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Emerging technologies for the Early location of Entrapped victims under Collapsed Structures & Advanced Wearables for risk assessment and First Responders Safety in SAR operations

D8.9 SnR Evaluation Framework

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Search and Rescue Project Profile

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Partners

	NATIONAL TECHNICAL UNIVERSITY OF ATHENS (NTUA) Co-ordinator	Greece
	AIDEAS OÜ (AIDEAS)	Estonia
	SOFTWARE IMAGINATION & VISION S.R.L (SIMAVI)	Romania
	MAGGIOLI SPA (MAG)	Italy
	KONNEKT-ABLE TECHNOLOGIES LIMITED (KT)	Ireland
	THALES ITAIA Italia SPA (THALIT)	Italy
	ATOS IT SOLUTIONS AND SERVICES IBERIA SL (ATOS)	Spain
	ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS (CERTH)	Greece

	UNIVERSITA DEGLI STUDI DI CAGLAIRI (UNICA)	Italy
	UKEMED GLOBAL LTD (UGL)	Cyprus
	PUBLIC SAFETY COMMUNICATION EUROPE FORUM AISBL (PSCE)	Belgium
	UNIVERSITA DEGLI STUDI DI FIRENZE (UNIFI)	Italy
	DEUTSCHES FORSCHUNGSZENTRUM FUR KUNSTLICHE INTELLIGENZ (DFKI)	Germany
	UNIVERSITA CATTOLICA DEL SACRO CUORE (UCSC)	Italy
	VRIJE UNIVERSITEIT BRUSSEL	Belgium
	SYNYO GmbH (SYNYO)	Austria
	UNIVERSITEIT HASSELT (UHASSELT)	Belgium
	SPOLECZNA AKADEMIA NAUK (SAN)	Poland
	GIOUMPITEK MELETI SCHEDIASMOS YLOPOIISI KAI POLISI ERGON PLIROFORIKIS ETAIREIA PERIORISMENIS EFTHYNIS (UBITECH)	Greece

Search and Rescue End-Users		
	ELLINIKI OMADA DIASOSIS SOMATEIO (HRT)	Greece
	ENOSI PTYCHIOYCHON AXIOMATIKON YPAXIOOMATIKON PYROSVESTIR OY SOMATEIO (EPAYPS)	Greece
	JOHANNITER-UNFALL-HILFE EV (JOHAN)	Germany
	JOHANNITER OSTERREICH AUSBLIDUNG UND FORSCHUNG GEMEINNUTZIGE GMBH (JOAFG)	Austria
	CONSIGLIO NAZIONALE DELLE RICERCHE	Italy
	POMPIERS DE L'URGENCE INTERNATIONALE (PUI)	France
	ASOCIATA CLUSTERUL ROAMN RENTRU PROTECTIE SI ECOLOGIE IN DOMENIUL MATERIALELOR CHIMICE, BIOLOGICE, RADIOLOGICE/NUCLEARE SI EXPLOZIVE (PROECO)	Romania
	SERVICIO MADRILENO DE SALUD (SERMAS)	Spain
	FUNDACIÓN PARA LA INVESTIGACIÓN E INNOVACIÓN BIOSANITARIA DE ATENCIÓN PRIMARIA (FIIBAP)	Spain

	ESCUELA ESPANOLA DE SALVAMENTO Y DETECCION CON PERROS (ESDP)	Spain

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Executive Summary

Purpose of this SnR evaluation framework is to provide guidance on a structured evaluation process for all use cases to evaluate all technology components developed under the SnR project. In order to achieve this, a set of KPIs has been formulated for each individual technology component. Subsequently an iterative definition and selection process has been established to identify relevant KPIs for each use case. The evaluation criteria take account of the technologies on the one hand, but on the other hand also consider context specific needs of each use case.

The deliverable takes stock of the objectives of all use cases that have already been defined in the respective pilot plans. These are important to understand the different contexts in which the technologies will be tested and from which different needs and requirements for the different technologies may result. This Framework intends to provide guidance for the overall set up of the evaluation process applying a common approach. However, the variety of technologies and use cases makes it impossible to define one process that fits every situation and hence needs to leave room for some flexibility in adapting the evaluation tools, while still leaving possibilities for comparison.

D8.9 elaborates on the development process of the SnR evaluation framework, under involvement of end-users and technical partners, also providing indications for further research and next steps to be taken for the evaluation phase of the project. Furthermore, it details the data collection methodologies, listing and summarizing all relevant methods needed to plan and execute the trials. These have also been matched with the preliminary set of KPIs for the technology components which have been selected for use cases.

The deliverable concludes with a checklist for all use case organizers in order to ensure that planning prior, during and after completion of the use cases is timely and adequate. The framework will be core for this next phase of the project when it comes to testing the technologies in the use cases. Considerations on the evaluation need to be incorporated in the overall planning and set up of the use cases to have a clear understanding of the tasks that need to be performed and by whom, to have high quality data for the evaluation.

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1 Introduction

Evaluation is key to measure performance and success of developed technologies, and how this relates to overall performance and processes relevant to first responders in the context of SnR. An evaluation should then also be able to generate recommendations for further refinement of the subject of interest of the evaluation.

An overarching SnR Evaluation framework becomes crucial for two reasons. Firstly the high number of technologies that are being developed and ought to be tested within the project should fulfil key criteria. Also, they require a structured way to monitor and evaluate the performance. Secondly the project follows the ambition to test the technologies under different circumstances and in varying contexts, simulated through the seven use cases to be executed starting from the first planned use case in April 2022. The high number of use cases and variety thereof further stresses the need for a unified approach, albeit the fact that the evaluation framework should provide enough flexibility to incorporate the individual needs of each of the use cases.

D8.9 opens with an overview of objectives relating to the project, the evaluation at hand and the respective use cases at the center of WP8. Furthermore, brief reference is made to the IFAFRI capability gaps which have been identified as relevant reference for this project. The SnR technologies aim to help close these gaps. Chapter 3 explains the applied methods and process to develop the evaluation framework before presenting methodologies for data collection as key part of the evaluation in chapter 4. Here attention is also put on the relevance of considering gender aspects in the overall evaluation. Chapter 5 defines the evaluation design, presenting relevant KPIs per each component and use case context. Furthermore, links to the TRL are made and relevant roles onsite for the data collection at the use case implementation and execution phase are presented. The deliverable concludes with a simple checklist for the preparation, execution and analysis of the evaluation, ensuring that use case owners are able to prepare and follow a similar approach for the evaluation.

1.1 Link to other WPs – Relation to other documents

Task 8.3 "Overall assessment, evaluation and pilot improvements and deliverable D8.9 "SnR Evaluation Framework" bring together many components of the SnR project, preparing the evaluation of technologies which will be tested in the seven Use Cases. The Evaluation Framework draws on the following preliminary project results:

WP1: D1.5 Report on user requirements, existing tools and infrastructure (V2) served as valuable input for the definition of KPIs and a crosscheck for developed SnR technologies. Furthermore, it introduced the IFAFRI capability gaps which serve as a suitable basis to underline the need and user requirements for SnR technologies.

WP5: Provided further input on technology specific KPIs (in relation to the Rescue MIMS)

WP7: Provided an important overview of SnR technologies; D7.1 served as a basis, with completion of D7.3 in the course of the development of D8.9 updates of SnR technologies were made to reflect the current state of developments to be assessed

WP8: D8.1 SnR Guidelines and User's handbook is important reference for use case planning teams for the preparation of the pilot exercises and gives general indications on what organizing teams should take in mind also with regards to the evaluation phase thereof. D8.9 builds on this basis. The Pilot plans (D8.2-D8.8) provide the use case specific objectives relevant for the evaluation framework. D8.9 forms the basis for subsequent pilot implementation and evaluation reports D8.10 (M28) and D8.11 (M35) linked to the SnR platform releases in M27 and M33.

While the development of the evaluation framework draws directly on previous output of some WPs, it should be noted that at the evaluation stage all project efforts, divided up in the various WPs, come together. In other words, D8.9 does relate to all WPs directly or indirectly, evaluating the overall efforts that went into the development of the SnR technologies.

2 Aims and Objectives

2.1 Project specific Objectives

Overarching aim within the Search and Rescue project is the optimization of SAR processes. As SAR operations are very time sensitive, and fast response time can contribute to a successful rescue of victims, one of the general ambitions of the SnR project is to speed up the process, making operations more timely and efficient. More specifically, the project focusses on the development and improvement of technologies for an early location of entrapped victims as well as advanced wearables for risk assessment and overall increased safety for first responders active in SAR operations.

As per the Grant Agreement, part of the aim of WP8 is to define evaluation procedures for the use cases to assess the impact of the project to its target communities and respective end-users. Key purpose lies in the implementation and evaluation of the overall approach of the SnR platform, defining validation activities to ensure validity of results. The seven use cases should serve to test and monitor progress and validate methodologies and technologies. The evaluation framework aims to describe a harmonised approach for the evaluation of technologies and procedures performed and tested within the use cases, detailing evaluation instruments and methodologies for the specific context of each use case and end-user profiles participating. Furthermore, the evaluation procedures should be detailed, taking into account the planning and coordination phase of the evaluation process, in accordance with planned objectives and outcomes.

The SnR Evaluation Frameworks forms an important part in making sure the project consortium can reach these objectives resulting in a successful project.

2.2 Use Case specific Objectives

Each of the seven use cases was set up with specific objectives in mind reflecting the operative needs of the end-user organizations linked to the innovative SnR technologies. Within the respective Pilot Plans for each Use Case (D8.2-D8.8) each planning team defined relevant objectives for the planned exercise with the specific technologies to be tested in mind.

As has been introduced in D8.1 Pilot Guidelines and users handbook the exercise objectives detail what is to be achieved by exercise participants, formulated in a SMART way to make these objectives specific, measurable, achievable, realistic and time-bound. In other words the formulation of objectives needs to be workable for measurement.

Below table1 provides an overview of the seven use cases, with the respective objectives envisioned at this stage of the project. Similarly, mention of preliminary UC specific KPIs as per the GA and pilot plans are indicated, which will be adapted with progression of the pilot planning to ensure its applicability.

[1] Content adapted from D1.5 and D8.2-D8.8

<table>
<tr><th>UC</th><th>Title (country, partners)</th><th>UC objectives/aims</th><th>SnR Technologies</th></tr>
<tr><td rowspan="2">1</td><td>Victims trapped under rubble (Italy)

CNR, MAG, UniCa, UNIFI, THALIT</td><td>The contribution of the tools/equipment developed within the project to a whole series of simulated ad hoc situations will be tested</td><td>1) Wearable GPS tracker (UniCA)
2) Situational Awareness Model (UBITECH)
3) COncORDE (KT)
4) Decision Support System (DSS)(KT, CNR, NTUA)
5) Rescue kits for children (UniFI)
6) Smart textile professional uniform (UniFI)
7) Wearable ECG, EMG (UniCA)
8) Wearable strain sensors (UniCA)
9) AI algorithms for recognizing objects from drone images (AIDEAS)</td></tr>
<tr><td colspan="3">DSS KPIs
degree of accordance/discordance of the decision-maker and the DSS recommendations (e.g., in case of recommended EMS allocation to Incidents, how many EMS unit did the High Commander actually dispatch to a specific Incident, and what is the difference with the recommended?)
time that is required by the DSS to consume a message, process it and return the send a response back.
Field Operation KPIs
time of initial notification call;
time until the first ill/injured victim has been triaged in the field;
time until the last ill/injured victim has been triaged in the field;
time until first treatment was performed;
time until victim is evacuated from scene;
time until victim arrives to the Emergency Department;
time to notification of the first appropriate staff person who assumes medical management coordination role;
time to arrival of the first EMS ambulance on scene;
time to transportation/evacuation of the last ill/injured survivor from the scene;
time until first triage assessment in Emergency Department;
time until last triage assessment in Emergency Department;
average time spent by victims on the scene;
average time spent by victims on ambulances and helicopters;
number of victims evacuated from scene;
number of victims that receive first triage;
number of victims transported to emergency department (first triage);
number of victims transported to emergency department.</td></tr>
<tr><td>2</td><td>Plane crash, mountain rescue, non-urban (Greece)

HRT, NTUA, CERTH, UBI</td><td>Test the capabilities of the SnR platform on risk assessment, crisis management and rescue/volunteer mobilization</td><td>1) Smartwatch(KT)
2) 3D Mixed Reality Command Centre (depending on the required hardware) (CERTH)
3) Smart Glasses (to be used for training and if possible, to display information through AR on the field) (SIMAVI)
4) Volunteer application (CERTH)</td></tr>
</table>

			5) COncORDE (KT) 6) Emergency Response Health Condition Monitoring Device (Test the device on the simulated victims) (CERTH) 7) e-learning based platform (to be used for training) (CERTH) (This depends upon when the actual training material (developed by T2.4 will be available for upload and use in the platform. The respective deliverable is due on M24. The e-platform (CERTH's part) will be ready to accommodate the material once the material is ready. Therefore, it also depends on when UC2 will be taking place.) 8) Artificial intelligence (We understand that this is a technology for image/video analysis. If so, we would like to test it with images from the drones) (AIDEAS) 9) Situational Awareness (UBITECH)
	KPIs: • Support the exchange of information between first responders on the field and the Command-and-Control Centre • How quick is the information flow? • How many users can have access to the same information and the same time • Show only relative information to the end-user • Classification of information • How a DSS can support media coverage • How a DSS can support handling the relatives of the victims • Offline access • Local network to support dissemination of information among first responders on the field		
3	**Heavy storms in the region of Kufstein railway station derailing a train (cross-border pilot, Austria-Germany)** JOAFG, JUH, SYNYO, DFKI, THALIT	• Train patient routing system (tech. supported) • Rebuild communication infrastructure/ad-hoc infrastructure to re-establish basic communication • Train takeover of data management for different ambulance services at the command centre • Manage Common Operational Picture (CONCORDE emergency app)	1) Smartwatch(KT) 2) Obstacle Detection System (ODS) (THALIT) 3) Rescue Robots & Semi-Autonomous vehicles (DFKI) 4) COncORDE (KT) 5) Six Gas Hazmat Monitor (UniCa)

		• implement and train triage structures • Conduct informed hazard assessment (using HazMat detection devices) • Test interoperability of search and rescue with dogs and technical equipment *Optional: Covid Tracing via Patient Routing System*	
	KPIs: • Establish communication link to the next full capable node • Time to Re-establish communication • Data transfer/Data Exchange digital-paper-digital • Interoperability of patient routing system AUT/GER (exchange patient data via patient routing system) • Time until all trapped victims are rescued • Usability of technical equipment (gas detection, UGV, CONCORDE app) • Interoperability of CONCORDE platform • Connection with S&R platform		
4	**Forest fire expanded and threat to industrial zone (Attica or Boeotia, Greece)** EPAYPS, NTUA, CERTH, UBI	Test the remote sensing technologies proposed in the SnR project for the safety of first responders: • alarms for early warning of toxicity and radiation exposure • generally inspection of the hot zone area • use of RPAS/drones, such as rescue robots to facilitate SAR operations	1) Smart Glasses (SIMAVI) 2) Smartwatch (KT) 3) Emergency response health condition monitoring device(CERTH/HRT) 4) Radiation sensors (wearable) (UNICA) 5) Chemical sensors - Rescue MIMS (NTUA) 6) Drones (UHasselt) 7) Collaborative drones' platform (UHasselt) 8) Rescue Robots & Semi-Autonomous vehicles (DFKI) 9) Obstacle Detection System (ODS) (THALIT) 10)Volunteer application, (Tech 3.1) (CERTH)
	KPIs: • Number of organizations and users involved • Number of new requirements recorded • Level of realism of the exercise • Level of effectiveness of the smart glasses • Operation capability of chemical sensors on roving systems or robotic platforms • Effectiveness of the S&R technologies (wearables etc.) • Capability of the local network to support dissemination of information among first responders on the field		
5	**Victims trapped under rubbles (France)**	• Test the components (MIMS, drones, Situational Awareness Model,	1) Situational Awareness Model (UBITECH) 2) COncORDE (KT). 3) Wearable ECG, EMG (UniCa).

	PUI, KT, THALIT, ATOS	Emergency Communication App, Physio DS, Wearable Tracker and connected uniforms) • Test medicalization of buried victims • work in real-life operational USAR conditions with designated areas for a base of operations, a USAR coordination cell (UCC) and a medical centre	4) PHYSIO DSS (KT, CNR, NTUA). 5)Wearable tracker (UniCa) 6) Rescue MIMS (NTUA) 7) Smart textile professional uniform (UniFI) 8) Drones (UHASSELT)
	KPIs: *Focus on time and effectiveness:* • Notification and coordination time • Time for crisis notification call issues by the Operations Centre to reach user's communication devices • Time needed for a user's post (e.g. text, photo) to be transmitted in other user's mobiles • Effectiveness in supporting the communication and coordination between first responders on the field and the Operations Centre provided by the tested devices/tools • Effectiveness in monitoring the first responders/volunteers/victims' health vitals • Average time until unaffected persons reach safe assembly points • Total evacuation time for all actors • Average time spent by victims on the scene		
6	Resilience Support for Critical Infrastructures through Standardized Training on CBRN (Romania) PROECO-CBRNE, SIMAVI, KT, ATOS	• Testing the technologies, products and services developed within the SnR project in case of a real intervention situation for a terrorist attack using CBRN • Define a standardized training system	1) Smart glasses (SIMAVI) 2) COncORDE (KT) 3) Six Gas Hazmat Monitor (UniCa) 4) Smart textile professional uniform (UniFI) 5) Wearable strain sensor (UNICA) 6) Rescue system for kids (UNIFI) 7) E learning base platform (to be used for training) CERTH
	KPIs: • Notification and coordination time: ○ The time when the notifications of the emergency cell reach the formations and the persons providing the intervention; ○ the time required to publish a document (eg text, photo) sent to the mobile phones of other users participating in the intervention or the media. • Response time: ○ the arrival time of each team in the disaster area; ○ Time for rescuers to reach the first / last the person affected / injured on the spot.		
7	Chemical substances spill (Spain) SERMAS - ESDP, ATOS, KT	• Delimit the working zones according to the existing risks and toxicity levels, in order to guarantee the safety of the first	1) Concorde EMS & Associated module/services (KT). 2) COncORDE (KT) 3) DSS (decision support system) (KT, CNR; NTUA).

		responders and rescue dogs, and as well, indirectly to the safety of the victims of the incident. • Recognition of changing safety zones by CONCORDE and chemical sensors	4) Wearable strain sensors (UniCa). 5) Six Gas Hazmat Monitor (UniCa)
	KPIs: • Notification and coordination time • Time for crisis notification call issues by the Operations Centre to reach user's communication devices • Time needed for a user's post (e.g. text, photo) to be transmitted in other user's mobiles • Response time • Time for rescuer's arrival on scene • Effectiveness in supporting the communication and coordination between first responders on the field and the Operations Centre provided by the tested devices/tools • Effectiveness in monitoring the first responders/volunteers/victims' health vitals • Average time until unaffected persons reach safe assembly points • Total evacuation time for all actors • Average time spent by victims on the scene • Time for rescuers to reach the first/last affected/injured person on scene		

Table 1: Use Case objectives and technologies

All use case organization teams focus on the main objective of testing the SnR technologies and equipment in their respective operative context of their organizations and in part in coordination with other organizations. As the pilots are becoming more detailed throughout the preparation and planning, these objectives may be further revised to become more specific and better applicable to each of the use cases and contexts of technology testing to meet the required outcomes.

2.3 IFAFRI Capability Gaps

IFAFRI[2] capability gaps have been introduced in D1.5 to establish an important reference to the SnR user requirements.

The International Forum[3] specialises on technologies for first responders to realize safe, effective and efficient missions, a focus similar to the ambitions of the SnR project and its objectives. The forum has defined 10 core areas for which innovative technologies could have a high impact on first responder's safety and efficiency in their missions. The identification of such capability gaps is further linked with innovation needs and operational requirements as well market information.

[2] International Forum to Advance First Responder Innovation
[3] https://www.internationalresponderforum.org/about

Figure 2-1: IFAFRI capability gaps[4]

The technologies and various components developed within the SnR project address all of the above gaps identified. These aspects lie at the core to improve the time-sensitive work of first responder's on the ground. The developed and improved SnR technologies will be tested and its application and handling evaluated from April 2022 onwards, with the first use case being executed. In order to structure this evaluation process across all use cases and the technological components this framework has been developed and will be presented in the following chapters, keeping the capability gaps in further consideration, while developing operative (process oriented) as well as technology-focussed (functional) KPIs for each technology component.

[4] https://www.internationalresponderforum.org/sites/default/files/IFAFRI_FLYER_2020.pdf

3 Framework Development

The evaluation framework was developed following the steps, visualized in the following Figure 3-1. The first three processes are already finished at this stage. In the following months, according to the timing for the seven use cases, the last process will be done in close cooperation with the use case owner. The detailed processes are described below.

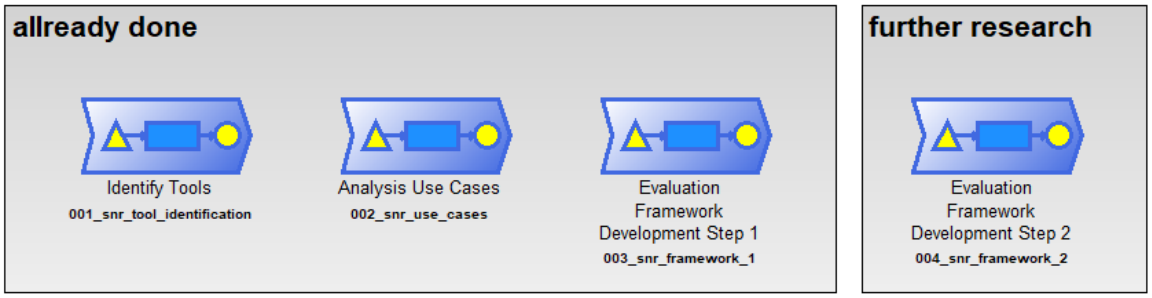

Figure 3-1: Evaluation Framework[5]

The first step was to identify the SnR Tools which are relevant for the use cases. Therefore, a process following the steps in Figure 3-2 was developed. Based on the results of D1.5 as well as the SnR DoA the SnR tools were analyzed and structured for the further research.

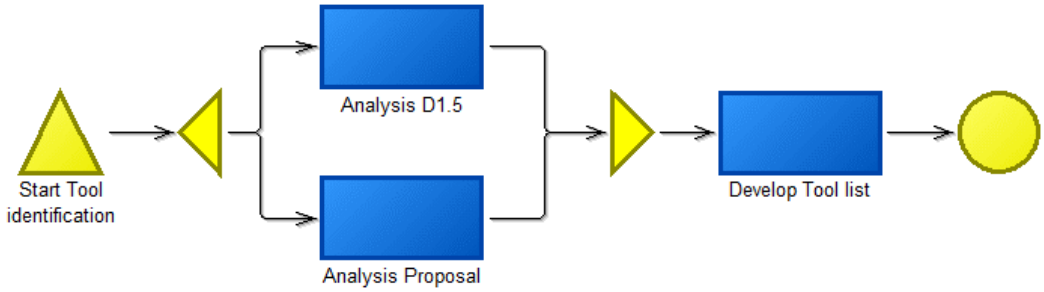

Figure 3-2: Identify Tools - Process[6]

For identification of the KPI´s for the SnR tools the deliverables D8.2 to D8.8, which describe the planned Use Cases, were analyzed. This process is visualized in the following Figure 3-3. During the second process step – Assignment UC and Tools – some miscellaneous (e.g. description, designation, usage) within the available documentation referring the SnR tools was identified. These deviations were taken into account for further research. The KPI´s were identified and formulated based on the authors' expertise and structured for each tool in a general KPI section and a use case specific section.

[5] Developed with Adonis BPM CE Version
[6] Developed with Adonis BPM CE Version

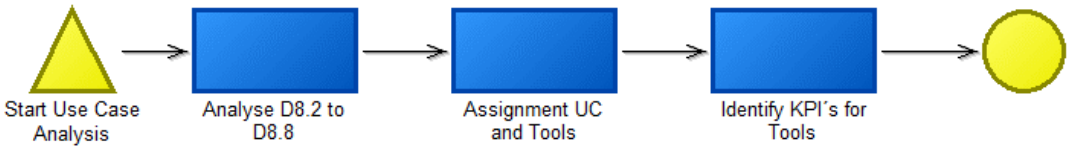

Figure 3-3: Use Case Analysis - Process[7]

Based on the results so far, the process for the development of the evaluation framework was designed. The process is visualized in the following Figure 3-4.

To receive as much information as possible an Excel based questionnaire for end-users was developed, containing a readme, a SnR Dashboard as well as several tool tables. Each table can be reached from the SnR Dashboard Tools table for easy navigation. This questionnaire was also forwarded to the technical partners to receive further input, especially due the identified miscellaneous information within the identified tools. Each tool template consists of the three sections:

- General KPI´s
- Use Case specific KPI´s
- Explanation of application of the tool within the Use Case.

The questionnaire is visualized in the following Figure 3-5 to Figure 3-7. The empirical methods for measurement of the KPI´s, which are available within the template are described in detail in chapter **Error! Reference source not found.**.

A video tutorial was recorded from JOAFG to support all stakeholder as much as possible for providing their specific input. The template as well as the video were uploaded via Alfresco to be accessed by all project partners.

The last step in this process was the analysis of all the input from end-users as well as some input from technical partners. The result of this analysis is part of chapter **Error! Reference source not found.**.

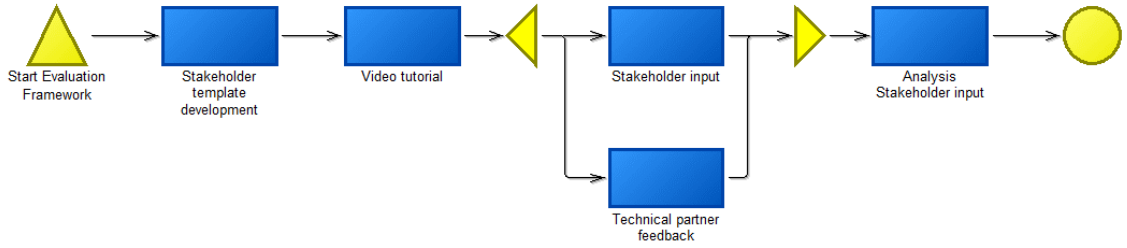

Figure 3-4: Evaluation Framework Development 1 - Process[8]

[7] Developed with Adonis BPM CE Version
[8] Developed with Adonis BPM CE Version

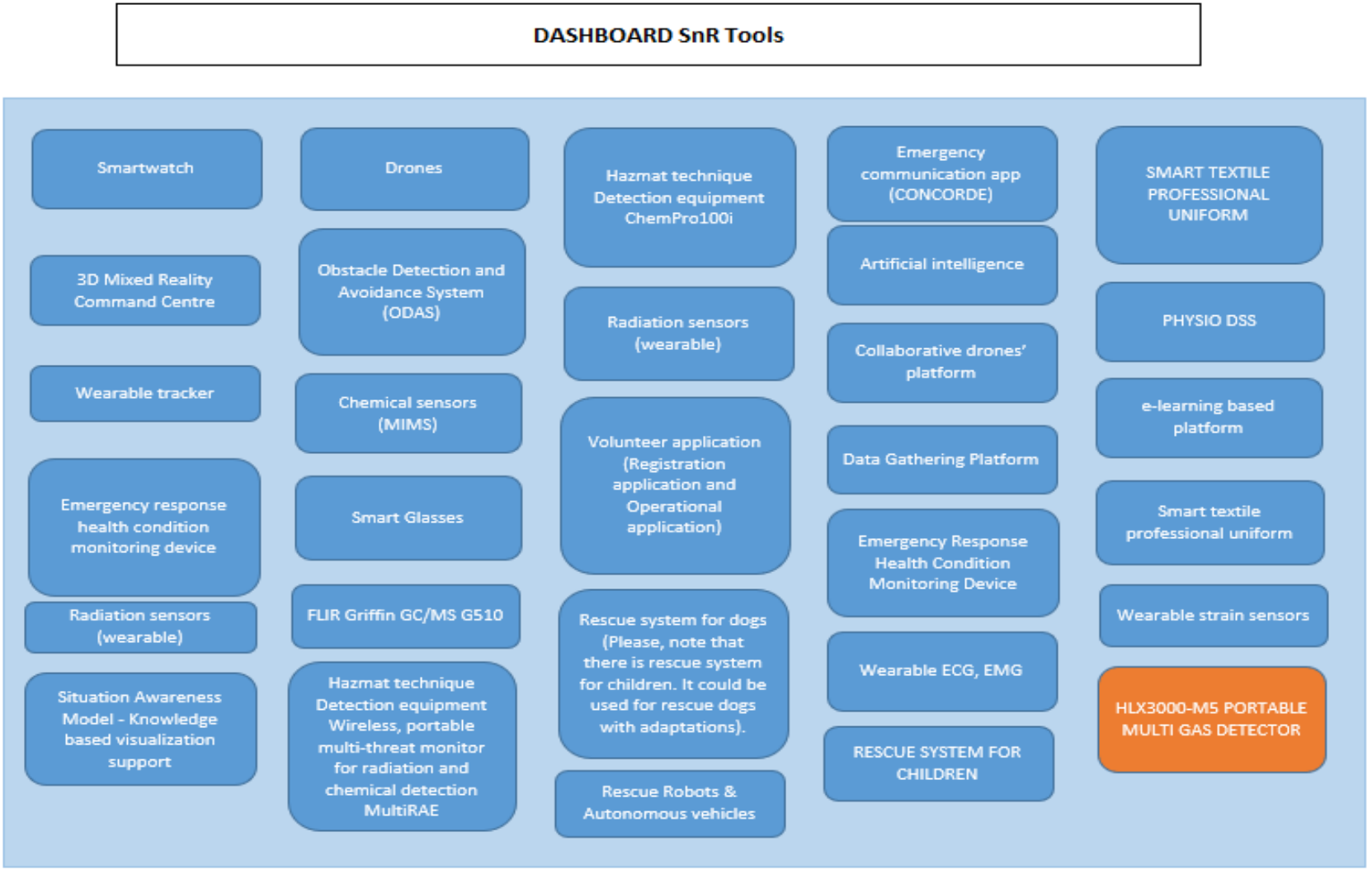

Figure 3-5: Dashboard SnR Tools

Dear stakeholder and Use Case and/or Trial owner,
here you can find the exact instructions on how to fill out the templates for the KPI´s.

In case you have further questions which are not answered in our instructional video, don´t hesitate to contact us.

Thank you in advance for your participation and supporting us with your expertise.

1. You can navigate to the specific tool template via the dashboard.

2. From the tool template you can navigate back to the dashboard.

3. Within the specific tool template you will find the general KPI´s as well as some Use Case (or Trial) specific ones. The KPI´s provided by us (based on Trial and tool descriptions) should be assigned by YOU to YOUR specific scenario, if need be. Otherwise leave the assignment blank.

4. In case YOU identify further KPI´s for your specific scenario, add them within the grey marked area in the form (don´t forget the assignment to the Use Case).

5. At the bottom of each template for the specific tool we provided a table for YOU. Fill out the table and describe the specific use of the tool in the Use Case by stating WHO, WHAT, WHEN, WHERE and HOW the tool is being used.

Figure 3-6: Readme SnR

The end-user partners (as well as the technical partners) check the identified KPI´s and assign them to their Use Case. In addition, they have the possibility to identify new or adapted general or Use Case specific KPI´s. To that effect they were able to use the grey marked cells in the Excel templates.

As mentioned above, the third step (WHO, WHEN, WHERE, WHAT and HOW) allows the end-user to define exactly the implementation of the tool as well as the interaction between the tools in the specific use case.

KPI evaluation sheet

Tool	SMARTWATCH

						Use Case assignment (1-yes)						
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI's	1	Smartwatch can be used with safety or protective gloves		observation quantitative								
	2	Smartwatch can be used with medical latex gloves		observation quantitative								
	3	The heart rate can be displayed in real time by user		observation quantitative								
	4	The heart rate can be transfered to headquater and/or communication app in real time		observation quantitative								
	5	The GPS signal can be transfered to headquater and/or communication app in real time		observation quantitative								
	6	The user is informed via alert function in case of disfunction immediately		Observation qualitativ								
	7	The user in informed via alert function in case of critial heart rate		Observation qualitativ								
	8	The user receive alert via communication app		Observation qualitativ								
	9	The body temperature can be transfered to headquater and/or communication app in real time		Observation qualitativ								
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											

						Use Case assignment (1-yes)						
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI's	1	Duration time of smartwatch is minimum 240 minutes		observation quantitative								
	2	In case of lost connection the sensor information are stored and transfered automatically when reconnected		observation quantitative								
	3	User is able to inform headquater in case of emergency via "panic button"		observation quantitative								
	4	device can withstand heat (fire fighting)		Observation qualitativ								
	5	device can easily be cleaned/decontaminated		Observation qualitativ								
	6											
	7											
	8											
	9											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	
WHEN	
WHERE	
WHAT	
HOW	

BACK to DASHBOARD

Figure 3-7: Tool Smartwatch - template[9]

[9] This figure is also available in Annex I in format A3.

The identified process for the further research is visualized in the following Figure 3-8.

Each step is also described in detail below.

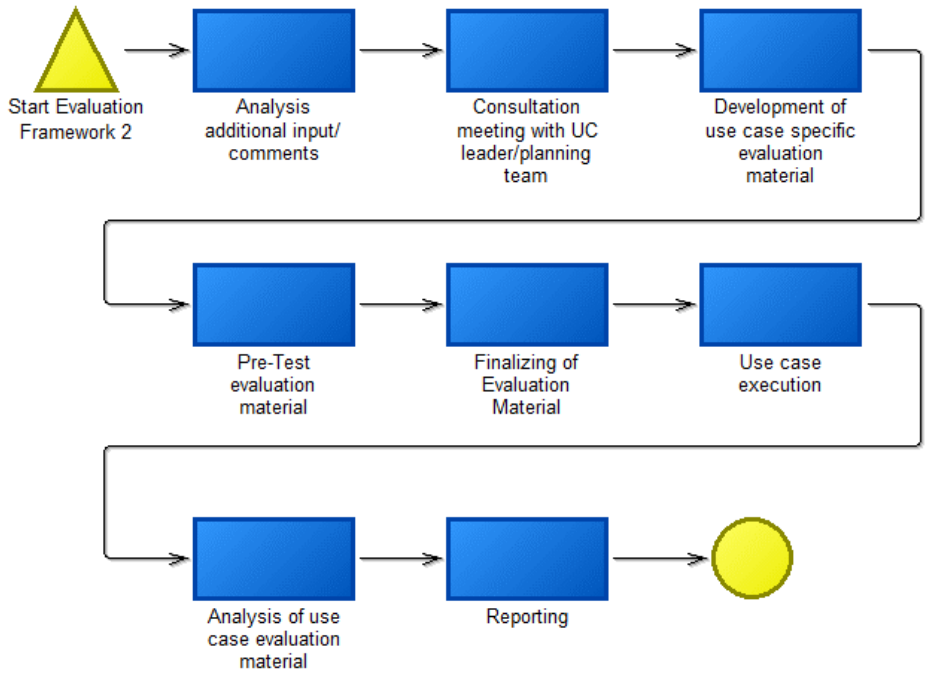

Figure 3-8: Evaluation Framework Development 2 - Process[10]

- Analyze input technical partner: Next to the end-user partners the KPI matrix was also forwarded to technical partners simultaneously. Therefore, some relevant input (KPI´s, alternate designation, etc.), was developed by the partner in parallel which was not yet reviewed by end-users. In this step this input is analyzed and the content is implemented for further research. New input on technologies and KPIs will be taken up in further consultations with UC leads in preparation of the UC specific evaluations.
- Consultation meeting with UC leader/planning team: UC planning teams should plan a meeting with JOAFG at least 8 weeks ahead of the use case execution and evaluation thereof. Purpose of the meeting is an orientation on the necessary procedures for the evaluation for all parties involved (linked to preparatory evaluation material development – i.e. questionnaires, guidelines)
- Development of use case specific evaluation material: For each use case the evaluation method-design will be set up by JOAFG (consisting of either explorative, explanative or mixed-method designs) and required material is developed by JOAFG under support of the UC planning team.
- Pre-Test evaluation material: use case organizers should pre-test evaluation material (reliability) with operative team members communicating feedback to JOAFG for any revisions

[10] Developed with Adonis BPM CE Version

- Finalizing of Evaluation Material: The final evaluation material for each use case is updated and finalized by JOAFG according to the needs of respective partners JOAFG forwards the material as digital as well as printable version to the use case lead.
- Use case execution: The use case takes place according to the individual planning. After the conduction of the exercise the evaluation coordinator/use case lead forwards the evaluation data/dataset in the defined format (digitalized version) to JOAFG including a use case specific evaluation report.
- Analysis of use case evaluation material: JOAFG analyzes the evaluation data in cooperation with the use case organizers. When comparable analysis units are available results will be compared
- Reporting: JOAFG does the reporting of the evaluation results for each use case and tool.

4 Methodologies for data collection

Following, relevant approaches for the data collection regarding the use cases is detailed, also explaining methods and equipment for data collection.

The framework outlines the process undertaken in order to conduct the data gathering in the different scenarios. To do so people involved in the data collection, especially those in charge of the studies within the scenarios, have to be familiarized with the different methodological approaches which differ according to the specific research interests in mind. This chapter will outline the general difference between qualitative and quantitative approaches within the scenarios for the trials as well as the equipment needed for doing empirical work in the fields (deducted from the proposed methods within the empirical approaches). Also the importance of quality assurance and its impact on the data collection within the trials is explained. The gender perspective is also taken into account as an important variable within every data collection plan and at every step of the research process. Within the evaluation of the scenarios mostly data from primary sources will be used (observation, interviews, questionnaires). As with all social scientific methods the guidelines, questionnaires should be set up well in advance of the actual field trial (ideally several weeks before the evaluation takes place).

4.1 Qualitative approaches

Qualitative approaches are mainly used when a closer look is being taken at a process. The aim of qualitative research is to understand reasons and motivations of subject matters (e.g. people). The lifeworld of the participants is taken into consideration and part of the interpretation of the data (e.g. past experiences, moods, etc.). The most common qualitative methods for undertaking evaluations will be presented here.

4.1.1 Qualitative observation

A qualitative observation is best used when the interaction of a group of participants is of interest. This interaction can be focused on the interaction among the participants as well as the interaction with tools. (Kumar, 2014) Most importantly, during an observation (qualitative or quantitatively) the researcher or dedicated person to conduct the data collection, is simply observing the scene in a non-inquisitorial way of involvement. (Walliman, 2008)

The qualitative method of an observation provides two main approaches, namely the participant observation and the non-participant observation.

In the participant observation the researcher participates in the activities of the observed group, whereas in the non-participant observation the researcher does not get involved in the activities of the group that is being observed.

Also, the observation can take place in natural situations (normal activities) and controlled situations (a stimulus is provided and the group is observed on how it reacts to the stimulus). (Kumar, 2014) Both

options are a possibility for the evaluation of the scenarios, depending on the focus of the specific evaluation-case.

4.1.2 Interviews

An interview is a person-to-person interaction with a specific research focus in mind. (Kumar, 2014) There are many different formats of interviews. One of them being the semi-structured interview, with a guideline that is set-up before the interview. This is the preferable format used within this evaluation framework. The guideline covers all relevant research aspects in the format of open-ended questions. The chronological structure of the questions can be adjusted to the dynamics of the interview, but all questions should be covered by the end of the interview. The interview should then be transcribed word by word in order to enable an analysis of the data. The interviewees should agree to an informed consent (including their signature) of having their data (anonymously) transcribed. A transcription guideline will be provided by JOAFG.

Depending on the qualitative approach the data will be analyzed using a qualitative content analysis. There are different forms of qualitative content analysis, depending on the main research objective of the study. The analysis of the data will be conducted by JOAFG.

4.2 Quantitative approaches

Quantitative approaches have a focus on data in the form of measurements of social interactions, attitudes and effects. It is a numerical approach to research in the social sciences. Different to qualitative approaches the results of quantitative methods are not interpreted according to their meaning and the single cases they are conducted in/with but on a broader scale trying to describe samples of populations on what they do, not why they do something. Depending on the research and evaluation interest of the scenario, also a quantitative approach can be of interest.

4.2.1 Quantitative observation

A quantitative observation is similar to a qualitative observation, although the focus here lies on the objective collection of data (how often is something being done, how often do certain reactions occur). Usually a quantitative observation is conducted with a larger sample size (as is usual with quantitative methods) to represent a specific sample of interest. The instrument used is mostly a questionnaire with scales and closed-ended questions, where the observer can note the data observed. The analysis of the data primarily consists of descriptive and inferential statistical methods (considering the sample-size).

4.2.2 Quantitative Surveys/Questionnaire

Questionnaires are another means of collecting quantitative data. Similar to a quantitative observation a questionnaire is used to record the data. This can be done via pen and paper and/or online via an online-survey-tool. The questions are closed-ended, using items and or scales as answering-options. 2Questionnaires can either be filled in by the participants themselves (e.g. as is the case with an online-format) or they can be filled in by the researcher, asking the participants directly. The difference, especially in comparison to an interview, is that the analysis of the data is based on numerical results mostly using statistical methods (descriptive and inferential).

Additionally the measurement of single units (eg. Meters, minutes, etc.) can be included in the questionnaire.

Other approaches to collect data which are not classified as originally quantitative or qualitative research methods can also be added to the evaluation, if necessary (eg. Statistical reports of tools).

4.3 Equipment and tools for data collection

The tools and equipment needed for the different forms of data collection, should be prepared in advance of the field trials.

Some thought has to be put into, if the data collection should/has to be done online (eg. Online-surveys) or in pen&paper format. If online-tools are being used they have to be programmed and tested in advance (e.g. lime survey). Also, different online-survey tools have different features, so the tool should be tested beforehand, if it is suitable for the planned study. The online-survey-tool should also have the functionality to export the data in order to analyse it in one of the common statistics-tools (eg. SPSS).

Some consideration should also be made in regards to recording the evaluations and the type of equipment needed in order to do so (e.g. camera, phone, etc.).

Observations can be recorded with a camera, a protocol should be made (taking additional notes during the observation – especially when conducting qualitative observations). Keep in mind that people tend to behave and act differently when being recorded, which could have an influence on the results of the study.

The audio of an interview has to be recorded in order to transcribe it for a further analysis of the data. For this phone recordings are sufficient, as long as the audio-quality of the recording is good enough (be aware of any obstructing noise) for the transcription.

4.4 Quality assurance

To ensure the data quality and the usefulness of the collected data, a quality assurance process will be established following the principles of ISO 9001:2015. This will be located advanced to the pilots with a training of data collectors and a first collection of test data to ensure the coding and usefulness of pre-test. This test data will then be evaluated by the defined measurement tools to ensure that the

expected result is available after the evaluation. This should ensure the reliability of measurements and the correctness of evaluation.

Therefore, a pre-test has to be done when all measurement tools are ready. This pre-test has a defined evaluation result. The necessary data will be produced backwards to the measurement points. The measurements will be done for real to ensure the correct performance of the tools but reported with the pre-defined values to test the evaluation procedures.

The quality assurance team will have the results and do the check. This team is independent from the test development team.

To ensure the process quality, the quality assurance team will do a test run of the full process as table top exercise. This shall provide a better overview of the needed actions to be done in advance and as preparation. A protocol to this will support the development of checklists for the pilot sites.

Two elements need to be defined by this:

1. Data collection process
2. Pilot process

For both processes each of the following elements will be made available in a document that is supporting the evaluation framework:

Objectives, Terms, Context of pilots, leadership, planning of pilots for Quality assurance, support, operation, Evaluation and measurement, optimization.

This will be supported by the guiding principles of the PDCA cycle (PlanDoCheckAct).

4.5 Gender perspective

On November 2020, the Spanish Agency for Research updated the Integration of Gender Analysis on Research (IAGI)[11] guidelines aimed at the evaluation of proposals, which serves as a suitable reference for the purpose and objective of evaluation activities to be carried out within SnR as will be further explained in the following section.

IAGI refers to the cross-cutting integration of sex and/or gender analysis in all phases of the research cycle, whenever the subject matter, results or applications of the project may (in)directly affect human beings. Even in purely technological research, such as the SnR research at hand, men and women may

[11] Informative note on the evaluation of Integration of Gender Analysis on Research in the calls for proposal of the Spanish Research Agency. Science and Innovation Ministry. Available at https://www.ciencia.gob.es/gesdamdoc-servlet/?uuid=157bd395-1ed5-4ed9-9714-0129d06a6dd8&workspace=dam&formato=pdf
Accessed November, 2021

be affected differently by the results of the project (by their ease of access to the product or service developed or by the type of applications they most need, for instance). The IAGI aims to ensure greater scientific rigor, based on evidence and ethical research.

In addition, it is seen as an added value in terms of creativity, scientific excellence, social responsibility and returns on investment, as it takes into account possible different needs associated with biological (sex) and/or social and cultural (gender) characteristics of women and men.

Therefore, the use of sex/gender analysis methods is not only relevant in gender-specific research; it is also an essential quality factor in almost all R&D&I studies.

This approach has been considered in the SnR project, so the following aspects will be taken into account:

- **The research approach:** SnR will establish how the findings of the project will be applied to the specific needs of men and/or women.
- **The research methods.** SnR will present sex-disaggregated samples, and, where relevant, proportional representation of females and males in order to ensure that the information collected will allow for a sex/gender analysis that incorporates other key factors that may interact with sex/gender as age, for instance. In this way, gender variable will be collected from the evaluation tools used in the UCs in order to provide data to perform a gender analysis and cross with additional variables.
- **Relevant ethical issues** that may have particular implications for men and/or women (similarly or differently) are identified and addressed into the SnR project.
- **The dissemination/transfer of knowledge** is approached through a strategy that will facilitate the application of the research results to the needs of women and/or men (significant differences and/or similarities revealed by the project in this regard may be reported).

5 Evaluation design

5.1 KPI definition

The definition of KPIs was based on a number of project documents focussing on the technology development (e.g. D7.1) but also the documentation of the Use Cases (D8.2-D8.8) and the GA as the initial foundation. These early KPIs and descriptions fed into the development of KPIs defined for the KPI matrix that was shared with partners in the process of developing the SnR evaluation framework. All in all, JAOFG received input from 7 end-user organizations and 4 technical partners. In addition, another partner contribution has been made on non-functional KPIs, for general application, independent from the individual use cases and specific components. According to the feedback it was possible to identify all relevant KPI´s for the Use Case 2 to 7. The amount of KPI´s and the assignment to the UC is visualized in the following Figure 5-1.

	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
identified and assigned KPI´s	***18***	***94***	***57***	***111***	***92***	***76***	***65***

Figure 5-1: KPI´s assigned to UC

During the planning phase a new tool (HLX3000-M5 PORTABLE MULTI GAS DETECTOR) was identified and implemented (marked orange in the dashboard).

Furthermore, technical partners forwarded additional tool specific KPI´s and non-functional KPI´s. In addition, a new tool (SOT DSS) was identified by a partner including some KPI´s (also marked orange in the dashboard). This KPI´s will be analyzed in the next step and implemented for the following interview which each trial owner (Figure 3-8).

Four identified tools were renamed due to comments from a technical partner.

Finally, a listed tool was identified as no longer valid and replaced by another one (Hazmat technique Detection equipment ChemPro100i is replaced by HLX3000-M5 PORTABLE MULTI GAS DETECTOR).

The updated Dashboard for the SnR tools is visualized in the following Figure 5-2.

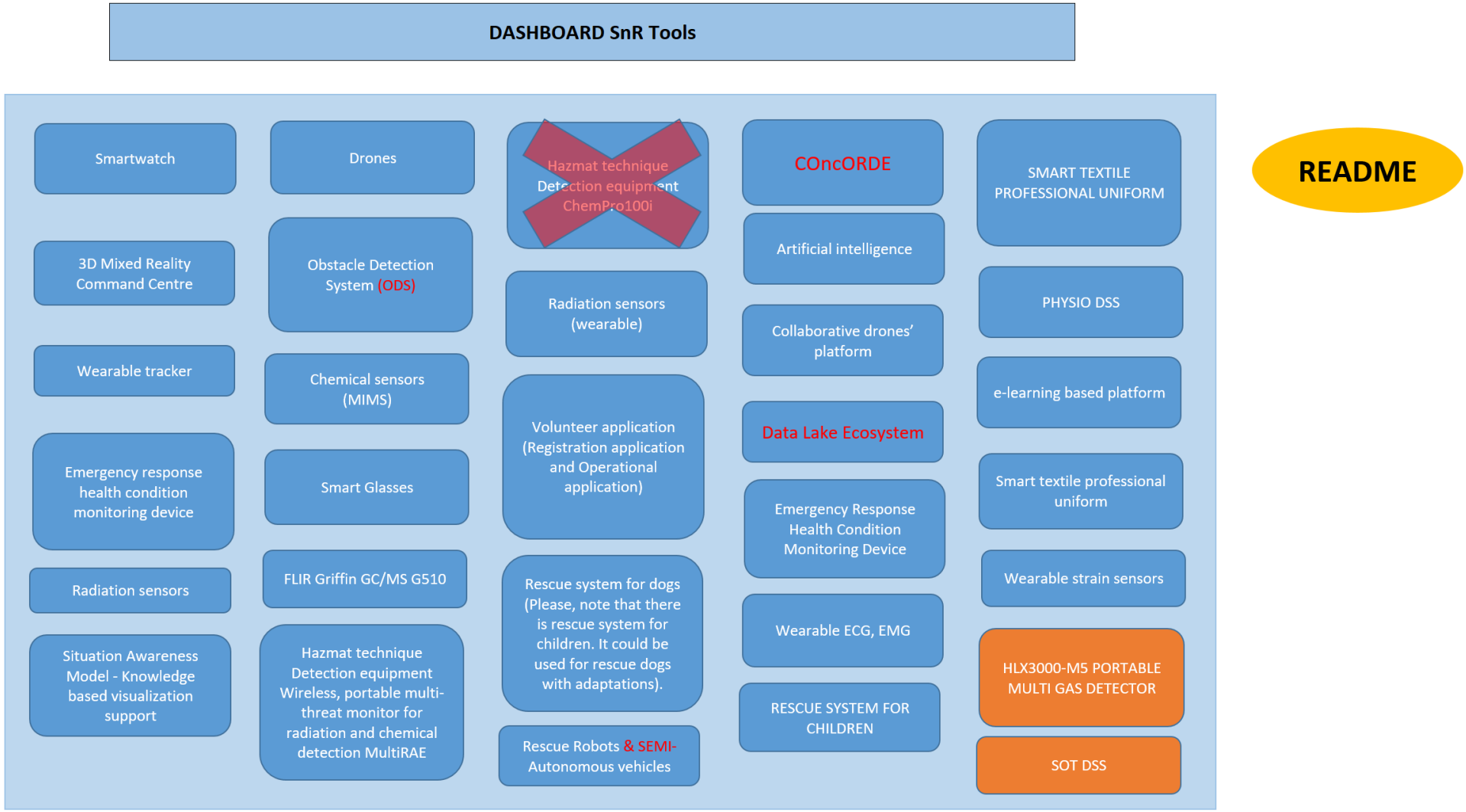

Figure 5-2: DASHBOARD SnR Tools - update

The non-functional KPI´s are visualized in the following Table 2.

Table 2: Non-functional KPI´s

Number	Description	Method	Measurement
1	Using the proposed solution makes the tasks easier to complete	qualitative	questionnaire/interview
2	Using the proposed solution makes the tasks faster to complete	quantitative	time
3	Using the proposed solution makes the task safer to complete	qualitative	questionnaire/interview
4	Does the proposed solution facilitate cooperation with other organisations?	qualitative	questionnaire/interview
5	Do you consider that sensitive data are enough protected?	qualitative	questionnaire/interview
6	It is easy to understand the solution functitonality	qualitative	questionnaire/interview
7	Does the solution require a long training?	qualitative	questionnaire/interview
8	Would the solution be easy to integrate into your current system?	qualitative	questionnaire/interview

From Use Case 1 there was only one tool assigned so far. Due to D8.2 it is possible to identify the relevant tools which are used in this Use Case 1. All identified KPI´s from the other Use Cases will be used for the tools of Use Case 1.

Some identified tools are not assigned to specific UCs so far. This will also be included in the consultation meetings with the UC planning teams (Figure 3-8).

In the following Figures the developed and identified KPI´s as well as the empirical method and the assignment to the specific Use Cases are visualized.

Tool		SMARTWATCH											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI´s	1	Smartwatch can be used with safety or protective gloves		observation quantitative			1	1	1			1
	2	Smartwatch can be used with medical latex gloves		observation quantitative			1	1				1
	3	The heart rate can be displayed in real time by user		observation quantitative			1	1	1			
	4	The heart rate can be transfered to headquater and/or COncORDE in real time		observation quantitative			1	1	1			
	5	The GPS signal can be transfered to headquater and/or COncORDE app in real time		observation quantitative			1	1	1			
	6	The user is informed via alert function in case of disfunction immediately		Observation qualitativ			1	1	1			1
	7	The user in informed via alert function in case of critial heart rate		Observation qualitativ			1	1	1			1
	8	The user receive alert via communication app		Observation qualitativ				1	1			1
	9	The body temperature can be transfered to headquater and/or communication app in real time		Observation qualitativ			1	1	1			1
	10											
	11	Smartwatch can be used with medical nitrilo gloves						1				1
	12	The heart rate can be displayed in real time by user	BPM: Beat per minute	measurement of single unit (time, etc.)				1				1
	13	The heart rate can be transfered to headquater and/or communication app in real time	On real time : seconds	measurement of single unit (time, etc.)				1				1
	14	The GPS signal can be transfered to headquater and/or communication app in real time	On real time	measurement of single unit (time, etc.)				1				1
	15	The user receive alert via communication app	On real time: seconds	questionnaire (quantitative)			1	1				
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI´s	1	Duration time of smartwatch is minimum 240 minutes		observation quantitative				1	1			1
	2	In case of lost connection the sensor information are stored and transfered automatically when reconnected		observation quantitative			1	1	1			
	3	User is able to inform headquater in case of emergency via "panic button"		observation quantitative			1	1	1			
	4	device can withstand heat (fire fighting)		Observation qualitativ			1	1	1			
	5	device can easily be cleaned/decontaminated		Observation qualitativ			1	1	1			
	6											
	7											
	8											
	9											
	10											
	11	device can easily be cleaned/decontaminated with open questions for value future points of improvement		interview								1
	12	In case of lost connection the sensor information are stored and transfered automatically when reconnected	minutes	measurement of single unit (time, etc.)								1
	13	User is able to inform headquater in case of emergency via "panic button"		interview								1
	14	device can withstand heat (fire fighting)		interview								1
	15	device can easily be cleaned/decontaminated		interview								1
	16	Duration time of smartwatch is minimum 240 minutes	minutes	measurement of single unit (time, etc.)			1					

Figure 5-3: Smartwatch

Tool		3D Mixed Reality Command Centre										
						Use Case assignment (1-yes)						
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI´s	1	the system can display stereoscopic 3D visualizations		observation quantitative			1					
	2	the system can display BIM 3D visualizations		observation quantitative			1					
	3	the system can register images from multiple sources (drones, robots, first resonders) in specific positions of the 3D visualization		observation quantitative			1					
	4	the user can choose the type of information to be visualized (filter information)		observation quantitative								
	5	the system can present proposed actions from the DSS in a structured manner		observation quantitative			1					
	6	the system presents data of rescuers/rescue units regarding location and condition		observation quantitative			1					
	7	the system presents position of a distress call in real time		observation quantitative			1					
	8	user can communicate with field units via Skype		observation quantitative								
	9	system reacts to hand gestures of user (also with gloves)		observation quantitative								
	10											
	11	the user can choose the type of information to be visualized (filter information)		questionnaire (quantitative)			1					
	12	system reacts to hand gestures of user (also with gloves)		Observation qualitativ			1					
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)						
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI´s	1	the system can be used indoor and outdoor		Observation qualitativ			1					
	2	device can be used for min. 120min	min	measurement of single unit (time, etc.)								
	3	system can be used on a local network connection		observation quantitative			1					
	4	multiple people can use the system simultaneously		observation quantitative								
	5											
	6											
	7											
	8											
	9											
	10											
	11	multiple people can use the system simultaneously	percentage	measurement of single unit (time, etc.)			1					
	12	device can be used for min. 240 min	min	measurement of single unit (time, etc.)			1					
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											

Figure 5-4: 3D Mixed Reality Command Centre

Tool		Wearable tracker											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI´s	1	dog tracker sends GPS data in real time to receiver		observation quantitative						1		1
	2	dog tracker does not distract dog from his work		Observation qualitativ						1		1
	3	dog tracker does not get loose during movement (running, crawling under rubble)		Observation qualitativ						1		1
	4	Min. duration time of 120min	min	measurement of single unit (time, etc.)								1
	5	Battery can be changed in less than 2min	min	measurement of single unit (time, etc.)						1		1
	6	the device is not limiting the dogs movement		observation quantitative								1
	7											
	8											
	9											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI´s	1	In case of lost connection the sensor information is stored and transfered automatically when reconnected		Observation qualitativ						1		1
	2	dog tracker can submit signal under rubble		observation quantitative						1		1
	3	tracker withstands low temperatures (-10 degrees C)		observation quantitative						1		1
	4											
	5											
	6											
	7											
	8											
	9											
	10											
	11	Dog tracker is easy to set up to the dog		Observation qualitativ	questionnaire							1
	12	Dog tracker is not lost during the UC		Observation qualitativ	questionnaire							1
	13	Dog handle is able to follow the dog using the wearable tracker		Observation qualitativ	questionnaire							1
	14	Previous time need to train the dog in order to use the wearable tracker		observation quantitative	questionnaire							1
	15											
	16											
	17											
	18											
	19											
	20											

Figure 5-5: Wearable tracker

Tool		Emergency response health condition monitoring device											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI's	1	The dog's heart rate can be transfered to dog handler in real time		observation quantitative								
	2	The dog handler is informed via alert function in case of disfunction immediately		observation quantitative								
	3	The dog handler is informed via alert function in case of critial heart rate		Observation qualitativ								
	4	Min. duration time of 120min	min	measurement of single unit (time, etc.)								
	5	Battery can be changed in less than 2min	min	measurement of single unit (time, etc.)								
	6	device does not distract dog in his work		observation quantitative								
	7	device is not limiting the dogs movement		Observation qualitativ								
	8											
	9											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI's	1	In case of lost connection the sensor information is stored and transfered automatically when reconnected		observation quantitative								
	2	dog tracker can submit singal under rubble		observation quantitative								
	3											
	4											
	5											
	6											
	7											
	8											
	9											
	10											
	11											
	12											
	13											
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Figure 5-6: Emergency response health condition monitoring device

Tool		Radiation sensors (wearable)											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI´s	1	The sensor can be mounted within 3 min	min	measurement of single unit (time, etc.)								
	2	The radiation sensor can transfer data to dog handler near real time		Observation qualitativ								
	3	The dog handler is informed via alert function in case of disfunction immediately		observation quantitative								
	4	The dog handler is informed via alert function in case of critial measurement values		Observation qualitativ								
	5	Min. duration time of 120min		observation quantitative								
	6	Battery can be changed in less than 2min	min	measurement of single unit (time, etc.)								
	7	device does not distract dog in his work		Observation qualitativ								
	8	device is not limiting the dogs movement		Observation qualitativ								
	9	Device can be decontaminated (chemical) and/or cleaned with detergent		observation quantitative								
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI´s	1	sensor can submit singal under rubble		observation quantitative								
	2											
	3											
	4											
	5											
	6											
	7											
	8											
	9											
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Figure 5-7: Radiation sensors (wearable for dogs)

Tool	Situation Awareness Model - Knowledge based visualization support												
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI´s	1	technology provides visual overview of the built structure and surroundings onsite during rescue operation on frontend		observation quantitative						1		
	2	system stores data		observation quantitative			1			1		
	3	system offers specific functionalities to users of different types (varying access rights depending on responsibilities)		Observation qualitativ			1			1		
	4	users can register and access the system easily		questionnaire (quantitative)			1			1		
	5	user can view and share specific information as per immediate needs in operation		questionnaire (quantitative)			1			1		
	6	user with admin rights is able to create and update information on the field roles' responsibilities		questionnaire (quantitative)			1			1		
	7	system ptovides real-time notifications, information is live or time-stamped		Observation qualitativ			1			1		
	8	system can alert user in case of sudden changes onsite		observation quantitative			1			1		
	9	provided information can be classified by user		questionnaire (quantitative)			1			1		
	10	system can provide recommendations on demand based on available information (SOPs, training scenarios etc.)		Observation qualitativ			1			1		
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI´s	1	visualization is organization specific depending on type of organisation		questionnaire (quantitative)						1		
	2											
	3											
	4											
	5											
	6											
	7											
	8											
	9											
	10											
	11	Support dissemination of information among first responders on the field		Interview			1					
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											

Figure 5-8: Situation Awareness Model - Knowledge based visualization support

Tool		Drones											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI's	1	can collect and save data from the area of interest at minimum 11000m²		observation quantitative					1	1		
	2	can take off and return to base on command		observation quantitative					1	1		
	3	can transfer information near real time over a distance of 2km (beyond visual line of sight)		observation quantitative					1	1		
	4	can be ready to fly within 10min onsite	min	measurement of single unit (time, etc.)					1	1		
	5	can stay in operation for min. 20min	min	measurement of single unit (time, etc.)					1	1		
	6	executes mission according to set flight path		observation quantitative					1	1		
	7											
	8											
	9											
	10											
	11	Can carry a thermal camera to locate missing persons							1			
	12	Can carry a thermal camera to locate at-risk persons							1			
	13	Can carry a thermal camera to assist the evacuation							1			
	14	Drone can help in a surveillance against forest fires							1			
	15	Drone can inform us in real time the behave of forest fire							1			
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI's	1	drone can operate in light rain and windy conditions		observation quantitative					1	1		
	2	drone can operate in/despite thick black smoke (fire hazard)		observation quantitative					1	1		
	3	drone can deliver relevant information in low visibility		questionnaire (quantitative)					1	1		
	4											
	5											
	6											
	7											
	8											
	9											
	10											
	11	Drone can operate in turbulent- gust wind +5m/sec	m/sec	observation quantitative					1			
	12											
	13											

Figure 5-9: Drones

Tool		Obstacle Detection System (ODS)											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI´s	1	system utilizes sensors (radar, LIDAR, camera) to detect, classify and track objects over a distance of 150-200m		observation quantitative				1	1			
	2	system can recognize potential obstacles for vehicle such as robot		observation quantitative				1	1			
	3	system can recognize obstacles in an azimuth angle view of 60-90 degrees		observation quantitative				1	1			
	4	system can detect humans, animals, vehicles and report their location		observation quantitative				1	1			
	5	system can detect and follow movement of objects to predict whether these may become obstacles		observation quantitative				1	1			
	6	system can operate in dire weather conditions (withstanding heavy rain, snow, fog)		observation quantitative				1	1			
	7	system alerts oeprator in case of collision probability in advance to avoid collision		observation quantitative				1	1			
	8	system sends location data, speed and orientation of each osbtacle detected to operator in realtime		observation quantitative				1	1			
	9											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI´s	1	system can detect rubble/debris on the ground		observation quantitative				1				
	2	system can detect road disruptions affecting the robots movement (holes etc.)		observation quantitative				1	1			
	3	system can operate in low visibility (smoke)		observation quantitative				1	1			
	4											
	5											
	6											
	7											
	8											
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Figure 5-10: Obstacle Detection System (ODS)[12]

[12] Tool name has been adjusted based on partner feedback; further feedback on KPIs received from tech. partners will be discussed in UC specific consultation/preparation meetings with UC planning teams

Tool		Chemical sensors (MIMS)												
						Use Case assignment (1-yes)								
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI´s	1	device is portable and can be carried by a first responder (max. weight 15kg)		observation quantitative						1		
	2	measurement results are received near real time		Observation qualitativ					1	1		
	3	device can detect VOCs and semi VOCs		Observation qualitativ					1	1		
	4	device can detect hazardous gases accurately (NH3, H2S, CO, CO2)		observation quantitative					1	1		
	5	device is ready for use within 15min	min	measurement of single unit (time, etc.)					1	1		
	6	device can operate for 240min	min	measurement of single unit (time, etc.)					1	1		
	7	device alerts user if critical measures are reached (hazardous compounds)		observation quantitative								
	8	device alerts user about propable victim detection		Observation qualitativ					1	1		
	9	device data can be recorded		observation quantitative					1	1		
	10	device can easily be cleaned/decontaminated		questionnaire (quantitative)					1	1		
	11	device can operate about 180 min	min	measurement of single unit (time, etc.)					1	1		
	12	device provides with on-line measurement of hazardous compounds to alert first responders	Intensity of the masses which correspond to the compounds of interest	measurement of single unit (time, etc.)						1		
	13	device provides with on-line measurement of "human signs" to alert first responders	Intensity of the masses which correspond to the compounds of interest	measurement of single unit (time, etc.)					1			
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)						
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI´s	1	device can be operated through remote control (paired with robot)		Observation qualitativ					1			
	2	can send information from below ground/under rubble		Observation qualitativ						1		
	3	device can operate in dusty environments (i.e. earthquake debris)		observation quantitative						1		
	4	device can operate in hot environments (heat zone around fire)		Observation qualitativ					1			
	5	full functionality on roving systems		Observation qualitativ					1			
	6											
	7											
	8											
	9											
	10											
	11	can record chemical data inside the voids of collapsed structures		Observation qualitativ						1		
	12	device could operate in dusty environments (i.e. earthquake debris) with the respective protection e.g. filter		Observation qualitativ						1		
	13											
	14											
	15											

Figure 5-11: Chemical sensors (MIMS)

Tool		Smart Glasses											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI´s	1	device visualizes real time information about the physical environment (threats)		observation quantitative			1		1	1	1	
	2	device can be used hands free		observation quantitative			1		1	1	1	
	3	user can see real life environment with an overlap of digital information		questionnaire (quantitative)			1		1	1	1	
	4	device does not impact on user's movement		questionnaire (quantitative)			1		1	1	1	
	5	user does not get motion sickness from wearing the device		questionnaire (quantitative)			1		1	1	1	
	6	device enables direct communication between first responders		questionnaire (quantitative)			1		1	1	1	
	7	training material can be generated and updated easily		questionnaire (quantitative)			1		1	1	1	
	8	training sessions can be recorded		Observation qualitativ			1		1	1	1	
	9	response times of first responders are monitored and ranked according to performance markers		Observation qualitativ					1	1	1	
	10	comfortable to wear over longer periods depending on mission		interview			1		1	1	1	
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI´s	1	user can select between different layers to be visualized (user-defined visualization of different categories)		questionnaire (quantitative)			1		1	1	1	
	2	device provides scenario-specific information on key resources, procedures		Observation qualitativ			1		1	1	1	
	3	user can switch on/off audio assistance as per his/her need		questionnaire (quantitative)			1		1	1	1	
	4	device can be used for drone control, remotely by voice		observation quantitative					1	1		
	5	device can display maps and on-call GPS locations		observation quantitative			1		1	1		
	6	device can mark heat signatures through lenses using thermal imaging		Observation qualitativ			1		1	1	1	
	7	device can visualize mission briefs and relevant info on call		Observation qualitativ			1		1	1		
	8											
	9											
	10											
	11	device can create and send geo-tagged pictures / video from the field with notes		observation quantitative							1	
	12	device have stream live video/audio		Observation qualitativ							1	
	13	Facilitate real-time observation and proctoring by mentoring search and rescue experts in a remote location around the word		Observation qualitativ							1	
	14											
	15											

Figure 5-12: Smart Glasses

Tool		FLIR Griffin GC/MS G510											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI´s	1	device identifies chemicals within four minutes		observation quantitative								
	2											
	3											
	4											
	5											
	6											
	7											
	8											
	9											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI´s	1											
	2											
	3											
	4											
	5											
	6											
	7											
	8											
	9											
	10											
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	18											
	19											
	20											

Figure 5-13: FLIR Griffin GC/MS G510

Tool		Hazmat technique Detection equipment Wireless, portable multi-threat monitor for radiation and chemical detection MultiRAE											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI´s	1	device is portable		observation quantitative								
	2	device can transmit data via WiFi connection		observation quantitative								
	3	device can detect up to six gases		observation quantitative								
	4	realtime data can be accessed from any location		observation quantitative								
	5	device can offset an alarm when set thresholds are reached		observation quantitative								
	6	device can be easily cleaned/decontaminated		questionnaire (quantitative)								
	7	device resists a 3m drop	meter	measurement of single unit (time, etc.)								
	8	device resists 0-90%RH of humidity	%	measurement of single unit (time, etc.)								
	9	device resits -20°C-+50°C of working temperature	°C	measurement of single unit (time, etc.)								
	10	device has a response time under 30sec	second	measurement of single unit (time, etc.)								
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Case specific KPI´s	1	device operates hands-free without manual trigger (as part of the uniform)		Observation qualitativ								
	2											
	3											
	4											
	5											
	6											
	7											
	8											
	9											
	10											
	11											
	12											

Figure 5-14: Hazmat technique Detection equipment Wireless, portable multi-threat monitor for radiation and chemical detection MultiRAE

Tool		Radiation sensors (wearable)											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI´s	1	device can detect x-ray exposure		observation quantitative					1			
	2	device can communicate in real-time to a smartphone app (Android)		Observation qualitativ					1			
	3	data from device is stored in app		observation quantitative					1			
	4	device can eaily be cleaned/decontaminated		questionnaire (quantitative)					1			
	5											
	6											
	7											
	8											
	9											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
se Case specific KPI´s	1	sensor can be easily mounted on person or device (like baby carrier)		questionnaire (quantitative)					1			
	2											
	3											
	4											
	5											
	6											
	7											
	8											
	9											
	10											
	11											
	12											

Figure 5-15: Radiation sensors (wearable)

Tool		Volunteer application (Registration application and Operational application)											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI's	1	volunteers can register themselves via volunteer app to a database (name, contact, skills/experience, deployment limitations)		questionnaire (quantitative)			1		1	1		
	2	first reponder organizations can find suitable volunteers in database through search function (based on relevant search criteria)		questionnaire (quantitative)			1		1	1		
	3	first responder organization can directly contact a specific volunteer through the app		observation quantitative			1		1	1		
	4	first responder organizations can send messages to a pool of vounteers		observation quantitative			1		1	1		
	5	user with access rights can add/edit/save information regarding resources		questionnaire (quantitative)			1		1	1		
	6	(restricted) user can access saved information		observation quantitative			1		1	1		
	7	user can allocate HR from database to form teams for response		observation quantitative			1		1	1		
	8	app allows for different user categories related to varying access rights (different user roles)		questionnaire (quantitative)			1		1	1		
	9											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI's	1	multiple users can access the app simultaneously		observation quantitative					1	1		
	2	information is updated in real time		observation quantitative			1		1	1		
	3											
	4											
	5											
	6											
	7											
	8											
	9											
	10											
	11	The information flow is quick	number of users	questionnaire (quantitative)			1					
	12	Off line access		Observation qualitativ			1					
	13	multiple users can access the app simultaneously	number of users	questionnaire (quantitative)			1					
	14											
	15											

Figure 5-16: Volunteer application (Registration application and Operational application)

Tool		Rescue System for Dogs											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI's	1	The system is usable within a few minutes and one person.		Observation qualitativ								
	2	The system is easy to decontaminate and/or clean.		Observation qualitativ								
	3	The interaction with the dog is possible, also when system is closed.		Observation qualitativ								
	4	The system monitors dogs parameters in real time on the display.		Observation qualitativ								
	5	The system is usable in water		Observation qualitativ								
	6	the system is usable under water (for at least 5 mins)		Observation qualitativ								
	7	The system is shockproofed (fall from 3m high).		Observation qualitativ								
	8											
	9											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI's	1	It is possible to pass high altitudes via rope.		Observation qualitativ								
	2	The system is ready for transportation with helicopter in a view minutes.		Observation qualitativ								
	3											
	4											
	5											
	6											
	7											
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	20											

Figure 5-17: Rescue System for Dogs

Tool	Rescue Robots & SEMI-Autonomous vehicles												
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI's	1	The robot is remote controled without direct line of sight.		observation quantitative				1	1			
	2	The robot identify obstacles automatically and operate autonomous due to the identified obstacles		observation quantitative				1	1			
	3	The robot can climb stairs and rocks (e.g. inhouse or heavy terrain).		observation quantitative				1	1			
	4	The robot is able to be deconaminated (chemical as well as physical).		observation quantitative				1	1			
	5	The robot is operational at minimum for 120 minutes.	minute	measurement of single unit (time, etc.)				1	1			
	6	The robot is operational over a distance of minimum 100 meters and approximately 50cm concrete between operator and system.	meter, centimeter	measurement of single unit (time, etc.)				1	1			
	7	The robot can operate without negative impact due weather conditions.		Observation qualitativ				1	1			
	8											
	9											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI's	1	The robot can be operated by a non technical person.		observation quantitative				1	1			
	2	The robot is used as platform for chemical sensors wich can mounted within a few minutes.		observation quantitative				1	1			
	3	The robot identify obstacles also in case of bad view (e.g. smoke or fog) and night.		observation quantitative				1	1			
	4	speed in open area	meter/ minute	measurement of single unit (time, etc.)				1	1			
	5											
	6											
	7											
	8											
	9											
	10											
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Figure 5-18: Rescue Robots & semi-autonomous vehicles

Tool		CONCORDE											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI´s	1	Actual situation (situational picture) is visalized including informations like threats, elements, weather conditions, etc.		observation quantitative			1	1		1	1	1
	2	Situational picture is avialable in real time.	seconds	observation quantitative			1	1		1	1	1
	3	Situation is recorded (also documented) over specific time (e.g. 240 minutes).	minutes	Observation qualitativ			1	1		1	1	1
	4	Situational picture support decision maker.		interview			1	1		1	1	1
	5	Can input data from technologies on the field?		Observation qualitativ				1			1	
	6	Can alert first responders to life-threatening conditions by monitoring vital signs of multiple trauma patients?		Observation qualitativ							1	
	7	It has external services?		Observation qualitativ							1	
	8	It has map integration?		Observation qualitativ							1	
	9	It has notification tools?		Observation qualitativ							1	
	10	It is rescue and field applications?		Observation qualitativ							1	
	11	It has tracking tools?		Observation qualitativ							1	
	12	Access user information		Observation qualitativ							1	
	13	It has video documentation		Observation qualitativ							1	
	14	It has remote diagnosis and asistance		Observation qualitativ							1	
	15	Actual situation (situational picture) is visualized including informations like threats, elements, weather conditions, etc. with close questions (easier use, intuitive, quickly, with possibility to adapt to specific circunstances, like mute the app, or avoid environmental noise, and others)and also space for suggestions of improvement		interview								1
	16	Time until the first ill/injured victim has been triaged in the field	Seconds	Observation qualitativ								
	17	Time to notification	Seconds	Observation qualitativ								
	18	Support the exchange of information between first responders on the field and the Command and Control Centre		Observation qualitativ								
	19	Show only relative information to the end user		Observation qualitativ								
	20	How many users can have access to the same information and the same time	Total Sum	Observation qualitativ								
	21	Number of organisations and users involved	Total Sum	Observation qualitativ								
	22	Time for crisis notification call issues by the Operations Centre to reach user's communication devices	Seconds	Observation qualitativ								
	23	Effectiveness in supporting the communication and coordination between first responders on the field and the Operations Centre provided by the tested devices/tools		Observation qualitativ								
	24	Effectiveness in monitoring the first responders/volunteers/victims' health vitals		Observation qualitativ								

Figure 5-19: CONCORDE – General KPI´s

						Use Case assignment (1-yes)						
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI´s	1	Specific information like alerts due to changed parameters are visualized.	real time	observation quantitative			1	1		1	1	1
	2	Specific information like alerts due to changed parameters takes place accoustically.	real time	observation quantitative			1	1		1	1	1
	3	Patient routing is visualized in real time.	real time	observation quantitative				1		1		1
	4	After the settings the system works automatically.	real time	observation quantitative			1	1		1		1
	5											
	6											
	7											
	8											
	9											
	10											
	11	ensuring the flow of information in real time between: those with management positions of the intervention (airport director, civil protection inspector, head of security guards, head of the private emergency service intervention group, head of the decontamination crew, head of the medical team)	real time								1	
	12	ensuring the flow of information for messages of special importance (backup frequency)	real time								1	
	13	Classification of information		Observation qualitativ			1					
	14	The DSS can support media coverage	Based on specific guidelines	observation quantitative			1					
	15	The DSS can support handling the relatives of the victims	Based on the training from the e-learning platform	Observation qualitativ			1					
	16	Dogs are able to be detected in the platform		observation quantitative								1
	17											
	18											
	19											
	20											

Figure 5-20: CONCORDE – Use Case specific KPI´s

Tool		Artificial intelligence											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI´s	1	With AI persons can identified automatically.		observation quantitative			1					
	2	With AI vehicles can identified automatically.		observation quantitative								
	3	AI can support decison making.		interview			1					
	4											
	5											
	6											
	7											
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	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI´s	1	System identifies at least 8 of 10 vehicles in open area of 500m²	percent	measurement of single unit (time, etc.)								
	2	System identifies at least 8 of 10 pserons in open area of 500m² standing.	percent	measurement of single unit (time, etc.)			1					
	3	System identifies at least 8 of 10 persons in open area of 500m² laying on ground.	percent	measurement of single unit (time, etc.)			1					
	4	Time of identification last person after data availability.	minute	measurement of single unit (time, etc.)			1					
	5											
	6											
	7											
	8											
	9											
	10											
	11	With AI plane crash debris can identified automatically	percent	measurement of single unit (time, etc.)			1					
	12											
	13											

Figure 5-21: Artificial intelligence

Tool	Collaborative drones' platform												
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI's	1	Data transfer between specifc drones works.		observation quantitative					1			
	2	Data transfer between specific drones and robots works.		observation quantitative					1			
	3	Data transfer between sensors and headquaters works.		observation quantitative					1			
	4	Data transfer works without time delay.		interview					1			
	5											
	6											
	7											
	8											
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	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI's	1	Drone can be operated in real time with this system.		observation quantitative					1			
	2	Automatical landing can be operated with this system.		observation quantitative					1			
	3	Drones can monitored with this system.		observation quantitative					1			
	4	Dronedata (status, measure data, sensor data, etc.) are available in real time.		interview					1			
	5											
	6											
	7											
	8											
	9											
	10											
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	19											
	20											

Figure 5-22: Collaborative drones' platform

Tool		Data Lake Ecosystem											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI's	1	the maximum number of records that the data storage component can return in response to a given query	second	measurement of single unit (time, etc.)								
	2	the time that the data storage component takes to process a query and return the results	second	measurement of single unit (time, etc.)								
	3	homogeneity of the data		Observation qualitativ								
	4											
	5											
	6											
	7											
	8											
	9											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI's	1											
	2											
	3											
	4											
	5											
	6											
	7											
	8											
	9											
	10											
	11											
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	18											
	19											
	20											

Figure 5-23: Data Lake Ecosystem

Tool		Emergency Response Health Condition Monitoring Device											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI's	1	Sensors are easy to fix on patient without moving the patient.		Observation qualitativ			1		1			
	2	Bio sensor data are transfered automatically over distance of minimum 100 meters and 50 cm concrete between.		observation quantitative					1			
	3	Visualization of data on several devices (smart phone, tablet, laptop)		observation quantitative			1		1			
	4	Alert function in case of critical data accoustically.		observation quantitative			1		1			
	5	Position of sensor are transfered automatically over distance of minimum 100 meters and 50 cm concrete between.		observation quantitative					1			
	6	System supports decision support.		interview			1		1			
	7											
	8											
	9											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI's	1	Time of alert appears on display or smartwatch of rescue person.	seconds, minutes	measurement of single unit (time, etc.)			1		1			
	2	Time of alert appears on display of headquater.	seconds, minutes	measurement of single unit (time, etc.)			1		1			
	3	Monitoring of sensors in real time available.		observation quantitative			1		1			
	4											
	5											
	6											
	7											
	8											
	9											
	10											
	11											
	12											
	13											
	14											

Figure 5-24: Emergency Response Health Monitoring Device

Tool		Wearable ECG, EMG											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI´s	1	Sensors are easy to fix on patient without moving the patient.		Observation qualitativ						1		
	2	Heart rate data are transfered automatically to device.		observation quantitative						1		
	3	Electrocardiographic signals are transfered automatically to device.		observation quantitative						1		
	4	Surface electromyographic signals are transfered automatically to device.		observation quantitative						1		
	5	Electrodermal response data are transfered automatically to device.		observation quantitative						1		
	6	respiratory values are transfered automatially to device.		observation quantitative						1		
	7	Arterial oxygen saturation data is transfered automatically to device.		observation quantitative						1		
	8											
	9											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI´s	1	Time of alert appears on display or smartwatch of rescue person.	seconds, minutes	measurement of single unit (time, etc.)						1		
	2	Time of alert appears on display of headquater.	seconds, minutes	measurement of single unit (time, etc.)						1		
	3											
	4											
	5											
	6											
	7											
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Figure 5-25: Wearable ECG, EMG

Tool		RESCUE SYSTEM FOR CHILDREN											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI's	1	The system is usable within a few minutes and one person.		Observation qualitativ							1	1
	2	The system is easy to decontaminate and/or clean.		Observation qualitativ							1	1
	3	The interaction with the child is possible, also when system is closed.		observation quantitative							1	1
	4	The system monitors childs parameters in real time on the display.		observation quantitative							1	1
	5	The system is usable in water.		observation quantitative								1
	6	the system is usable under water (for at least 5 mins).		observation quantitative								1
	7	The system is shockproofed (fall from 3m high - without child!).		observation quantitative							1	1
	8											
	9											
	10											
	11	It is adaptable to different weights and heights of the child?		Observation qualitativ							1	
	12	It is comfortable with hot and cold weather?		observation quantitative							1	
	13	It is light and not bulky?		Observation qualitativ							1	
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI's	1	It is possible to pass high altitudes via rope.		observation quantitative								1
	2	The system is ready for transportation with helicopter in a view minutes.		observation quantitative								1
	3	Time of alert appears on display or smartwatch of rescue person.	seconds, minutes	observation quantitative							1	1
	4	Time of alert appears on display of headquater.	seconds, minutes	observation quantitative								1
	5											
	6											
	7											
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Figure 5-26: RESCUE SYSTEM FOR CHILDREN

Tool		SMART TEXTILE PROFESSIONAL UNIFORM											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI´s	1	The uniform (each part: textile, glove, shoe, helmet) can be worn over a period of minimum 12 hours without restrictions for the probands.		interview							1	
	2	The uniform (each part: textile, glove, shoe, helmet) can be decontaminated without loss of functionality.		interview							1	
	3	The Personal Alert Safety System (PASS) works without jacket.		observation quantitative								
	4	The helmet can be worn with different protective mask systems without functional or wearing comfort restrictions.		interview								
	5	The gloves don´t restrict the handling of general rescue equipment (e.g. drills, ropes, etc.).		interview								
	6	There are no comfort restrictions due to gender aspects.		interview							1	
	7											
	8											
	9											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI´s	1	The protective shoes have sufficient adhesion on sloping surfaces (e.g.)		interview							1	
	2	Time of alert appears on display of headquater.	seconds, minutes	measurement of single unit (time, etc.)								
	3											
	4											
	5											
	6											
	7											
	8											
	9											
	10											
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Figure 5-27: SMART TEXTILE PROFESSIONAL UNIFORM

Tool		PHYSIO DSS											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI´s	1	The relevant data can imported in the system easy and in short time.		Observation qualitativ		1				1		1
	2	The results of prioritization of patients (prediction) can used for descision support.		interview		1				1		1
	3	The results of prioritization of patients (prediction) are available in time.		interview		1				1		1
	4											
	5											
	6											
	7											
	8											
	9											
	10											
	11	Predicted patient physiological state evolution versus reasonable physiological conditions (as provided by expert physiacians)		Observation qualitativ		1						
	12	Correctness of the patient physiological evolution on the basis of the assigned treatment		Observation qualitativ		1						
	13	Correctness of suggestions on the treatment to be administered		Observation qualitativ		1						
	14	uncertainty quantification		Observation qualitativ		1						
	15	Web-service response time: the time that a specific (modeling) webservice needs to receive input arguments, process them and return output values	second	measurement of single unit (time, etc.)		1						
	16	number of misclassificated victims as concerns prioritization	number	observation quantitative		1						
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI´s	1	Time of changing parameters are recognized by algorithm.		observation quantitative		1				1		1
	2	Time of system prioritization to medical person prioritization.		interview		1				1		1
	3	Time of changing recognized in seconds.	second	measurement of single unit (time, etc.)		1				1		1
	4											
	5											
	6											
	7											
	8											
	9											
	10											
	11	The results collecting data from the dogs (if it is possible)		measurement of single unit (time, etc.)								1
	12	Predicted patient physiological state evolution versus reasonable physiological conditions (as provided by expert physiacians)		Observation qualitativ		1						
	13	Correctness of the patient physiological evolution on the basis of the assigned treatment		Observation qualitativ		1						
	14	Correctness of suggestions on the treatment to be administered		Observation qualitativ		1						
	15	uncertainty quantification		Observation qualitativ		1						
	16	Web-service response time: the time that a specific (modeling) webservice needs to receive input arguments, process them and return output values	second	measurement of single unit (time, etc.)		1						
	17	number of misclassificated victims as concerns prioritization	number	observation quantitative		1						
	18											
	19											
	20											

Figure 5-28: PHYSIO DSS

Tool	e-learning based platform												
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI´s	1	Time for development a general course by instructor.	hours	measurement of single unit (time, etc.)			1					
	2	Pictures can be implemented in course.		observation quantitative			1				1	
	3	Videos can be implemented in course.		observation quantitative			1				1	
	4	Participation overview available.		observation quantitative			1				1	
	5	Time for course participation per trainee including preparation for course.	minutes	measurement of single unit (time, etc.)			1					
	6											
	7											
	8											
	9											
	10											
	11	It's a multi-language online training platform?		questionnaire (quantitative)							1	
	12	The platform will be accessible from mobile devices and tablets?		observation quantitative							1	
	13	It has video documentation		observation quantitative							1	
	14	It has remote diagnosis and asistance		Observation qualitativ							1	
	15	Time for development a general course by instructor.	360 minutes	measurement of single unit (time, etc.)							1	
	16	Time for course participation per trainee including preparation for course.	1265 minutes	measurement of single unit (time, etc.)							1	
	17	The e-learning platform can support the press office trainees on how to hande the relatives of the victims	Based on reports	Observation qualitativ			1					
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI´s	1	Course can be developed specific for the Use Case.		interview			1				1	
	2	Feedback from trainees after course participation and Use Case participation about impact.		observation quantitative			1				1	
	3											
	4											
	5											
	6											
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Figure 5-29: e-learning based platform

Tool		Smart textile professional uniform											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI´s	1	The smart textiles for dogs can be adjusted.		Observation qualitativ								
	2	The smart textiles for dogs do not restrict the ability to move.		Observation qualitativ								
	3											
	4											
	5											
	6											
	7											
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	11											
	12											
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	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI´s	1	The smart textiles allows transportation of dog with helicopter.		observation quantitative								
	2	The location of the dog is monitored in real time with a handheld device.		observation quantitative								
	3	The range of location works in open area within 500 meters.		observation quantitative								
	4	The location of dog is monitored in real time also under rubbles or in cellars/tunnels.		observation quantitative								
	5											
	6											
	7											
	8											
	9											
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	20											

Figure 5-30: Smart textile professional uniform (DOGS)

Tool		Wearable strain sensors											
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI's	1	Sensors are adjustable due to gender and size.		interview							1	
	2	The sensors do not disturb wearing comfort of probands.		interview							1	
	3	Display sensor information in general in real time available.		observation quantitative							1	
	4	Specific sensor data can be monitored and analysed after action.		observation quantitative							1	
	5	Maximal angle (e.g. knee, elbow) identified per proband after action.		observation quantitative								
	6	It is light weighted devices, ultra-flexible in order not to alter the garments wearability and comfort?		observation quantitative							1	
	7	It is sensitivity suitable for the envisaged application?		observation quantitative							1	
	8	It has relatively fast response time?		observation quantitative							1	
	9	Access user information		observation quantitative							1	
	10	It has video documentation		observation quantitative							1	
	11	It has remote diagnosis and asistance		observation quantitative							1	
	12	Facilitate real-time observation and send data to monitoring sistem		observation quantitative							1	
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI's	1	automated statistical analysis (aggregated by system): bends over 30° per minute knee		OTHER	statistic report							
	2	sautomated statistical analysis (aggregated by system): bends over 30° per hour knee		OTHER	statistic report							
	3	automated statistical analysis (aggregated by system): bends over 30° per minute elbow		OTHER	statistic report							
	4	automated statistical analysis (aggregated by system): bends over 30° per hour elbow		OTHER	statistic report							
	5	automated statistical analysis (aggregated by system): maximal bends knee		OTHER	statistic report						1	
	6	automated statistical analysis (aggregated by system): maximal bends elbow		OTHER	statistic report						1	
	7											
	8											
	9											
	10											
	11											
	12											
	13											

Figure 5-31: Wearable strain sensors

Tool		HLX3000-M5 PORTABLE MULTI GAS DETECTOR												
						Use Case assignment (1-yes)								
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI´s	1	device can detect hazardous chemicals simultaneously		observation quantitative				1			1	
	2	device alerts user when set threshold is reached		observation quantitative				1			1	1
	3	device can easily be cleaned/decontaminated		observation quantitative				1			1	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
	11	Gases are detected		Observation qualitativ				1				1
	12	Gases concentration		measurement of single unit (time, etc.)				1				1
	13	Exposure time (each gas)	seconds	measurement of single unit (time, etc.)				1				1
	14	Alerts sent	number	Observation qualitativ				1				1
	15	device can easily be cleaned/decontaminated with an specific area for explain incidences		questionnaire (quantitative)								1
	16	device can detect hazardous chemicals simultaneously	seconds	measurement of single unit (time, etc.)								1
	17	device can easily be cleaned/decontaminated		interview								1
	18											
	19											
	20											
						Use Case assignment (1-yes)								
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI´s	1	identification of the chimical that was used in the terrorist attack with CBRN means	maximum 15 seconds	measurement of single unit (time, etc.)							1	
	2											
	3											
	4											
	5											
	6											
	7											
	8											
	9											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											

Figure 5-32: HLX3000-M5 PORTABLE MULTI GAS DETECTOR

Tool	SOT DSS												
						Use Case assignment (1-yes)							
	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI´s	1	Allocation of EMS units to Incidents reccomendation)		Observation qualitativ								
	2	Allocation of Patients to EMS units		interview								
	3	Allocation of EMS Roles to tasks		interview								
	4	Expected Casualties										
	5											
	6											
	7											
	8											
	9											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
						Use Case assignment (1-yes)							
	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI´s	1	Accurate reccomendation point on the first 3 services		observation quantitative								
	2	Time until victim is evacuated from scene		observation quantitative								
	3	Time of changing recognized in seconds.	second	measurement of single unit (time, etc.)								
	4	Time until victim arrives to emergency department	second	measurement of single unit (time, etc.)								
	5	Time until first triage assessment in emergency department	second	measurement of single unit (time, etc.)								
	6	Operation decision time	second	measurement of single unit (time, etc.)								
	7											
	8											
	9											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											

Figure 5-33: SOT DSS

5.2 TRL evaluation in the SnR project

As established in the H2020 Program of Work specific to the call, novel technologies under the topic through which the SnR Project is financed, should be tested and validated in a training context and in field experiments. Systems and technologies complying with this requirement could be deployed in case of need, in conditions similar or close to those in which they are tested. Participation of first responders and emergency personnel in testing the equipment is done at a large scale during the seven use cases of the SnR project and synergies between them, the administrative personnel and the scientists and technology developers could offer a strong and reliable basis for the development of SnR products.

Regarding the need of sufficient maturity, industry and research partners of the SnR project proposed following 20 products / technologies, around TRL 6, as written in the GA, which are summarized in the table below:

Table 3: SnR proposed technological equipment, TRL advancement and partner in charge of technology development

Equipment[13]	Present TRL	End TRL	Partners in charge of technology development
Smart Glasses & Advanced Augmented Reality (AR) technologies*	4	6	SIMAVI
COncORDE*[14]	5	7	KT
Wearable GPS Tracker	4	6	UniCa
Wearable ECG, EMG (wearable)	6	7	UniCa
Wearable Strain sensors (wearable)	5	7	UniCa
Gas hazmat monitor*	5	7	UniCa
Emergency response health condition monitoring device	4	6	CERTH/HIT
Radiation sensors (wearable)	5	7	UniCa
Rescue drones	9	9	UHasselt
AI services on top of rescue drones	6	7	AIDEAS
Rescue Robots & semi-autonomous vehicles*	6	7	DFKI, THALIT
Chemical sensors	4	6	NTUA
SOT Decision Support System (DSS)*	4	6	KT
PHYSIO DSS*	4	6	CNR
Training through AR/VR	5	6	SIMAVI*
Smart textile professional uniform	4	6	UNIFI
Rescue system for children	4	6	UNIFI

[13] Updates are marked with a *
[14] Previously: Emergency communication app

Equipment[13]	Present TRL	End TRL	Partners in charge of technology development
3D Mixed Reality Command Centre	3	6	CERTH/HIT
Smartwatch	3	5	KT
Volunteer app	4	6	CERTH *(front-end)* KT**(back-end)*

The demand for TRL 6 was furthermore triggered by the need that the SnR platform, one of the main outcomes of the project, should reach close to TRL 6, so it could be used in case of need for emergency response. The new products / technologies will be used in the field demonstrations together with other mature technologies and with the COTS products, so there will be a wide possibility to check and evaluate them against validated means and criteria.

TRL Basics

According to HORIZON 2020 – WORK PROGRAMME 2014-2015 General Annexes Page 1 of 1 Extract from Part 19 - Commission Decision C(2014)4995 G. Technology readiness levels (TRL) Where a topic description refers to a TRL, the following definitions apply, unless otherwise specified:

Table 4: TRL overview

TRL	Description
1	basic principles observed
2	technology concept formulated
3	experimental proof of concept
4	technology validated in lab
5	technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)
6	technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)
7	system prototype demonstration in operational environment
8	system complete and qualified
9	actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)

These definitions are also in line with NPR 7123.1B, NASA Systems Engineering Processes and Requirements, Appendix E

Regarding the TRL's under analysis in connection with the 20 technologies proposed to be validated in the SnR project, following some further comments are provided.

TRL 4 - **Technology validated in lab**. The main components of the technology/ system are integrated to prove system's functionality. The operating conditions could be less complete than for the real product, the test results need to refer to the components assembly with notice on differences or compliance with respect to the expected results. The gap between TRL 4 and TRL 6 is the bridge between R&D and engineering application, a general requirement of TRL 4 is to prove the technology components work well as system, stand alone or together with other mature components.

TRL 5 – **technology validated in relevant environment**. All components of the system/ technology are put together, the resulting configuration is similar to the real-life scenario. Lab tests are carried on and their results analysis and significance relative to the real product is concluded. The tested system is almost prototype.

TRL 6 – **technology demonstrated in relevant environment**. Prototype is tested at large and real scale, in a real context, relevant for its functionality environment. Deliverables resulted from evaluations include information regarding tests and explanations regarding possible deviations. Considering that TRL6 is the final step in technology development prior to operational phase, the prototype has to be compliant with all requirements imposed to the operational system and the testing environment has to be as close as possible to the real working conditions of the system.

TRL 7 – **system prototype demonstration in operational environment**. In this stage the prototype needs to be demonstrated in a context relevant for its real application. Evaluation and tests need to be carried out at real scale and differences need to be concluded in specific documents stipulating conditions in which results were obtained and differences relative to real conditions and requirements.

1. KPI (Key Performance Indicators)

Key Performance Indicators (KPIs) are the critical (key) indicators of progress toward an intended result. KPIs provide a focus for strategic and operational improvement, create an analytical basis for decision making and help focus attention on what matters most.

In the SnR project each technology/equipment developer will define the KPI for each product. Furthermore KPIs have been derived from various SnR deliverables, forming part of the evaluation framework. All the indicators will be tested in a laboratory and during the Use Cases.

A short report about the compliance on the fulfilment of the foreseen indicators will be submitted

2. TRL evaluation and validation process - proposal

The SnR project partners organize meetings that establish the conditions for carrying out the exercises / scenarios (UCs) in which the equipment and technologies proposed in the project are experimented / developed / validated. Considering the limited time and technical means for evaluation of UC, a common approach to the issue of TRL evaluation is proposed.

a. Before each UC, the equipment / technology provider will submit a declaration on his own responsibility stating that the equipment / technology (s)he wants to demonstrate
    - complies with UC safety requirements and is intended to be used only within the scope of respective UC;
    - has reached the minimal TRL provided in the GA (see table 3)
b. Each equipment / technology provider will propose a GO / NO GO matrix with KPI's in line with UC'S provisions, which will be used to evaluate the equipment during the UC.
c. The UC coordinator will appoint a person (or team of 2-3 experts), to evaluate each technology / equipment during UC development, based on proposals from UC participating entities, other than the persons belonging to the entity providing the evaluated technology / equipment
d. When drawing up the report for each UC, include a chapter in which each equipment / technology is qualified as compliant / non-compliant / partly compliant to the tests that have been established for the UC where it is demonstrated;
e. Include in WP10 (Project Coordination and Quality Assurance) a uniform approach to the problem of assessing the TRL level at the beginning of the project and at the end of it, taking into consideration the results obtained at UC's.

5.3 Role description

In order to ensure adequate data collection for the evaluation process it is important to plan and divide responsibilities for each of the use cases.

Each Use Case Organizing Team will have to ensure that all roles and responsibilities for the evaluation of the use case, and respective data collection are specified and personnel assigned prior to commencement of the execution of the use case.

JOAFG will support Use Case Organizers with any questions arising concerning the evaluation process and procedures (e.g. research-design, empirical methods used for the evaluation) and will make sure to provide all needed questionnaire templates (also in a digital version) as per the Use Case needs.

Following, role descriptions focussed on the evaluation and exercise control (EXCON) are provided in order to clarify the personnel needs for the execution of SnR Use Cases.

There should be one person responsible solely for the evaluation of the Use Case and the used technologies per scenario. The evaluator/evaluation coordinator must not be biased and needs to be able to observe, experience and analyse the Use Case in the field / at the Use Case sites from the participants' perspective.

The evaluation coordinator can be supported by additional evaluators, depending on the needs and the tasks to be performed, especially during the stage of data collection on site. The needs should be considered in the preparation phase prior to the execution of the exercise.

As detailed in chapter 4 Methodologies of data collection various methods may be applied to receive feedback and generate data for an adequate evaluation. The team needs to be assembled accordingly and briefed, taking account of the different data collection methods intended to be applied during and briefly after the exercise.

Often participants' feedback is collected at the end of an exercise, via a survey to be filled out by the participants and the technicians (if applicable):

- The survey for participants may contain questions about the Use Case itself (e.g. if the Use Case scenario and content felt realistic) and questions regarding the overall impression and satisfaction of the used technologies (giving room for suggestions for improvement).
- The survey for the technicians may contain questions about the satisfaction with their developed technology and its performance, what went well / where there is room for improvement and if the Use Case itself was suitable for testing every aspect of the technologies to be tested.

In D8.1 roles of the evaluators have been expressed as threefold, including tasks on (1) recording of observations and participants feedback, (2) observing and assessing processes, procedures and techniques and (3) reporting against objectives of the use case.

Another role to be set up is that of an observer. This should be someone who observes how the pilot is run, if the process runs smoothly and if the evaluation was conducted in good conditions.

After the collection of data, the evaluator compiles all data generated to be analysed and sums up the performed tasks and relevant data on respondents in a report. Such report should also help to receive feedback from the use case evaluation team to understand whether adjustments need to be made for future evaluations of other SnR pilots. The initial report forms basis for subsequent analysis to report on further improvement of the technologies by the technical partners.

If may be considered, conducting an additional survey focused on those working in the EXCON. Feedback regarding administration, the general organisation, the venue and the management may help for future exercise organization and the work to be performed in the EXCON.

5.4 Interaction between Tools in specific Use Cases

With the circulated questionnaire, next to the KPI´s, end-users were also asked to explain the use of the tools within the use case exactly.

This description follows the five steps:

- WHO? (Who will use the tool; single person, team, etc.)
- WHEN? (When is the tool used? Day, night, temperature below zero, etc.)
- WHERE? (WHERE the tool is used? on solid ground, muddy ground, underground (20 meter), in building, in fire zone (60°C maximum), etc.)
- WHAT? (For WHAT is the tool used? Purpose of the tool? What are relevant actions to be executed with the tool?)
- HOW? (How is the tool used/applied? single, as a component together with other SnR tools and components, etc.)

This chapter was designed and implemented in the questionnaire to give the technical partners an overview about the understanding of the end-users on the topic of the single tools as well as the interaction of the tools. Due to the chosen structure of the subchapters, it may happen that there is more than one description per tool placed for a use case (e.g. more than one trial owner, technical partner input, etc.). On the other hand, the content of the subchapters are not complete so far. During the ongoing research it will be continuously updated and completed.

Also, the results of this chapter will be part of the further step Interview with Trial Owner.

In the following subchapters the received descriptions are visualized for the specific tools.

5.4.1 Use Case 1

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	The operation center on-field/command center who defines the prioritization for victims' evacuation
WHEN	During all the Use Case execution, but after the victim has been taken care of and some physiological information have been sent to CONCORDE and processed by the PHYSIO DSS
WHERE	at the command center or at the operational center on the field
WHAT	for the prediction of the physiological status of the victim with the aim of providing an efficient victim prioritization
HOW	It is used jointly with CONCORDE and the SOT DSS.

Figure 5-34: Physio DSS – UC 2

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	UC1, UC2, UC3, UC4, UC5, UC6, UC7
WHEN	BEGINING OF THE EMERGENCY, ORCHESTRATION OF ROLES, DISPATCH TO FIRST RESPONDERS, PATIENT MANAGEMENT
WHERE	COMMAND, CENTER, FIELD, HOSPITALS
WHAT	CONCORDE IS THE ACTUAL SNR PLATFORM, INTEGRATED WITH THE REST SNR TECHNOLOGIES. CONCORDE ORCHESTRATES THE EMERGENCY, DEMONSTRATES THE DETECTIONS FROM THE SNR TECHNOLOGIES IN TECHNICAL AND OPERATIONAL LEVEL
HOW	THERE WILL BE CONCORDE ROLES. HIGH COMMANDER FOR THE COMMAND CENTER, PSAP AS PUBLIC ANSWERING POINT IN THE FIELD, FIELD COMMANDER AS THE COMMANDER IN THE FIELD, EMS AS FIRST RESPONDERS, RESCUERS AND RETRIEVERS. ALL THESE ROLES ARE COOPERATING IN A OPERATIONAL LEVEL AND INTERACTING WITH THE PLATFORM (THROUGH DETECTIONS, DSS, SA, ETC)

Figure 5-35: CONCORDE (description from KT) – UC 1-7

5.4.2 Use Case 2

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	Every single first responder
WHEN	During UC | apr. October to November |
WHERE	Mountain Area
WHAT	Support the exchange of information between first responders on the field and the Command and Control Center
HOW	In combination with other SnR technologies

Figure 5-36: Smartwatch – UC 2

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	The commanding officer will use the device
WHEN	During the rescue opereation
WHERE	On the field
WHAT	The mixed reality glasses with the application
HOW	By wearing the MR glasses and using the application. The device will be tested with ERM connectivity.

Figure 5-37: 3D Mixed Reality Command Centre – UC 2

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	First responders
WHEN	During the UC
WHERE	Indoor & Outdoor
WHAT	Support the exchange of information between first responders on the field and the Command-and-Control Centre
HOW	In combination with other SnR technologies

Figure 5-38: Situation Awareness Model - Knowledge based visualization support – UC 2

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	first responder (team leader)
WHEN	During the UC
WHERE	Mountain Area
WHAT	Support in the coordination of first responders on the field and the Command and Control Center.
HOW	In combination with other SnR technologies

Figure 5-39: Smart Glasses – UC 2

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	The app is going to be used by volunteers. Also it should be used by at least 2-3 civilians.
WHEN	Before the emergency occurs and during the field operation
WHERE	At the zone where the field opretation takes place. Before the operation anywhere
WHAT	Check the GPS service during field operation through the red button functionality. Check received incident information for civilians. Check team availability.
HOW	Through the volunteer app web page, using a smartphone or a tablet. For the UC testing will also receive push notifications from KT's back-end.

Figure 5-40: Volunteer application (Registration application and Operational application) – UC 2

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	Every single first responder
WHEN	During the UC | aprox October to November
WHERE	Mountain Area
WHAT	Support in the coordination of first responders on the field and the Command and Control Center.
HOW	In combination with other SnR technologies

Figure 5-41: CONCORDE – UC 2

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	UC1, UC2, UC3, UC4, UC5, UC6, UC7
WHEN	BEGINING OF THE EMERGENCY, ORCHESTRATION OF ROLES, DISPATCH TO FIRST RESPONDERS, PATIENT MANAGEMENT
WHERE	COMMAND, CENTER, FIELD, HOSPITALS
WHAT	CONCORDE IS THE ACTUAL SNR PLATFORM, INTEGRATED WITH THE REST SNR TECHNOLOGIES. CONCORDE ORCHESTRATES THE EMERGENCY, DEMONSTRATES THE DETECTIONS FROM THE SNR TECHNOLOGIES IN TECHNICAL AND OPERATIONAL LEVEL
HOW	THERE WILL BE CONCORDE ROLES. HIGH COMMANDER FOR THE COMMAND CENTER, PSAP AS PUBLIC ANSWERING POINT IN THE FIELD, FIELD COMMANDER AS THE COMMANDER IN THE FIELD, EMS AS FIRST RESPONDERS, RESCUERS AND RETRIEVERS. ALL THESE ROLES ARE COOPERATING IN A OPERATIONAL LEVEL AND INTERACTING WITH THE PLATFORM (THROUGH DETECTIONS, DSS, SA, ETC)

Figure 5-42: CONCORDE (description from KT) – UC 1-7

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	Operational Commander |
WHEN	During the UC
WHERE	Mountain Area
WHAT	Support the pilot action during SAR activities
HOW	In combination with other SnR technologies

Figure 5-43: Artificial Intelligence – UC 2

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	The ERM will be used for the rescuers and will be placed on the victims
WHEN	During the first contact with a victim
WHERE	On the field
WHAT	The ERM device will be used
HOW	The ERM will be attached to the victim. Output will be sent to the data lake.

Figure 5-44: Emergency Response Health Condition Monitoring Device – UC 2

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	The trainees, the users of the UCs who will be trained though the e-learning platform
WHEN	Before or in parallel with the UCs
WHERE	In private time (own login into the e-platform)
WHAT	Test the user's understanding of the lesson provided of each UC and testing the technical functionality of the platform
HOW	Using the web based e-learning platform

Figure 5-45: e-learning based platform – UC 2

5.4.3 Use Case 3

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	UC1, UC2, UC3, UC4, UC5, UC6, UC7
WHEN	BEGINING OF THE EMERGENCY, ORCHESTRATION OF ROLES, DISPATCH TO FIRST RESPONDERS, PATIENT MANAGEMENT
WHERE	COMMAND, CENTER, FIELD, HOSPITALS
WHAT	CONCORDE IS THE ACTUAL SNR PLATFORM, INTEGRATED WITH THE REST SNR TECHNOLOGIES. CONCORDE ORCHESTRATES THE EMERGENCY, DEMONSTRATES THE DETECTIONS FROM THE SNR TECHNOLOGIES IN TECHNICAL AND OPERATIONAL LEVEL
HOW	THERE WILL BE CONCORDE ROLES. HIGH COMMANDER FOR THE COMMAND CENTER, PSAP AS PUBLIC ANSWERING POINT IN THE FIELD, FIELD COMMANDER AS THE COMMANDER IN THE FIELD, EMS AS FIRST RESPONDERS, RESCUERS AND RETRIEVERS. ALL THESE ROLES ARE COOPERATING IN A OPERATIONAL LEVEL AND INTERACTING WITH THE PLATFORM (THROUGH DETECTIONS, DSS, SA, ETC)

Figure 5-46: CONCORDE (description from KT) – UC 1-7

5.4.4 Use Case 4

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	Firefighters
WHEN	During the time of the UC
WHERE	At the UC
WHAT	
HOW	On the hand to have these information at the command center

Figure 5-47: Smartwatch – UC 4

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	Uhasselt and EPAYPS will use the drone at UC4.
WHEN	The estimated time for the implementation of UC4 is sometime in March or November 2022
WHERE	The pilot will take place a Weekend during the daytime, in a region called Lecheo close to city of Korinthos
WHAT	Drone can help the Fire Officers to estimate the danger
HOW	Drone can be used either as a single device to inform the first responder who operates it or as part of the SnR platform, by sending the respective data to the Sub-Center

Figure 5-48: Drones – UC 4

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	Robots autonomous vehicles
WHEN	During their function
WHERE	In the UC area to find the victims
WHAT	
HOW	

Figure 5-49: Obstacle Detection System (ODS) – UC 4

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	NTUA and PUI team will use the MIMS in UC5. NTUA and EPAYPS team will use the MIMS in UC4 on board DFKI robot
WHEN	MIMS will be used during summer 2022 in UC5 (day, over 30oC). MIMS will be used during Autumn 2022 (day, below 15oC)
WHERE	MIMS will be used at simulated debris in UC5. MIMS will be used at solid ground in UC4 on board DFKI robot
WHAT	MIMS wiil be used as a handheld device in UC5 to measure "human signs" e.g. acetone under rubbles. MIMS will be used on-board DFKI's robot in UC4 to measure exposure to hazardous compounds e.g. benzene
HOW	MIMS can be used either as a single device to inform the first responder who operates it or as part of the SnR platform, by sending the respective data to the DSS.

Figure 5-50: Chemical sensors (MIMS) – UC 4

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	The app is going to be used by volunteers. Also it should be used by at least 2-3 civilians.
WHEN	Before the emergency occurs and during the field operation
WHERE	At the zone where the field opretation takes place. Before the operation anywhere
WHAT	Check the GPS service during field operation through the red button functionality. Check received incident information for civilians. Check team availability.
HOW	Through the volunteer app web page, using a smartphone or a tablet. For the UC testing will also receive push notifications from KT's back-end.

Figure 5-51: Volunteer application (Registration application and Operational application) – UC 4

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	The ERM will be used for the rescuers and will be placed on the victims
WHEN	During the first contact with a victim
WHERE	On the field
WHAT	The ERM device will be used
HOW	The ERM will be attached to the victim. Output will be sent to the data lake.

Figure 5-52: Emergency Response Health Condition Monitoring Device – UC 4

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	A specially educated firefigter
WHEN	During all period of UC but mainly for search and rescue in industrial zone
WHERE	
WHAT	
HOW	

Figure 5-53: Rescue Robots & semi-autonomous vehicles – UC 4

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	UC1, UC2, UC3, UC4, UC5, UC6, UC7
WHEN	BEGINING OF THE EMERGENCY, ORCHESTRATION OF ROLES, DISPATCH TO FIRST RESPONDERS, PATIENT MANAGEMENT
WHERE	COMMAND, CENTER, FIELD, HOSPITALS
WHAT	CONCORDE IS THE ACTUAL SNR PLATFORM, INTEGRATED WITH THE REST SNR TECHNOLOGIES. CONCORDE ORCHESTRATES THE EMERGENCY, DEMONSTRATES THE DETECTIONS FROM THE SNR TECHNOLOGIES IN TECHNICAL AND OPERATIONAL LEVEL
HOW	THERE WILL BE CONCORDE ROLES. HIGH COMMANDER FOR THE COMMAND CENTER, PSAP AS PUBLIC ANSWERING POINT IN THE FIELD, FIELD COMMANDER AS THE COMMANDER IN THE FIELD, EMS AS FIRST RESPONDERS, RESCUERS AND RETRIEVERS. ALL THESE ROLES ARE COOPERATING IN A OPERATIONAL LEVEL AND INTERACTING WITH THE PLATFORM (THROUGH DETECTIONS, DSS, SA, ETC)

Figure 5-54: CONCORDE (description from KT) – UC 1-7

5.4.5 Use Case 5

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	NTUA and PUI team will use the MIMS in UC5. NTUA and EPAYPS team will use the MIMS in UC4 on board DFKI robot
WHEN	MIMS will be used during summer 2022 in UC5 (day, over 30oC). MIMS will be used during Autumn 2022 (day, below 15oC)
WHERE	MIMS will be used at simulated debris in UC5. MIMS will be used at solid ground in UC4 on board DFKI robot
WHAT	MIMS wiil be used as a handheld device in UC5 to measure "human signs" e.g. acetone under rubbles. MIMS will be used on-board DFKI's robot in UC4 to measure exposure to hazardous compounds e.g. benzene
HOW	MIMS can be used either as a single device to inform the first responder who operates it or as part of the SnR platform, by sending the respective data to the DSS.

Figure 5-55: Chemical sensors (MIMS) – UC 5

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	The operation center on-field/command center who defines the prioritization for victims' evacuation
WHEN	During all the Use Case execution, but after the victim has been taken care of and some physiological information have been sent to CONCORDE and processed by the PHYSIO DSS
WHERE	at the command center or at the operational center on the field
WHAT	for the prediction of the physiological status of the victim with the aim of providing an efficient victim prioritization
HOW	It is used jointly with CONCORDE and the SOT DSS.

Figure 5-56: Physio DSS – UC 5

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	UC1, UC2, UC3, UC4, UC5, UC6, UC7
WHEN	BEGINING OF THE EMERGENCY, ORCHESTRATION OF ROLES, DISPATCH TO FIRST RESPONDERS, PATIENT MANAGEMENT
WHERE	COMMAND, CENTER, FIELD, HOSPITALS
WHAT	CONCORDE IS THE ACTUAL SNR PLATFORM, INTEGRATED WITH THE REST SNR TECHNOLOGIES. CONCORDE ORCHESTRATES THE EMERGENCY, DEMONSTRATES THE DETECTIONS FROM THE SNR TECHNOLOGIES IN TECHNICAL AND OPERATIONAL LEVEL
HOW	THERE WILL BE CONCORDE ROLES. HIGH COMMANDER FOR THE COMMAND CENTER, PSAP AS PUBLIC ANSWERING POINT IN THE FIELD, FIELD COMMANDER AS THE COMMANDER IN THE FIELD, EMS AS FIRST RESPONDERS, RESCUERS AND RETRIEVERS. ALL THESE ROLES ARE COOPERATING IN A OPERATIONAL LEVEL AND INTERACTING WITH THE PLATFORM (THROUGH DETECTIONS, DSS, SA, ETC)

Figure 5-57: CONCORDE (description from KT) – UC 1-7

5.4.6 Use Case 6

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	First responders (medical team)
WHEN	during flied exercise
WHERE	Tuzla airport
WHAT	rescuer AR helmet
HOW	

Figure 5-58: Smart Glasses – UC 6

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	first responders (private CBRN Tuzla airport team)
WHEN	during de field exercise
WHERE	Tuzla airport terminal
WHAT	
HOW	

Figure 5-59: HLX3000-M5 PORTABLE MULTI GAS DETECTOR – UC 6

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	emergency cell from Tuzla airport
WHEN	during field exercise
WHERE	Operations Center
WHAT	
HOW	

Figure 5-60: CONCORDE – UC 6

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	UC1, UC2, UC3, UC4, UC5, UC6, UC7
WHEN	BEGINING OF THE EMERGENCY, ORCHESTRATION OF ROLES, DISPATCH TO FIRST RESPONDERS, PATIENT MANAGEMENT
WHERE	COMMAND, CENTER, FIELD, HOSPITALS
WHAT	CONCORDE IS THE ACTUAL SNR PLATFORM, INTEGRATED WITH THE REST SNR TECHNOLOGIES. CONCORDE ORCHESTRATES THE EMERGENCY, DEMONSTRATES THE DETECTIONS FROM THE SNR TECHNOLOGIES IN TECHNICAL AND OPERATIONAL LEVEL
HOW	THERE WILL BE CONCORDE ROLES. HIGH COMMANDER FOR THE COMMAND CENTER, PSAP AS PUBLIC ANSWERING POINT IN THE FIELD, FIELD COMMANDER AS THE COMMANDER IN THE FIELD, EMS AS FIRST RESPONDERS, RESCUERS AND RETRIEVERS. ALL THESE ROLES ARE COOPERATING IN A OPERATIONAL LEVEL AND INTERACTING WITH THE PLATFORM (THROUGH DETECTIONS, DSS, SA, ETC)

Figure 5-61: CONCORDE (description from KT) – UC 1-7

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	first responder Tuzla CBRN team and medical emergency team
WHEN	during field exercise
WHERE	route: Tuzla airport terminal - decontamination tent - emergency medical sorting tent - rescue ambulance
WHAT	
HOW	

Figure 5-62: Rescue system for children – UC 6

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	first responder medical team
WHEN	during field exercise
WHERE	triage medical tent
WHAT	full smart textile profesional uniform
HOW	

Figure 5-63: Smart textile professional uniform – UC 6

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	5 students from the private emergency service of Tuzla airport 5 students from the medical staff of the Central Military Hospital 6-8 students from the PROECO-CBRNE staff personal
WHEN	may/june 2022
WHERE	course on-line
WHAT	Standardized training on CBRN Terrorism at operational level for first responders
HOW	using the MOODLE e-learning platform

Figure 5-64: e-learning based platform – UC 6

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	first responders Tuzla airport private CBRN team
WHEN	during field exercise
WHERE	route: Tuzla airport terminal - decontamination tent - emergency medical sorting tent - rescue ambulance
WHAT	
HOW	

Figure 5-65: wearable strain sensors – UC 6

5.4.7 Use Case 7

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	Dog handles
WHEN	After the UC
WHERE	At their home, one day later to perform the UC
WHAT	Items mentioned above regarding the smartwatch
HOW	Filling a questionnaire and providing additional inputs in the open questions. Many of the questions can be responded Yes or No.

Figure 5-66: Smartwatch – UC 7

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	Dog handle
WHEN	After the UC
WHERE	At dog handle home
WHAT	The ítems mentioned above
HOW	Questionnaire and additional information provided in the open questions.

Figure 5-67: Wearable tracker (dogs) – UC 7

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	The operation center on-field/command center who defines the prioritization for victims' evacuation
WHEN	During all the Use Case execution, but after the victim has been taken care of and some physiological information have been sent to CONCORDE and processed by the PHYSIO DSS
WHERE	at the command center or at the operational center on the field
WHAT	for the prediction of the physiological status of the victim with the aim of providing an efficient victim prioritization
HOW	It is used jointly with CONCORDE and the SOT DSS.

Figure 5-68: Physio DSS – UC 7

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	1 Chief sanitary source (first physician& *Jefe de dispositivo sanitario*)in contact with the Intervention Group Command and Service Coordination Unit (Coordination Center). Transmits information to the SCU(Coordination Center) with type of incident, number of victims, possible risks, precise resources, access routes and paths. 2 Second Advanced Life Support Physician (Chief of sanitary advance post & *Jefe de puesto sanitario avanzado*) 3Triage's Nurse Performs triage according to the START triaje method and reports it to the Chief of Duty Physician. Accompanies triage with life-saving gestures Supervises the evacuation wheel to the PSA (Advanced Sanitary Post) 4 Emergencies Technician In the event of being a Advance support unit with emergency nurse and two technicians ,for support. 5 TES (Emergency Health Technician) Inform the JDS(Chief of Duty Physician) of the incorporation and availability of resources. Gathers information and assesses the situation for access and parking decisions. Comunica joins JDS(Chief of Duty Physician). 6 TES (Emergency Health Technician)in charge of Greens victims Watch and accompany the greens until their final resolution. 7 Evacuation Nurse Oversees (Advanced Sanitary Post) PSA support and stabilization Distribute the wounded in the PSA Request resources for evacuation by providing the necessary information. 8 TES(Emergency Health Technician) appointed by the JDS (Chief of Duty Physician). Affiliation 9 Emergencies Technician inside the Post Sanitary Advanced that is in charge of the mobile and tetra communications between Coordination Center and Phisician Head of PSA . Summary, communication support technician in POst Sanitary Advanced. Records the entry of patients into the(Advanced Sanitary Post) 10 Emergencies Technician of Logistic Support *(Alfa Lima). Belonging to Logistics/ communication Unit Logistics Support Team TES (Emergency Health TechnicianTES accompanies the JG (Chief of Duty Physician). 11Second(Emergency Health Technician TES assumes PSA communications Assembly of the PSA and supply of sanitary equipment. Assumes communications Chief of (Advanced Sanitary Post) 12 Incident ,Management Team from Coordination Centre (112 COmmunity of Madrid Center call) ->1 Technicians in dispatch resources -> Nurse in contact with Hospital for beds availability -> Physician Coordinator in charge of the oversees the resources that have been activated considering the number and gravity of the victims., with continue reevaluation of the incident.
WHEN	When the pilot has been developed. to be use in real use.
WHERE	In the template zone of the incident, where is developed the asistant of the victims and the evacuation. And it is used also in the post command. (cold zone) and coordination center professionals
WHAT	1 Chief sanitary source (first physician& Jefe de dispositivo sanitario)in contact with the Intervention Group Command and Service Coordination Unit (Coordination Center). **Transmits information to the SCU(Coordination Center) with type of incident, number of victims, possible risks, precise resources, access routes and paths.** 2 Second Advanced Life Support Physician **(Chief of sanitary advance post** & Jefe de puesto sanitario avanzado) 3Triage's Nurse Performs triage according to the START triaje method and reports it to the Chief of Duty Physician. Accompanies triage with life-saving gestures Supervises the evacuation wheel to the PSA (Advanced Sanitary Post) 4 Emergencies Technician In the event of being a Advance support unit with emergency nurse and two technicians ,for support. 5 TES (Emergency Health Technician) Inform the JDS(Chief of Duty Physician) of the incorporation and availability of resources. Gathers information and assesses the situation for access and parking decisions. Comunica joins JDS(Chief of Duty Physician). 6 TES (Emergency Health Technician)in charge of Greens victims Watch and accompany the greens until their final resolution. 7 Evacuation Nurse Oversees (Advanced Sanitary Post) PSA support and stabilization Distribute the wounded in the PSA Request resources for evacuation by providing the necessary information. 8 TES(Emergency Health Technician) appointed by the JDS (Chief of Duty Physician). Affiliation 9 Emergencies Technician inside the Post Sanitary Advanced that is in charge of the mobile and tetra communications between Coordination Center and Phisician Head of PSA . Summary, communication support technician in POst Sanitary Advanced. Records the entry of patients into the(Advanced Sanitary Post) 10 Emergencies Technician of Logistic Support *(Alfa Lima). Belonging to Logistics/ communication Unit Logistics Support Team TES (Emergency Health TechnicianTES accompanies the JG (Chief of Duty Physician). 11Second(Emergency Health Technician TES assumes PSA communications Assembly of the PSA and supply of sanitary equipment. Assumes communications Chief of (Advanced Sanitary Post) 12 Incident ,Management Team from Coordination Centre (112 COmmunity of Madrid Center call) ->1 Technicians in dispatch resources -> Nurse in contact with Hospital for beds availability -> Physician Coordinator in charge of the oversees the resources that have been activated considering the number and gravity of the victims., with continue reevaluation of the incident.
HOW	With Android mobile in format 3G/4G conexion We understand that this tool include Concorde Platform because Concorde Platorm is united with Emergency Communication App.

Figure 5-69: CONCORDE – UC 7[15]

[15] This figure is also available in Annex II in format A3.

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	UC1, UC2, UC3, UC4, UC5, UC6, UC7
WHEN	BEGINING OF THE EMERGENCY, ORCHESTRATION OF ROLES, DISPATCH TO FIRST RESPONDERS, PATIENT MANAGEMENT
WHERE	COMMAND, CENTER, FIELD, HOSPITALS
WHAT	CONCORDE IS THE ACTUAL SNR PLATFORM, INTEGRATED WITH THE REST SNR TECHNOLOGIES. CONCORDE ORCHESTRATES THE EMERGENCY, DEMONSTRATES THE DETECTIONS FROM THE SNR TECHNOLOGIES IN TECHNICAL AND OPERATIONAL LEVEL
HOW	THERE WILL BE CONCORDE ROLES. HIGH COMMANDER FOR THE COMMAND CENTER, PSAP AS PUBLIC ANSWERING POINT IN THE FIELD, FIELD COMMANDER AS THE COMMANDER IN THE FIELD, EMS AS FIRST RESPONDERS, RESCUERS AND RETRIEVERS. ALL THESE ROLES ARE COOPERATING IN A OPERATIONAL LEVEL AND INTERACTING WITH THE PLATFORM (THROUGH DETECTIONS, DSS, SA, ETC)

Figure 5-70: CONCORDE (description from KT) – UC 1-7

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	Physician, technician and nurse in charge of the assistance and evacuation of the children
WHEN	When kids have being detected inside the area of the incident
WHERE	In the pilot of Madrid, inside the collapsed structure. (First Scenario) during the first assistance and evacuation to the template/cold area of the incident.
WHAT	for the care of children injured in the earthqueake
HOW	With inmovilization techniques and monitarization of health parameters and clinic signs

Figure 5-71: Rescue system for children – UC 7

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	We assumed that the device will be used by both, the dog handle and the rescue dog.
WHEN	it is used both, in the assessment of the disaster area and in the location of victims.
WHERE	In situ (disaster area)
WHAT	Deviced used
HOW	Observation, questionnaires, interviews.

Figure 5-72: Physio DSS – UC 7

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	Dog handle. It depends on the device, it can be considered that the rescue dog could wear a detector on the harness to ensure its safety in the working area.
WHEN	During the UC
WHERE	In situ
WHAT	Measurements and values reflected in the CONCORDE
HOW	Questionnaires, observations and technical information collected at the CONCORDE

Figure 5-73: HLX3000-M5 PORTABLE MULTI GAS DETECTOR – UC 7

6 Checklist for Use Case Evaluation Planning

In order to facilitate the evaluation process following checklist can be followed by use case planning teams to fulfil the required steps for each phase of the evaluation process, from planning to the execution during the pilot as well as the post-processing after completion of the pilot.

6.1 For preparation

- An evaluation preparation meeting shall be organized with the UC planning team and JOAFG to discuss specific needs regarding adaptation of KPIs and data collection methods
- JOAFG will provide the templates for required questionnaires/semi-structured interview guides
- Definition of roles and responsibilities regarding data collection during use case execution (who is doing what when: observations, interviews, compiling of information, etc.), configuration of team (can be under consultation with JOAFG)
- Preparation of consent forms for participants
- Compile a list with materials needed for data collection (e.g. stop watches, pen and paper, etc.) and ensure all material is ready for use at the pilot site
- Ensure tech. equipment is provided and ready for use in case of digital data collection (e.g. direct input via online survey tool)
- Prepare the briefing for the evaluation team on-site (incl. a schedule for evaluation tasks during the exercise)
- JOAFG provides templates for reporting on the evaluation activities, tailored survey, interview guideline etc.
- UC planning team is responsible for translating data collection materials in native language if necessary

6.2 For the evaluation during the pilot

- Conduct a briefing for the evaluation team
- Ensure that all necessary materials for data collection (incl. time measurements etc.) and documentation are on site
- Check whether tech. equipment (for recordings etc.) is ready to use and functional
- ensure that participants are aware of their participation in research activities and collect the signed consent forms
- Ensure that the team is not disturbing participants and the course of the exercise
- Choose an appropriate time to collect feedback from participants (through surveys, interviews), e.g. avoid long waiting times
- Compile all data collected (digitally or in paper form) and store safely

6.3 For the data preparation after the pilot

- Ensure Data is translated into English for further analysis
- Ensure Data is digital (dataset in online survey tool, Excel)
- Provide a brief report on evaluation tasks performed (collection methods, sample size, etc.), using provided template specific to your trial
- Ensure consent forms are archived appropriately (taking appropriate measures for data privacy)
- Share data and supporting documentation in agreed format with JOAFG for further analysis and reporting by JOAFG
- JOAFG will compile evaluation data and results in dedicated deliverables D8.10 (M28) and D8.11 (M35) which will be shared within the consortium and may be used for further adjustments as per respective partner needs

7 Literature

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ANNEX I: KPI template – Smartwatch

KPI evaluation sheet

Tool	SMARTWATCH

	Number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	Use Case assignment (1-yes)						
						UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
general KPI's	1	Smartwatch can be used with safety or protective gloves		observation quantitative								
	2	Smartwatch can be used with medical latex gloves		observation quantitative								
	3	The heart rate can be displayed in real time by user		observation quantitative								
	4	The heart rate can be transfered to headquater and/or communication app in real time		observation quantitative								
	5	The GPS signal can be transfered to headquater and/or communication app in real time		observation quantitative								
	6	The user is informed via alert function in case of disfunction immediately		Observation qualitativ								
	7	The user in informed via alert function in case of critial heart rate		Observation qualitativ								
	8	The user receive alert via communication app		Observation qualitativ								
	9	The body temperature can be transfered to headquater and/or communication app in real time		Observation qualitativ								
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											

	number	description	Unit [meter/second, kg, etc.]	empirical Method of Evaluation [DropDown]	specify "OTHER" empirical Method of Evaluation	Use Case assignment (1-yes)						
						UC 1	UC 2	UC 3	UC 4	UC 5	UC 6	UC 7
Use Case specific KPI's	1	Duration time of smartwatch is minimum 240 minutes		observation quantitative								
	2	In case of lost connection the sensor information are stored and transfered automatically when reconnected		observation quantitative								
	3	User is able to inform headquater in case of emergency via "panic button"		observation quantitative								
	4	device can withstand heat (fire fighting)		Observation qualitativ								
	5	device can easily be cleaned/decontaminated		Observation qualitativ								
	6											
	7											
	8											
	9											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	
WHEN	
WHERE	
WHAT	
HOW	

BACK to DASHBOARD

ANNEX II: Tool—CONCORDE UC7

Explain within 3-5 sentences (use WHO, WHAT, HOW, WHEN, WHERE) is the tool exacly used within YOUR Use Case/Trial	
WHO	1 Chief sanitary source (first physician& *Jefe de dispositivo sanitario*)in contact with the Intervention Group Command and Service Coordination Unit (Coordination Center). Transmits information to the SCU(Coordination Center) with type of incident, number of victims, possible risks, precise resources, access routes and paths. 2 Second Advanced Life Support Physician (Chief of sanitary advance post & *Jefe de puesto sanitario avanzado*) 3Triage's Nurse Performs triage according to the START triaje method and reports it to the Chief of Duty Physician. Accompanies triage with life-saving gestures Supervises the evacuation wheel to the PSA (Advanced Sanitary Post) 4 Emergencies Technician In the event of being a Advance support unit with emergency nurse and two technicians ,for support. 5 TES (Emergency Health Technician) Inform the JDS(Chief of Duty Physician) of the incorporation and availability of resources. Gathers information and assesses the situation for access and parking decisions. Comunica joins JDS(Chief of Duty Physician). 6 TES (Emergency Health Technician)in charge of Greens victims Watch and accompany the greens until their final resolution. 7 Evacuation Nurse Oversees (Advanced Sanitary Post) PSA support and stabilization Distribute the wounded in the PSA Request resources for evacuation by providing the necessary information. 8 TES(Emergency Health Technician) appointed by the JDS (Chief of Duty Physician). Affiliation 9 Emergencies Technician inside the Post Sanitary Advanced that is in charge of the mobile and tetra communications between Coordination Center and Phisician Head of PSA . Summary, communication support technician in POst Sanitary Advanced. Records the entry of patients into the(Advanced Sanitary Post) 10 Emergencies Technician of Logistic Support *(Alfa Lima). Belonging to Logistics/ communication Unit Logistics Support Team TES (Emergency Health TechnicianTES accompanies the JG (Chief of Duty Physician). 11Second(Emergency Health Technician TES assumes PSA communications Assembly of the PSA and supply of sanitary equipment. Assumes communications Chief of (Advanced Sanitary Post) 12 Incident ,Management Team from Coordination Centre (112 COmmunity of Madrid Center call) ->1 Technicians in dispatch resources -> Nurse in contact with Hospital for beds availability -> Physician Coordinator in charge of the oversees the resources that have been activated considering the number and gravity of the victims., with continue reevaluation of the incident.
WHEN	When the pilot has been developed. to be use in real use.
WHERE	In the template zone of the incident, where is developed the asistant of the victims and the evacuation. And it is used also in the post command. (cold zone) and coordination center professionals
WHAT	1 Chief sanitary source (first physician& Jefe de dispositivo sanitario)in contact with the Intervention Group Command and Service Coordination Unit (Coordination Center). **Transmits information to the SCU(Coordination Center) with type of incident, number of victims, possible risks, precise resources, access routes and paths.** 2 Second Advanced Life Support Physician **(Chief of sanitary advance post** & Jefe de puesto sanitario avanzado) 3Triage's Nurse Performs triage according to the START triaje method and reports it to the Chief of Duty Physician. Accompanies triage with life-saving gestures Supervises the evacuation wheel to the PSA (Advanced Sanitary Post) 4 Emergencies Technician In the event of being a Advance support unit with emergency nurse and two technicians ,for support. 5 TES (Emergency Health Technician) Inform the JDS(Chief of Duty Physician) of the incorporation and availability of resources. Gathers information and assesses the situation for access and parking decisions. Comunica joins JDS(Chief of Duty Physician). 6 TES (Emergency Health Technician)in charge of Greens victims Watch and accompany the greens until their final resolution. 7 Evacuation Nurse Oversees (Advanced Sanitary Post) PSA support and stabilization Distribute the wounded in the PSA Request resources for evacuation by providing the necessary information. 8 TES(Emergency Health Technician) appointed by the JDS (Chief of Duty Physician). Affiliation 9 Emergencies Technician inside the Post Sanitary Advanced that is in charge of the mobile and tetra communications between Coordination Center and Phisician Head of PSA . Summary, communication support technician in POst Sanitary Advanced. Records the entry of patients into the(Advanced Sanitary Post) 10 Emergencies Technician of Logistic Support *(Alfa Lima). Belonging to Logistics/ communication Unit Logistics Support Team TES (Emergency Health TechnicianTES accompanies the JG (Chief of Duty Physician). 11Second(Emergency Health Technician TES assumes PSA communications Assembly of the PSA and supply of sanitary equipment. Assumes communications Chief of (Advanced Sanitary Post) 12 Incident ,Management Team from Coordination Centre (112 COmmunity of Madrid Center call) ->1 Technicians in dispatch resources -> Nurse in contact with Hospital for beds availability -> Physician Coordinator in charge of the oversees the resources that have been activated considering the number and gravity of the victims., with continue reevaluation of the incident.
HOW	With Android mobile in format 3G/4G conexion We understand that this tool include Concorde Platform because Concorde Platorm is united with Emergency Communication App.