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Concept on Key Enhancements on integrated tools for Planning and Logistics 4.0 in Emergency Response (KEPLER)

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Abstract. KEPLER brings innovation from the crucial preparation phase up to the response phase. This will be achieved by developing a framework of integrated tools for empowering emergency managers with the ability to (i) plan and build scenarios using a common methodology and a standard format, (ii) enrich them with resources and capabilities identified from a wide range of possible sources and (iii) manage the response phase starting from a predefined scenario, actualising it to the on-going disaster, verifying the available resources and capabilities and managing the situation thanks to full interoperability. The three tools will rely on five common services offering DSS capabilities, a repository of scenario, a functionality for requesting and tracking the deployment of external resources, a taxonomy service for semantic interoperability and an inbound/outbound interoperability layer. The targeted result is a fully integrated and scalable system for building, sharing, comparing and improving scenarios and response plans, resulting in a more efficient preparation and response to complex and multi-disciplinary disaster situations.

1 Background

Disasters affect the life and the properties of a huge number of citizens in Europe and represent a challenge for the economic sector of the society. Whilst they cannot be avoided, a well-organised preparedness of the actors involved in disaster risk management allows coping in a more efficient way with crisis situations. Given today's interconnection between people and services across regions and States, the challenge of being well prepared to face situations spanning across boundaries is increasingly complex and requires a well-coordinated effort between many authorities and responders. On the other side, information, resources, capabilities and equipment needed on a disaster scenario may be found and brought on site from locations far from the affected areas and provided by external organisations. The discovery of such (often much-needed) additional resources, the matching of the needs with the actual availability and the arrangement of a quick and efficient transportation where needed would represent a major enhancement in the ability of a community to plan and respond to a major event: in other words to increase its resilience.

An efficient response needs a thorough planning, carried by laying down a number of appropriate scenarios related to the risks a community and an area are prone to, identifying the impact of the materialisation of such risks in vulnerable areas and describing how situations may unfold in a number of plausible series of events. In response to these scenarios, emergency planners and managers must find the most appropriate responses, first counting on their own forces and resources, then identifying which resources would improve the response,

reduce the impact of the disaster, the time to intervention, maximise the efficiency of the rescue operations and increase the ability to react to the consequences of the disaster, and to shorten the time for restoring the basic services in the affected area.

To empower disaster managers with the ability to build accurate, efficient and effective response plans, a better set of instruments is called for building accurate dynamic scenarios and for identifying the resources needed for reducing the impact of a disaster on their community. The EC has put in place a mechanism for a strong cooperation between civil protection organisations that can be activated in case of need by a State: by such mechanism, a number of predefined and certified modules can be requested and, once found available, allocated and dispatched to the requesting site. While this tool has proven and is evidently extremely helpful, it was envisaged and designed for responding to major disasters and crisis, but not to plan and support the response to local emergencies, where the cooperation between neighbour Countries and very local capability providers (such as volunteers, professionals, local transport) may prove instrumental to a quick and successful response.

2 Objectives

The authors see a solution in the systemic setup “KEPLER” that aims at creating an integrated tool for offering information, capabilities, resources and equipment along with logistic solutions (including aviation) for their delivery and deploying. This "offering" side of the KEPLER platform will be complemented by a "demanding" side that emergency planners will use to identify the best match with their needs and build a better response planning based on many more possible resources than those they may actually be aware of. In addition to the use of offer/demand functionalities, the KEPLER platform would provide the set of information together with the lead-time for the delivery of the needed resources, by combining the time to have the resource available for dispatching and the most efficient logistics for their transportation, choosing amongst a variety of possible routes and carriers.

Combined with a scenario-building functionality and with the ability to discover the set of static data (such as map, cadastral data, emergency plans, demographics, infrastructures…) and dynamic data (such as sensors, meteorological data, traffic data), the KEPLER platform will be also available during the response phase. It would offer a unique and enhanced integrated tool for launching the response phase and verifying the actual availability of the resources identified during the scenario building. Once the event will be known in its reality, the planning would be adjusted and new or different resources will be searched, discovered, requested, arranged for quick transportation and made available on the scene.

Such scenario building and planning platform could therefore be used both for the preparation phase and for organising the response phase, allowing for improving both processes and ensuring a better efficiency before the disaster struck and immediately after the event onset. The joint effort of many different actors across groups (planners, simulation managers, providers of tool and services, resource manager, site managers…) would find in KEPLER a leveraging set of integrated tools for creating a stronger and more united community of practitioners and for sharing needs, solutions, plans, capabilities and lesson learnt.

In addition to a solid planning and a swift launch of the response phase, emergency managers also need solutions for a better intervention on site. In particular for creating, collecting and streamlining the more possible information from the affected area into real-time tools for staying abreast of the evolution of the situation and implement micro-plans for solving specific situations and bring relief and support where needed and when needed. Many solutions, tools and devices are available as results of previous projects and research efforts. KEPLER aims at building a flexible system for integrating as many as possible sources (on-the-ground observers, satellite imagery, sensor networks, advanced location capabilities, communications, social media, drones, local information providers, and simulation models) into a powerful, autonomous, quickly deployable integrated system that would be able to be set-up, configured and operated in the area affected by the disaster. The organised flow of information will represent an information centre for a complete situational awareness and for offering the widest range of information to decision makers.

An on-site operational KEPLER post would be able to operate under any known conditions and will be interoperable with as many as possible local subsystem, along with a robust connection with the KEPLER platform, so that evidence from the field will be seamlessly fed to the planning/responding tool for defining new needs and discovering/dispatching new resources.

3 Approach

These main goals (better preparedness and better response capacity) will be reached by achieving multiple sub-objectives, covering several areas of innovation: IT, Communication, Logistics, Operational Procedures, Societal, Ethical and Legal. That will be achieved by building a holistic system appropriately suited to the situation, including all the

actors involved in disaster management and following a practitioners-driven approach: since the practitioners are the crucial actors in every disaster management operation, KEPLER needs to be based on their point of view, requirements and recommendation.

While developing technological solutions and tools, the project will cover other innovative areas, building a context within which assessing the legal, social and ethical acceptance of the integrated solution, including the societal acceptance of the envisaged system.

4 Expected Results

The three major results aimed for in KEPLER are the following components:

1. A central system for matching needs and demands from emergency services with resources offered for managing a disaster (KEPLER platform). Such tool will be available both for planning exercise (targeting the definition of emergency and intervention plans) and for the real disaster scenario, when it will be used to check the actual availability of the resources planned to intervene. Any stakeholder will be able to create emergency plans for different events including also the use of resources from other Emergency Services. Doing so, they will be able to build different plans depending on the available resources, the time of their arrival, their logistics and deployment areas and their origin. The plans will be also simulated in order to assess their effectiveness and efficiency. Then, having these plans fully prepared and ready, as soon as a real threat comes into action, the ES will choose the more suitable response plan from the ones it has created.
2. An information interoperability system (KEPLER post) able to collect static and dynamic data from a variety of sources, which includes also the exchange of information between responders and humanitarian or external organisations. All the actors will also exploit a seamless communication network, based on land-, air- and satellite-based channels. The network will be created by the system, making it autonomous and available even in areas not covered by any existing communication network (or with network damaged by a disaster). The system will not only collect and aggregate data in a single interface, but will also include a DSS (Decision Support System) that will help the emergency systems to better define a line of action.
3. A set of technological tools (KEPLER tools) that are integrated in the planning and the response (e.g. drones, deployable sensor networks). The tools will cover both already existing components and innovative ones. The integrated system will be modular, so that the ES will be able to select the most appropriate combination of tools for the current or expected disaster.