demonstrations during Viksu camp and the analysis of them [8]. Target of the project is to develop a new interworking concept for security organizations which do not use the same communication network in their daily basis, but they could take a benefit from sharing their respective network infrastructure. The way to organize cross border use of the communication networks will be defined and validated by the security organizations authorities. Use cases such as pursuit of criminals across the border, close support of vehicles going through a border and disaster relief operations require security organizations from both countries to communicate together and to communicate with their control room. Technically these use cases needs options like inter-network communication, coverage expansion and migration [7].

The MACICO project's main objective to provide full interoperability between different TETRA and Tetrapol networks has been achieved. With the achieved technical solutions the following networks can be connected: TETRA-TETRA, TETRA-Tetrapol, Tetrapol-Tetrapol. This comes at the right time as there is today increasing pressure from the governments that this cooperation happens. The consortium is however conscious that the public safety actors (firemen and police, among others) do not like to share their resources (including their networks) and there is work ahead to convince them to adopt this new way of working; for example, further discussions would be needed to ensure data interoperability, a topic that was outside the MACICO project's responsibility but should be tackled to ensure real cooperation between security teams. An important aspect is also that the MACICO solution allows migration from an older to a more recent solution without interrupting the services. This opens new opportunities, for example, in the promising transition to Long Term Evolution (LTE) / 4G networks. Also, the importance of the satellite communication (SATCOM) during emergency situations, identify the associated challenges and call for concrete actions to overcome them is highlighted.

IV. Technical Solutions

Eye Solutions real-time video transfer solutions with wearable mobile video software product enables distributing multiple simultaneous videos between users. The platform consists of features for bandwidth management, real-time continuous video and audio shared across the team. The system was gathering live audio and video view from the field to the camp security management using cameras and microphones of ordinary modern smartphones (Fig. 3). The system consists of a PC which was used to administrate the system, some screens to monitor the situation, Android smartphones to gather the live information from the field and a multi-channel DSiP router. The java based system administration software used browser as an operating system and was run local in a PC. The smartphones can be remotely controlled by the administration software. Using a multi-channel router means, for example, that if a smartphone is outside the WiFi coverage area it switches smoothly to 3G.

Fig. 3 Smartphone installation on paramedic's (left) and fireman's uniform.

Ajeco is the creator and inventor of a patented communications architecture named Distributed Systems intercommunication Protocol (DSiP). The architecture is realized as a software suite consisting of node-, virtual router-, control- and monitoring utilities. The DSiP system solution has been developed during the past 14 years, and it is used among several critical applications with operational status.

The camp was equipped with 4Com routers, solution for secure and reliable multichannel communication by implementing the DSiP protocol. The DSiP solution is network- and technology agnostic in the sense that it is able to route data between network peers, regardless of the used physical means of transport. TETRA-, Satellite-, Mobile data-, LAN-technologies, for example, may all be used as parallel communications methods between network peers, however in such a way that the peers will not detect, or see, the different physical transport channels, regardless of linkperformance and latencies, of course. DSiP solution can utilize all existing telecom networks such as 4G (LTE), 3G/EDGE/GPRS, Satellite and TETRA and they appear as a single robust and secure data transfer path between the peers. The 4Com routers were installed to the command center and also to one fire truck together with PC with Eye Solutions application.

Situational awareness system of Eye Solutions and reliable communication through Ajeco's 4Com router were tested in

Fig. 4 Smartphone installation on fire truck. (Photo courtesy of Tapio Mäkinen.)

the camp. They were also available during the scenario exercise. In the Viksu 2014 camp, Samsung Xcover Android smartphones were used. Their installations on the rescue workers uniforms were made so that smartphones' cameras could take real-time video. One mobile command and control system was installed on the dashboard of a fire truck, as shown in Fig. 4. Within the "natural disaster" there were one to three observers in the command and control management room (see Fig. 5). Real-time picture was seen on the screens in the command and control room. Operations in the control room were recorded and analyzed.

V. Research Method and Process

Yin [19] identifies five components of research design for case studies: (1) the questions of the study; (2) its propositions, if any; (3) its unit(s) of analysis; (4) the logic linking the data to the propositions; and (5) the criteria for interpreting the findings. According to Gerring [20], a case study and research design may also refer to a work that includes several case studies, for example, comparative-historic analysis or comparative method. Yin [19] emphasizes that the unit of analysis defines what the case is and that the main unit of analysis is likely to be at the level being addressed by the main study question, which is followed by linking the data to propositions and the criteria for interpreting the findings.

Fig. 5 Viksu 2014 camp's command and control room.

The research data of this case study were gathered by interviews, observation in the field and literature reviews. During the research process there was interaction and discussion between the researcher and the rescue workers. Observing users in the field give the better way to understand usability requirements. In addition the interviews were recorded and analyzed with qualitative content analysis methods [21].

VI. Case Study Findings

As a result of literature review and interviews, we selected the following six features with regard to video/camera as being the subject of further analysis: (1) need for controlling the camera remotely, (2) need to share real-time video between actors, (3) camera features; water-proof, shockproof, freeze-proof, warm-proof, (4) Need of vehicle/personal tracking, (5) Need to see updated maps, (6) Need for reliable data connection.

TABLE I Specific user needs (scale 0–3)

Role	Need to control camera remotely	Need to share real-time continuous video between actors	Camera features; Water-proof, shock-proof, freeze-proof, warm-proof
Fire/rescue	0	2	3
Paramedics	0	3	1
Command and Control	3	3	0

TABLE II. Technical possibilities (scale 0–3)

	Remote control	Real-time continuous video	Camera features; Water-proof, shock-proof, freeze-proof, warm-proof
Eye-solutions situational awareness model	1	3	1

TABLE III. Specific user needs (scale 0–3)

Role	Need of vehicle / personal tracking	Need to see updated maps	Need for reliable data connection	Total points
Fire/rescue	2	1	3	**11**
Paramedics	2	1	3	**10**
Command and Control	3	3	3	**15**

TABLE IV. Technical possibilities (scale 0–3)

	Tracking	Maps	Reliability	
Eye-solutions situational awareness model	3	1	3	**12**

Table I and III presents the specific end-user needs of these six features. Table II and IV shows the technical possibilities of applied solutions with regard to the selected six features.

The critical decision making required in disaster situations is heavily based on the availability, accuracy, and timeliness of information that can be made available to the decision makers.

Importance of overall situation pictures increases in the beginning of the alarm. If first responders arrive in 20 minutes, one third of the "golden hour" has been lost. Therefore, it is not always enough that the patient is rushed to the hospital, but survival may be conditional that the treatment is started already on the field.

Incidents requiring response are matched with available resources. If the total demand is greater than the PPDR organization´s capacity to respond, decision-makers must establish priorities for response in large-scale disaster. Distributed real-time picture allows command and control management to allocate resources in the right proportion.

The result of the case study indicates that watching the real-time video tie persons down in the command and control room and they can´t participate in operational action at the same time. Command and control management needs more personnel to follow the screens. First vital report without real-time video complicates the allocation of resources. Therefore, for example, the (temporary) command and control management team in hospital needs the ability to see real-time picture.

A Camera installed in a PPDR vehicle needs remote control from the command center. Getting the overall picture depend on where the PPDR vehicle is placed at the scene of the accident.

View of an object from above would help command and control personnel noticed rescue workers movements and would show variable factors like tents from the whole area.

Different departments has their own situation centers, which means that the same real-time picture has to be available for every organization involved. The amount of situation centers affects the distribution of resources, organizing and forming of the situational awareness. The live video from the scene only provides more value if it expands the knowledge of the accident and the damages it has caused from the conception formed by verbal description.

Since recognizing an acute crisis from a usual routine assignments is based on situational assessment which is based on the available information, the information has to be relevant, as accurate as possible and timely in order to be useful for distributing resources. Other challenge is the communication systems currently in use: how a system providing real-time video can be implemented or concurrently fit with the VIRVE radio network devices currently in use by Finnish authorities.

Monitoring the real-time video footage cannot, however, delay the help to arrive to the scene by binding operative workers. A person involved with the operational actions cannot observe the video. Therefore, the tasks has to be assigned clearly and the operational work must be separated from gaining the situation awareness and from making decisions. In order to make reasonable decisions the accurate information must be formed quickly: for example the person in charge of a rescue operation must be able to make decisions of a need for a helicopter or even forming a field hospital.

In order to help forming situational awareness the real-time video must be in a useful visual form. It is necessary that the development of the situation can be observed and the spatial placement of the video sources is understood correctly. Possibility to delegate the usable video and other situational information to co-operatives is essential. When it comes to sharing resources in correct proportions for the situation, both operating models and information systems of the organizations involved must be compatible.

Command or situation center can benefit most from real-time video if the picture is sharp and it is shown on an up-to-date map or aerial view. The system demonstrated at the Viksu camp had aerial view with pictures taken approximately one year ago. As observed, the view was already different from the actual landscape and the temporary buildings like the tents complicated forming the correct picture even further. The environment can change within hours, particularly during natural disasters. It is important that the pictures from a camera held by an operative is placed on correct background. Best solution could be picture-in-picture: the captured live videos on a recent and updated aerial view taken within the last minutes.

This solution of live video on current aerial view from the scene would help the command or situation center to gain better overall picture from the situation and to utilize the separate videos from the field. If the image is up to date it could also reveal new threats. For example there might be patients that have walked away from the scene in a shock. In order to form this kind of view there needs to be sharp snapshots in a form that can be consolidated into one map. The source of this kind of pictures might be a radio controlled camera drone or sharp and recent satellite pictures. In both cases more resources in devices and data communications are required.

Responders are usually carrying their own smartphones in the field. Used solutions enable PPDR officials and partners to deploy the Android app easily. This allows first responders to use their own smartphones for emergency communications in situations where communications become difficult or jams completely.

VII. Discussions

In the future, it would be important to investigate real-time situational awareness solutions with micro air vehicles (MAVs) [22].

A remotely piloted or programmed MAV could bring the necessary added value for emergency and rescue services. According to Tikanmäki´s [23] research using unmanned air vehicle´s improve situational awareness.

There are also new kind of real-time awareness -solutions under the development. Epson and the National Institute of Information and Communications Technology (NICT), conducted tests to explore the feasibility of a new post-disaster rapid-response system.

The NICT provided a system for linking a super high-speed Internet satellite, with unmanned aircraft systems (drones) to enable wireless communications during disasters. System would allow images taken by a drone flying above regions devastated by disasters to be transmitted in real time via satellite [24].

PilotGaea GISDK 3D system allows real-time rendering of UAV full motion video on 3D GIS platform with flight position and orientation. It is UAV flight simulations and a flexible flight information display system, allowing the overlaying of UAS video with GIS simulated landscape and GIS [25].

It can be concluded that PPDR actors over the Western Europe are waiting for common operating model for decision makers. However, all PPDR ICT solutions need critical communications systems. There is a growing dependence and interest of military and civilian security actors on satellite communications not only during crisis and disaster, but also in every-day routine. It is a unique capability ensuring long-distance communications and broadcasting. It facilitates the use of mobile or deployable platforms as a substitute or support for ground-based communication infrastructures and to cater for the exchange of large quantities of data. Satellite communications is often the only possibility for public protection and disaster relief to communicate when they have to intervene in distant areas where the ground infrastructure is damaged or destroyed, using mobile or deployable systems.

A very important factor in critical communications systems, in addition to reliability and security, is a concept called Common Information Sharing Environment, or in short CISE. CISE is since 2009 being developed jointly by the European Commission and European Union / European Economic Area Member States including civilian and military authorities as well as the European agencies operating in the maritime field. It will create a political, organizational and legal environment to enable information sharing across the seven relevant sectors/user communities (transport, environmental protection, fisheries control, border control, general law enforcement, customs and defence) based on existing and future surveillance systems and networks with a view to achieve a fully operational CISE by 2020 [26].

In addition to providing multichannel communication, non-reputability, encryption, and security, the DSiP architecture provides means for solving complex compatibility issues providing interface and process ontology and methods.

One fresh point of view is how to utilize social media in catastrophe situations. Nowadays most of the citizens carries mobile devices with camera all the time. However, in Finland this possibility has hardly been utilized at all for forming situational awareness. For example in Sweden public-safety answering points (PSAP) have situational picture function [27] that helps them to form picture of the scale of the disaster and share this information with safety, fire and rescue authorities. Further, this information helps to allocate resources accordingly. With such a large quantity of photographs flooding the web. CrowdOptic's technology, which includes sensor data smoothing, EXIF data mining and focal analytics, is instantly deployable in a range of mobile applications and technology environments to enhance security. Instead of focusing purely on where photographs were taken, their goal is to determine what that photos were taken of [28].

UN and Nato's research institutions have developed decision support systems that make it possible to improve the an overall situation awareness.

For example the Emergency Relief Coordination Centre (ERCC) in the United Nations Office for Coordination of Humanitarian Affairs (OCHA) in Geneva acts as GDACS Secretariat [29]. Global Disaster Alert and Coordination System (GDACS) is a cooperation framework between the United Nations, the European Commission and disaster managers worldwide to improve alerts, information exchange and coordination in the first phase after major sudden-onset disasters. It includes disaster managers and disaster information systems worldwide and aims at filling the information and coordination gap in the first phase after major disasters [30].

GDACS provides real-time access to web-based disaster information systems and related coordination tools. Annual GDACS stakeholders meetings are attended by disaster managers, scientists, map experts, webmasters and other professionals, to define standards for information exchange and a strategy for further development of its tools and services [30].

The Euro-Atlantic Disaster Response Coordination Centre (EADRCC) is NATO's principal civil emergency response mechanism in the Euro-Atlantic area. It is active all year round, operational on a 24/7 basis, and involves NATO's 28 allies plus 22 partner countries. The Centre functions as a clearing-house system for coordinating both requests and offers of assistance mainly in case of natural and man-made disasters [31]. Attitudes must changes to introduce such a cross-border decision support system in Finland.

VIII. Conclusions

The case study findings can be summarized so that the used technology is useful. Having the right piece of information at the right time can literally save lives, money and resources.

The applied real-time situational awareness solution enhanced different PPDR actors to do their duties during the accident. However, usability and technological innovations must move to the same direction. A correct and reliable situational awareness solution will require an understanding of what are the real user-needs. Technical solutions are not essential if they are not useful.

The real time pictures and videos from the scene could be gathered from social media, but that binds more employees to search and follow several data sources with plenty of irrelevant information: the useful data could be a needle in a haystack. Therefore, providing the audience a separated system for capturing live video with their mobile devices could be a better option, that would also be easier to make compatible with the systems and procedures developed for the authorities.

Harnessing the power of civil activity and the capacity of mobile devices, combined with a centralized real-time situation awareness system, could form a decision support system, that would serve effectively all the authorities in all the situations described. With help of crowdsourcing useful information can be reached with aid from volunteer associations available. Emergency accommodation or food supply is easier to arrange when demand is equal to supply. Along with local situation and command centers this data could be provided to the Government in the most wide and massive disasters.

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