Deliverable 3.1 – Initial catalogue of societal resilience solutions

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Abstract: ENGAGE aims at linking the informal resilience naturally inherent in societies, communities, and citizens with the formal work of authorities to prepare for, prevent, respond to, and recover from disasters. It brings together 14 partners from 8 countries aiming to show how individuals and local practices can interrelate effectively with planned preparedness and response, practitioners, and technology.

The present deliverable describes the initial catalogue of solutions for societal resilience, along with the catalogue's purpose, structure, content, and design. It highlights findings from piloting four pilot processes with characterizations of solutions. Further, it describes the approach and process towards the catalogue and provides guidelines for developing the content for the final catalogue of solutions. Last, it provides some conceptual reflections, and sets directions for further work towards the final catalogue (D3.3).

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» **PCOS**

- **proposed:** Describes planned content and structure of different sections. Document authors submit for internal review.

- **revised:** Document authors produce new version in response to internal review comments.

- **approved:** Internal project reviewers accept the document.

» **Intermediate**

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- **revised:** Document authors produce new version in response to internal reviewer comments.

- **approved:** Internal project reviewers accept the document.

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- **approved:** Internal project reviewers accept the document.

» **Released:** Executive Board accepts the document. Coordinator releases the deliverable to the Commission Services.

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Executive summary

The present deliverable entails a **systematic description of an initial catalogue of solutions** that ENGAGE has developed, and guidelines for creating content for the catalogue. Moreover, it provides a description of the approach and process towards the initial catalogue as well as directions for future work. Although the deliverable contains examples and snapshots from a database of solutions, **the catalogue itself is embedded in an online repository**. This repository is a component of the ENGAGE Knowledge Platform, which is developed in T5.5 and documented in D5.5. The first public release of the platform is planned for spring 2022.

In essence, the overall aim of ENGAGE is to link informal resilience inherent in society with the formal efforts of authorities and first responders, where "solutions" are means to achieve this goal. **Solutions are here defined as any kind of mean or instrument to enhance the interaction between members of population and formal responders** (first responders and authorities), e.g., technologies, tools, processes, guidelines, or practices. **The objective of the final catalogue is to provide a knowledge repository describing such solutions with implementation guidance**, including important factors of the local context where they have been implemented. Through the catalogue, the goal is to help first responders and authorities leveraging the potential of contributions from population.

The final catalogue will provide both a set of solutions that are presented with relevant basic information and a selection of these, which are in-depth characterized. The overall structure of the catalogue includes **five main categories of information for a solution; (i) basic information, (ii) purpose and outcomes, (iii) lessons learned, (iv) guidelines, and (v) record management.** These categories, and their subcategories, have emerged from a systematic process building upon and integrating the results from ENGAGE's technical deliverables. Important factors for selecting and characterizing solutions have been discussed in internal and external workshops with end-users. To ensure a good process for in-depth characterization, a pilot of four solutions have been developed and carried out, as described in this deliverable.

A novelty of the catalogue is to provide contextual guidance to the users. ENGAGE acknowledges the situated and complex nature of societal resilience – and that building societal resilience cannot follow a "one-size-fits-all" recipe. Solutions successfully applied in one area or society might have specific aspects that heavily influences the implementation and use of said solutions. Therefore, in the catalogue, the guidelines and important factors for use and implementation of solutions include these contextual aspects, which enable users of the catalogue the possibility of a realistic judgment on the applicability to their own context.

The scope of the catalogue is to provide a pragmatic presentation of solutions, however, a more overarching **discussion of contextual and target aspects of solutions is presented** in this deliverable. This analysis provides a model of how a solution operates through contextual and target aspects to achieve an outcome. In the discussion it is pointed out that what is considered a contextual or target aspect will be dependent on the presumed degree of modifiability of the context. The contextual aspects influence the way solutions work on their target aspects. Moreover, solutions are assumed to contribute to diverse **resilience potentials** that subsequently may enable successful coping actions of a society in a crisis.

The validity of the final catalogue relies on developing in-depth content on mature solutions for the remainder of the project. To set the directions for this objective, guidelines for creating content for the catalogue is divided into three overarching processes, (a) selection and role allocation, (b) characterization, and (c) documentation. Furthermore, it provides detailed accounts on the who, the what and the how, when it comes to developing content for the catalogue. Adding to this, further work to develop the final catalogue include enhancing the basic information level, pursuing in-depth descriptions of several solutions, developing a common conceptual apparatus for the project, and validating the approach and content creation.

1 INTRODUCTION

The task 3.1. Selection of promising solutions consists of the identification of promising solutions, systematically characterizing them, including considerations and guidelines for implementation. These activities form the basis of the initial catalogue of solutions, which is the topic of the present deliverable. The final catalogue will be presented in D3.3 and is planned to finish in M36 (June 2023).

1.1 PURPOSE OF THE DOCUMENT

The purpose of this document is to provide a first version of the approach, structure, and content for the catalogue of solutions for societal resilience. The document serves as a basis for pursuing and revising several dimensions related to the cataloguing of solutions, including a process for selection and characterization of solutions, and the content and structure of a knowledge repository of the catalogue.

The catalogue as a stand-alone innovation and result is situated within WP5 and take the form of an online repository as part of the ENGAGE Knowledge Platform – while the content and structure is developed within WP3 (see Figure 1). The knowledge platform consists of other content in addition to the catalogue. The D3.1 deliverable lays the groundwork for providing first responders, authorities, and other stakeholders an applicable knowledge repository on promising solutions for societal resilience.
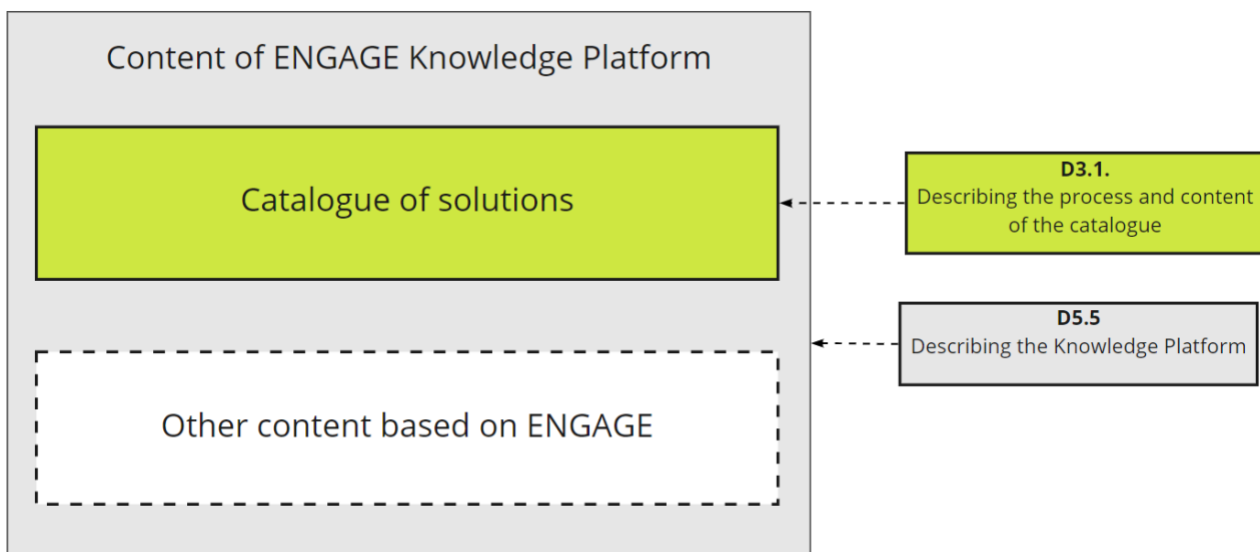
Figure 1 Relationship between the catalogue of solutions and the Knowledge Platform, including important deliverables

1.2 INTENDED READERSHIP

The document has the following groups of intended readers:

» First, this deliverable targets the whole consortium. Considering that the catalogue of solutions is one of the central results of the project, the transparency of the process and the details on the groundwork for the catalogue is important. Additionally, it sets the directions for content creation through the course of the project, and therefore applies to most partners.

» Second, the project's Knowledge and Innovation Community of Practice (KI-CoP) members is an important target group considering their operational expertise to provide input to the final

deliverable D3.3 as well as bringing the analytical insights from their input back in a systematic way.

» Third, although the catalogue itself is the main output of the efforts of the present task, the rationale and process towards it is documented in this deliverable. These descriptions are relevant for the stakeholders and end-users consulting the Knowledge Platform and the catalogue of solutions, to provide the background knowledge for the interested parties. Additionally, the guidelines presented in section 4 in this document are also a result and will be expanded in the next iteration of the catalogue.

» Fourth, there are the readers that are associated with the European Research Council, the European Commission (EC), and the project reviewers.

Overall, the dissemination level of the deliverable is public, and it can be shared outside the consortium, the EC, and the project reviewers.

1.3 CLARIFICATION OF SCOPE

From the Description of Action, a broad process of content creation (including selection, characterization, and analysis of numerous solutions) for the initial catalogue was foreseen. However, initial insights based on available results and, especially, end-users' input made it evident that, at this stage of the project, more emphasis needed to be put on the development of a sound process for content creation than on the production of content per se. Many different practical and challenging questions indeed emerged during the initial efforts, such as: Would we be able to find detailed information on the solutions that appeared relevant to produce their characterization? Would we be able to assess the maturity of solutions described in documents found to present this important information to end-users? How will the information be represented to end-users, so it supports their needs?

Trying to answer these questions further emphasized the central nature of the catalogue of solutions in the project and the necessity to proceed in close collaboration with other project tasks (initial identification of solutions, development of the Knowledge Platform) and with end-users (partners and KI-CoP members).

As a result, instead of documenting numerous solutions and create the risk of lacking relevance or usefulness, our approach chose depth over breadth and aimed to:

1) define and consolidate the information structure for the catalogue of solutions in collaboration with end-users

2) elaborate selection criteria to guide the identification of «promising» solutions from the initial list, in other words, support the prioritization of content creation efforts

3) develop a process to gather additional information and characterize promising solutions

4) pilot the process through a limited number of solutions (four) chosen with end-user partners (and with which they are familiar)

These different elements are described in detail in this initial version of the catalogue of solutions. They represent the sound basis from which to build content in the next steps and towards the final catalogue. The process of selecting solutions and content creation will continue throughout the remainder of the project and will be documented in deliverable 3.3.

1.4 STRUCTURE OF THE DOCUMENT

The deliverable consists of five chapters (see Figure 2). To set the scope for the deliverable, this chapter presents basic descriptions on purpose and target groups for the deliverable, glossary, and

relationships with other deliverables in the project. The following Chapter 2 presents the overall content and structure of the initial catalogue. Chapter 3 describes the approach and process of the work conducted as part of task 3.1. Then, Chapter 4 takes the work a step further and provides a stepwise guide for the ENGAGE project to pursue selection and characterization of the solutions towards the final catalogue. Lastly, Chapter 5 discusses conclusions and some conceptual points regarding contextual and target aspects, before it addresses directions for the remaining work of the project relating to the catalogue. In annexes, examples and tables from the information structure and compiled solutions are presented.

1 Introduction	Here we give basic introduction to the deliverable and explains some key concepts
2 Describing the Catalogue	Here the initial catalogue is described including its framework, structure & content
3 Approach and process	Provides a basic description of the approach and what activities we have conducted
4 Guidelines for ENGAGE	Here the process for selection and characterisation tfor content creation throughout the project is presented
5 Moving ahead	In this chapter you will find discussions and reflections on the work so far, and directions for the further work

Figure 2 Chapter structure of the report

1.5 THE RELATIONSHIP WITH OTHER DELIVERABLES AND WORK PACKAGES

This deliverable is intertwined with several other contributions from the ENGAGE project, as can be seen in Figure 3. A major implicit dimension of the work with D3.1 is to seek the integration of the results and efforts from existing and foreseen deliverables in the project. The following figure depicts in more detail the relations between results from previous findings and deliverables in the project, and how they feed into the initial catalogue of solutions. The figure is not exhaustive in terms of all relations but showing some specific contributions:
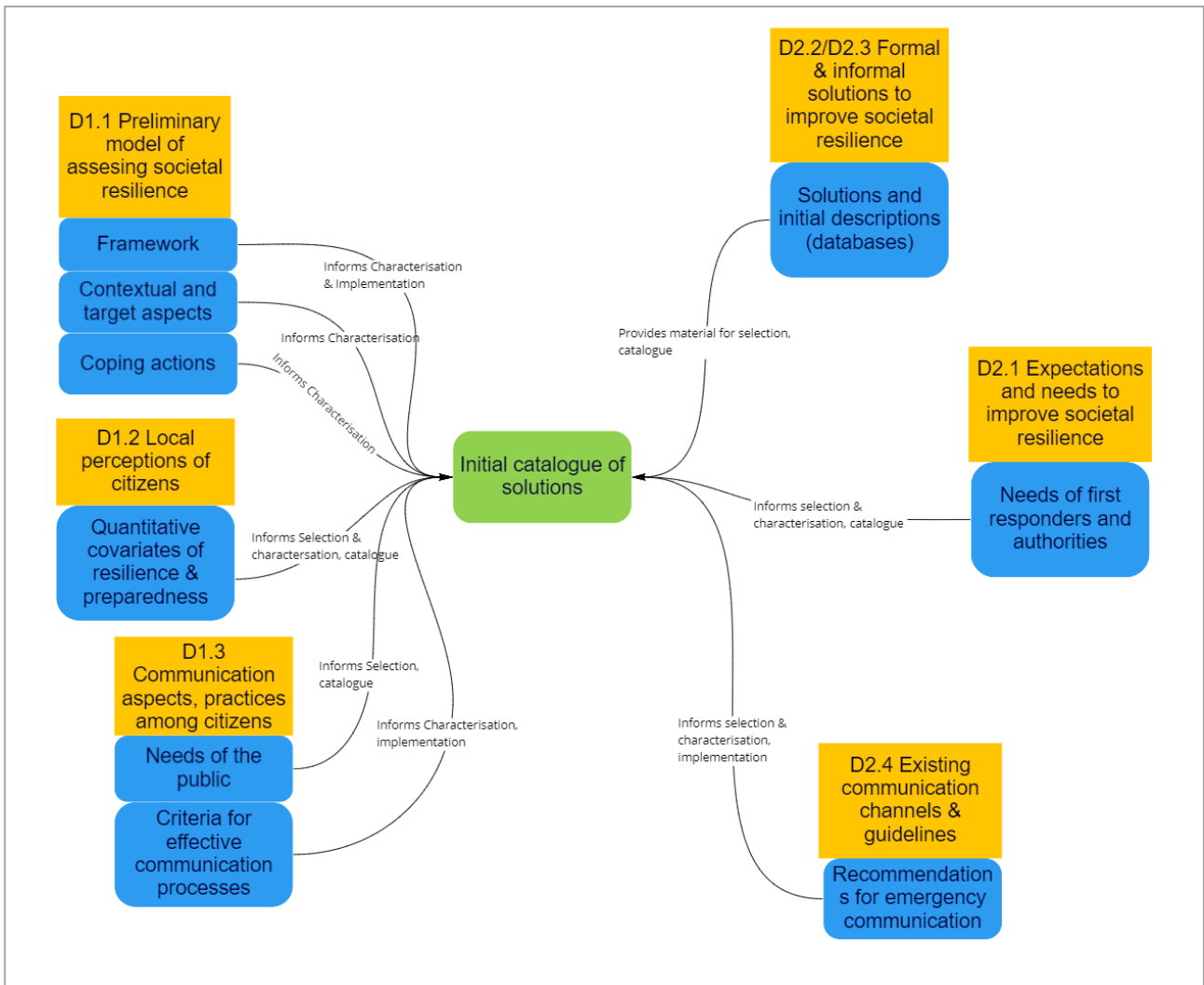
Figure 3 Relationships between results from the ENGAGE project and the initial catalogue of solutions

Considering the close connection between the WP2 activities on identifying solutions, and the WP3 activities on developing the catalogue of solutions, the relation is clearly described in Figure 4. Whereas WP2 focuses on systematic mapping with basic descriptions, WP3 highlights in-depth contextual information on selected promising solutions. Both serve an epistemic objective, where WP2 to a larger degree creates knowledge on the descriptive statistics, trends, and gaps, WP3 to a larger degree creates knowledge on the way solutions work, their context and understanding their contribution to societal resilience. The two parallel activities are coordinated in a common procedure and platform.
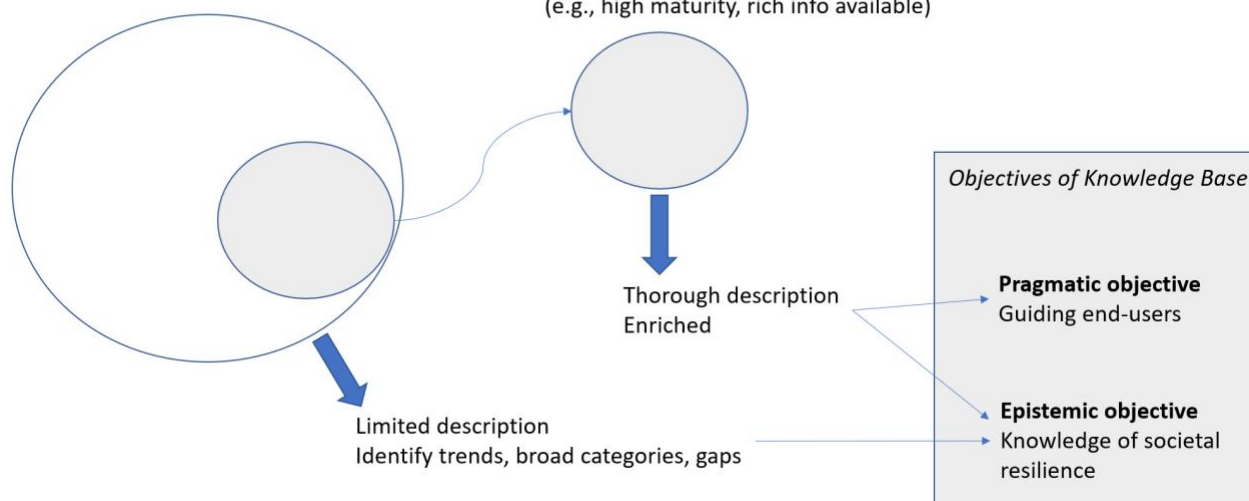
Figure 4 Relationship between systematic identification and systematic characterization of solutions

1.6 LIST OF TERMS AND DEFINITIONS

Key concepts and abbreviations for the deliverable are briefly described in Table 1. During the project it has become clear that the terms used in ENGAGE may be understood differently, for example depending on the frames of the research that is done. Therefore, terms, for example "contextual aspect", are described in the context of the work in WP3. In addition, there is a continuous discussion in the project to frame these terms. Although we in this deliverable employ the definitions as described in Table 1, we may adjust these definitions to the empirical data collection as the project progresses towards D3.3 and the final catalogue, as well as the developments in the rest of the project.

Table 1 Key concepts and abbreviations in D3.1

Concept/term/ abbreviation	Description
AirTable	A cloud-based database of solutions, forming the documented basis of the catalogue
Case	Application of a solution within a specific region or context
Catalogue of solutions	Records of solutions with documentation
Characterization	The process of systematically gathering and analyzing information regarding solutions
Contextual aspects	Inherent characteristics of society that influences the way solutions work for improving interaction between members of the population and formal arrangements
KI-CoP	Knowledge and Innovation Community of Practice
Knowledge Platform	Online repository, hosting the catalogue of solutions as well as other elements
NGO	Non-governmental organization
PG	Preparedness Guard (A solution used by the Red Cross to involve citizens

	as volunteers during crises. The solution is used as an example throughout the deliverable)
Societal resilience	The term *resilience* is a concept that entails a wide variety of ingredients and definitions depending on context, field of expertise and perspective Societal resilience is here defined as "a process that emerges from discourses and actions that are embedded in society, its structure, its values, and bonds" (see D1.1.). Societal resilience is considered a relational approach to the way people cope with disruptive events. See also D1.1. and Section 5 for more discussion on the use of societal resilience as a concept and relation to the catalogue
Solution	Any kind of means or instrument that emergency organizations and authorities can apply to reach the public and improve their interaction with them. This set of means or instruments can be guidelines, practices, processes, strategies, methods, technologies, tools, applications etc. (see D2.2)
Target aspects	Contextual aspects that can be modified by solutions for enhancing societal resilience (see D1.1)
VOST	Virtual Operations Support Team

2 INITIAL CATALOGUE OF SOLUTIONS FOR SOCIETAL RESILIENCE

This chapter describes the initial catalogue and its content. The initial catalogue is the first step towards the final catalogue, so in the following text, we present the status of the work done so far. It forms the basis for the continuous work towards the final innovation. First, however, we will shortly outline the main idea behind the catalogue, the target audience, and the purpose of use in the crisis management cycle.

Scope of the catalogue and intended use

The overall aim of ENGAGE is to link informal resilience inherent in society with the formal efforts of formal authorities. In this regard, an important objective of the ENGAGE catalogue of solutions is to provide a knowledge repository summarizing and highlighting solutions that could help key actors achieving this. Figure 5 gives an overview of main aims of the catalogue (e.g., tools, methods, apps, guidelines). Thus, the catalogue will provide both a set of solutions that are presented with relevant basic information and a selection of these which are more in-depth characterized. The in-depth characterized solutions are presented with contextual guidance that will aid users of the catalogue to find a solution relevant to their local context. The content from the catalogue will be publicly available in the online ENGAGE Knowledge Platform (see also section 2.1).

ENGAGE Catalogue of solutions	A knowledge repository guiding first responders, authorities, NGOs and researchers	Descriptions of their goals, outcomes and uses
	Presenting existing tools, methods, processes, guidelines, apps and other means to better use society as resources related to crisis management	Highlighting important factors to consider when seeking to implement a solution

Figure 5 What is the ENGAGE catalogue of solutions?

Two personas of **intended users** of the Knowledge Platform, including the catalogue of solutions, have been established in relation to the work of D5.5. These personas are fictional representations of typical target users of the catalogue. Examples of characteristics are that they work within a non-governmental organization or a regional health authority, and have the resources, knowledge, and experience to look for relevant solutions, and have the possibility to implemented these in his/her local context. However, the information given about solutions in the catalogue is intended to be useful also for other governmental, national, regional, and local authorities, as well as first responders. Secondary target users are active society organizations and communities, followed by researchers and academic users.

The catalogue is **intended to be used** between crises. As shown in Figure 6, the ENGAGE catalogue of solutions finds itself between the recovery phase after a crisis and preparing for the next crisis. Accordingly, it is a tool to aid the improvement work in an organization and/or a region, for example when evaluating lessons learned and deciding on new strategies and solutions for improving crisis management. However, some crisis will have longer durations, such as the

coronavirus pandemic, where there is more time to consider new solutions during the crisis. This situation could be considered a preparation phase within a slow crisis phase, where the catalogue should also be relevant.
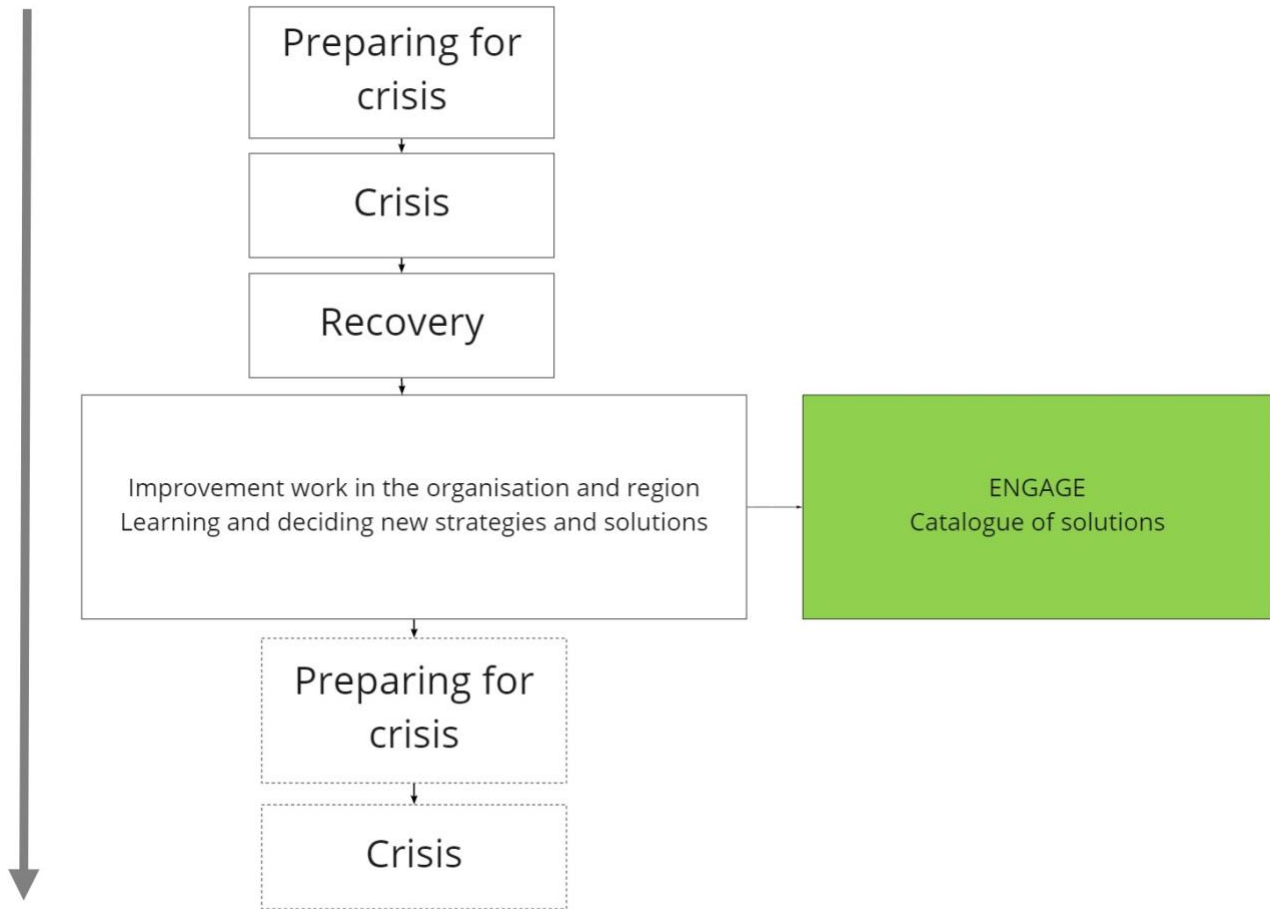
Figure 6 Main intended use of the ENGAGE catalogue of solutions in relation to the crisis management cycle

The development of the initial catalogue

The catalogue of solutions links the theoretical and scientific work of the project, and the operational work of practitioners. In this first phase of developing the catalogue, it has been important to have an iterative process and to involve end-users to ensure the relevance and to lay a solid foundation for further work (see e.g., Kensing et al, 1998). End-users have therefore been consulted through workshops, interviews, and surveys to map their expectations and needs for such a repository.

A general approach to the integrative work is to provide the catalogue with a sound theoretical and empirical basis, relying on the more scientific work in ENGAGE. Moreover, the scientific aspects are made more accessible by providing a simplified and pragmatic way of presenting the solutions in the catalogue. The content creation itself is based on data gathering using more traditional basic knowledge gathering techniques (such as a simple form), and some scientifically oriented methods (such as qualitative semi-structured interviews). The approach and work process towards the initial catalogue is described in detail in Chapter 3.

As a result, we have the first general framework for the catalogue and its main elements, which is described in section 2.2.

While WP3 is mainly concerned with the content and structure of the catalogue, it is closely connected to the visual appearance and how the catalogue will be used on the ENGAGE Knowledge Platform, which is performed in WP5. In the following, we briefly outline the layout and provide examples of how the initial catalogue will look like for external users.

2.1 DESIGN AND FUNCTIONS OF THE CATALOGUE OF SOLUTIONS

The catalogue of solutions will be available on the online ENGAGE Knowledge Platform. The platform will provide a set of guiding questions based on specific needs of the intended user. A core element is to provide the user not only with basic knowledge on solutions, but also highlighting the importance of the contextual factors where it has been used. Based on the user-testing so far in the project, core findings suggest that the catalogue should not aim towards recommending solutions based on the context of the user, but rather highlight the contextual factors that has been important for the applications considered in the repository. This way, the expert can compare this with their own context based on the guidance before planning for further inquiry or implementation. This relation between the catalogue and the decision-maker is emphasized in Figure 7:
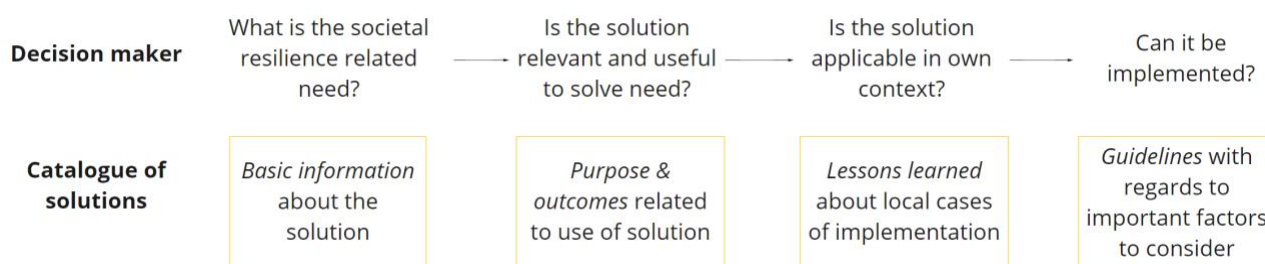
Figure 7 How the catalogue of solutions can support a decision-maker

From the homepage of the Knowledge Platform the user can access the catalogue of solutions in at least two ways (see also Figure 8):

5) Directly, by clicking on the call-to-action button "Explore the catalogue of solutions" - The user gets access to the whole repository of solutions and can filter them through basic or advanced filters. Tags and keywords facilitate the navigation.

6) Through Keywords Smart Search - By typing one or more keywords in the smart search bar, the user gets thematically related solutions.
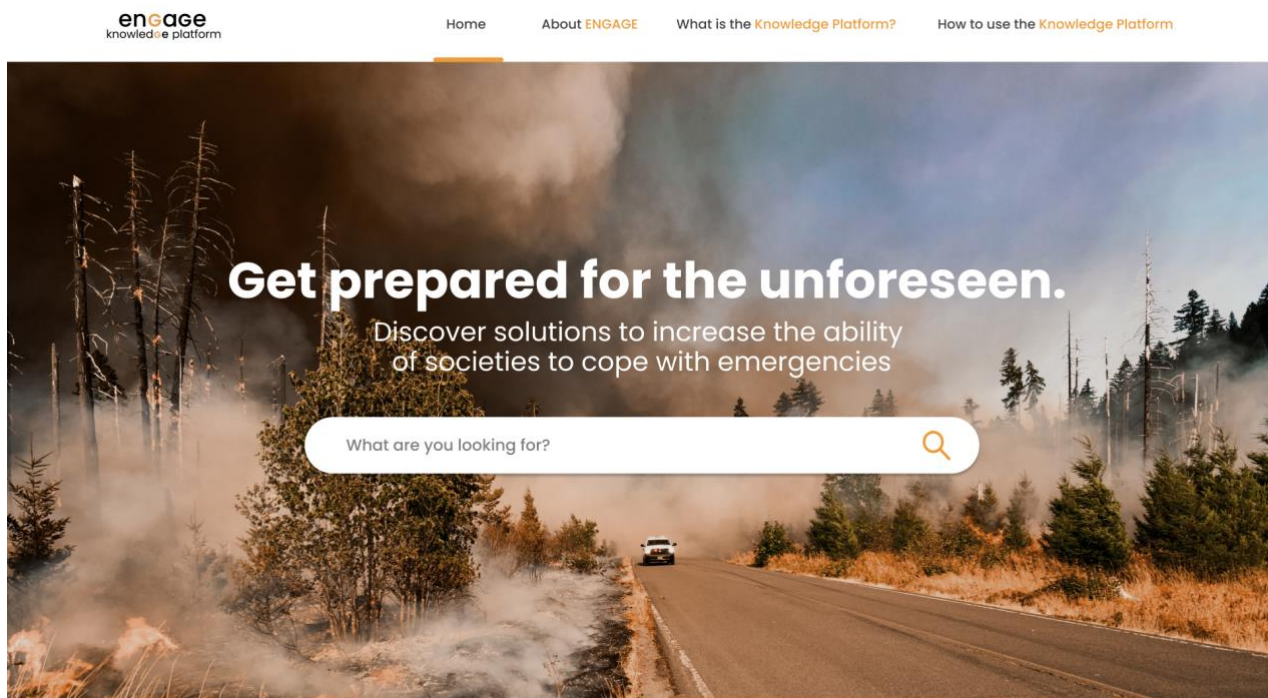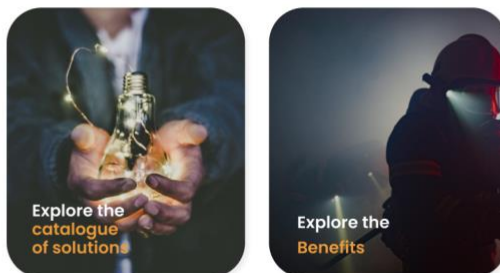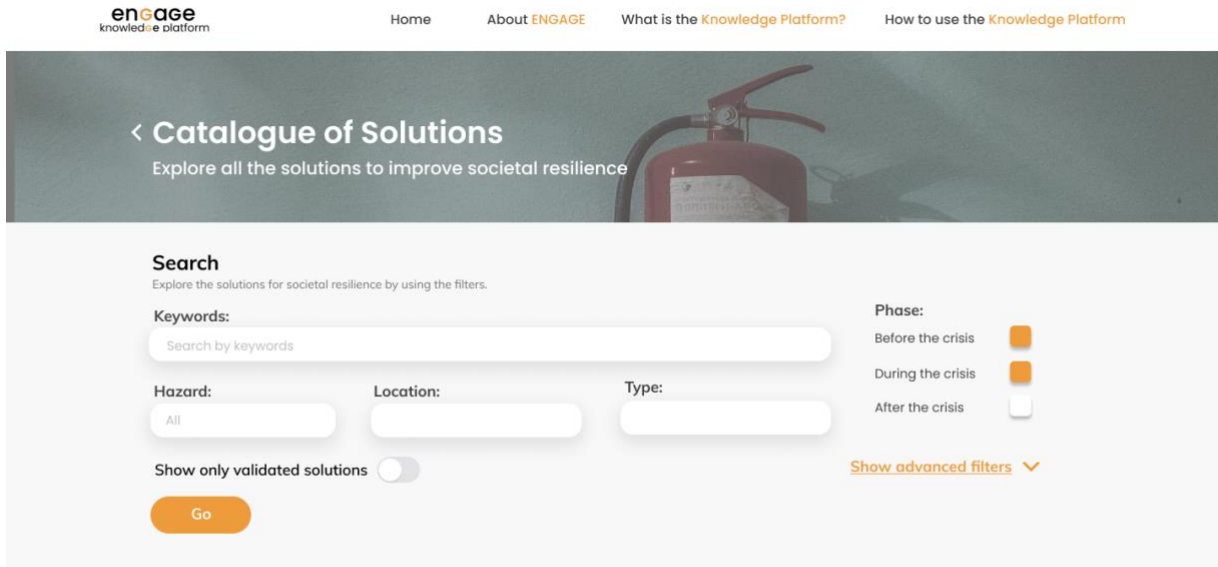
Figure 8 Possible representation of the start page of the Knowledge Platform

Furthermore, the presence of keywords, tags, and smart suggestions systems make finding solutions easy and immediate. See Figure 9 for an example. All solutions will be presented with basic information in a technical sheet where important information and links are provided. In addition, a selection of the solutions will be presented with more in-depth analysis, including example cases where applicable. Cases are applications of a solution within a specific region or context and will give more information about the contextual aspects influencing the solution. Publication details of the pages are always provided to monitor when the page was last updated.

Figure 9 Potential start page for the catalogue of solutions on the ENGAGE Knowledge Platform

2.2 INFORMATION STRUCTURE OF THE CATALOGUE

The overall structure of the catalogue includes five main categories of information (1) basic information, (2) lessons learned, (3) purpose and outcomes, (4) guidelines and (5) record management. These five categories, and the underlying subcategories describing the solutions and cases, are based on information about solutions for societal resilience that have been identified as important in previous work packages in the ENGAGE project, and additional data collection

The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020/2014-2020) under grant agreement n° 882850.

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performed in WP3. The details of how the terms and concepts from earlier work in ENGAGE have been operationalized in relation to the catalogue of solutions are further described in Chapter 3. The basic information category and selected information about record management will be provided for all solutions when presented in the catalogue. The remaining three categories will be available for the selection of solutions that will be analyzed in-depth. The five main categories of the catalogue are briefly described below. See also Figure 10 for an overview over main and sub-categories:
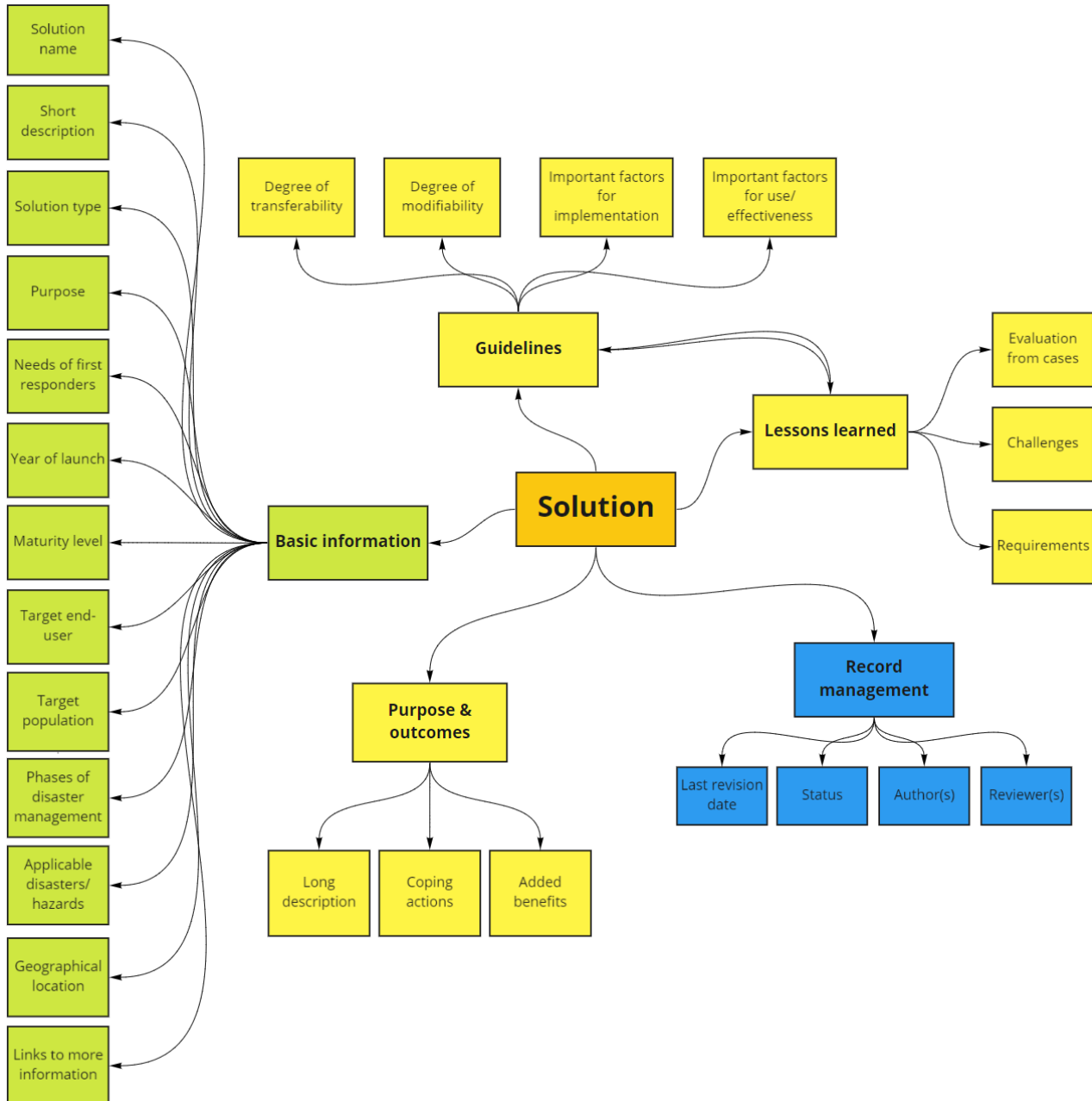
Figure 10 Main categories of the information structure of the ENGAGE catalogue of solutions

2.2.1 BASIC INFORMATION

This category includes important overall information about the solution, including the name of the solution, a short description, the solution type, and the target population (for example, minority groups) and target end-user of the solution, the phases of disaster management where the

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solution is applicable, the type of disasters the solution is used for and the geographical location of where the solution is used. This information will be provided for all solutions in the catalogue.

2.2.2 PURPOSE AND OUTCOMES

The purpose and outcomes category provides a longer description that elaborates on the main characteristics of the solution. The concrete coping actions that the solution is enabling different actors in the society to perform are also described in this category. Furthermore, it addresses added benefits and potential societal impact of the solution, beyond the main aim.

2.2.3 LESSONS LEARNED

The lessons learned category includes important information from the implementation of the solution in different cases. This includes information from available evaluations of the solutions, the challenges experienced, and the requirements for the solutions. These categories will describe experience-based information of the use and implementation of the solution, seen in relation to the specific context in which the solution has been implemented.

2.2.4 GUIDELINES

The guidelines will give information on relevant factors to take into account when considering implementing the solution. Important factors for implementation and use of the solution elaborates on the relevant local contextual factors for the solution. In addition, the degree of transferability and modifiability of the solution is described and provided background for.

2.2.5 RECORD MANAGEMENT

Record management will both have a function internally in the project for keeping track of updates and changes, and for the final catalogue, where revision dates will be provided. This will give users of the catalogue information about the newness of the information provided.[1]

2.3 CREATING CONTENT

To provide information to the different categories described above, we have established a process for content creation. Briefly put, this process involves collection, analysis, and documentation of data (see Chapter 4 for details). Regarding data collection, the project aims to collect data from different sources, but mainly through the collection of reports and other documents, in addition to semi-structured interviews. This will be done by an academic partner in ENGAGE and/or a partner with relevant language knowledge and access. When gathering data, we will seek to get information from developers, implementers and those impacted by the solution (including citizens) that is to be included in the catalogue.

Having collected empirical data, the next step will be to analyze and document the information in a joint template (see Annex F and G) to ensure comparability and reliability. Certain categories in the information structure require high degree of analytical involvement, for example 'added benefits', 'degree of modifiability', 'degree of transferability', and 'important factors for implementation and

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[1] The catalogue will be updated during the lifetime of the project. See also section 5.2 for a discussion about maintenance, system updates and further content creation that transcends the ENGAGE project.

use'. What is beneficial and important, as well deciding on the degrees, will be determined by a research partner, however, based on an analysis of raw data from primary sources, such as informants (developers, implementers, users, citizens) who have first-hand experiences with the solution.

2.4 OVERVIEW OF SOLUTIONS IN THE INITIAL CATALOGUE

The initial catalogue of solutions includes identified solutions from WP2. Four of the solutions were selected for in-depth characterization as part of the present efforts within WP3. We based this initial selection on three criteria, namely (a) availability, (b) maturity, and (c) using the solutions of ENGAGE partners. The latter criterion is a result from project meetings with partner end-users, who emphasized that it would be beneficial to start with solutions already implemented by ENGAGE partners, as it would ensure easier access to information. In the following we will describe those we have identified and highlight the ones that we have characterized in-depth so far. The final catalogue will consist of a higher number of solutions with this in-depth characterization, as well as potentially new solutions that we have not yet identified. The processes of in-depth characterization and for identifying new solutions are described in Chapter 4.

WP2 has identified existing solutions that may help to improve the interaction of authorities and emergency organizations with the civil population to respond and recover from crises efficiently. These solutions can be practices, guidelines, techniques, tools, technologies, methods that help them to reach the public and improve the interaction with them. The solutions can be either formal or informal based on whether they have been defined and developed beforehand to be used in a given situation or on the contrary, they have been created at the moment of the event because a solution is inexistent or not suitable to handle the given situation. The informal solutions are excluded in this initial catalogue due to their low maturity level. Further work should be directed towards considering the innovativeness and usefulness of the informal solutions (see also section 5.2). In total, 168 formal solutions were identified. The following table gives an overview of the number of formal solutions identified, structured according to their interaction purpose.

The most common types of solutions are awareness and training campaigns (28 solutions), and apps (26 solutions). Many experts emphasized that preparation is key to deal with crises, therefore, they have a lot of awareness and training campaigns in place. Furthermore, taking advantage of the potential of new technologies in disseminating and gathering information as well as better communicating with population, they developed several apps to reach population. Regarding the purposes, most of the solutions are aimed at improving the information and communication sharing with the population followed by improving communication with the population.

Table 2 Types of formal solutions and associated interaction purposes (adapted from D2.2)

	Improve communication	Enhance Risk awareness	Facilitate resource allocation	Improve knowledge & information sharing	Enhance preparedness	Capitalize social networks & relationships	Improve health and mental outlook	Empower governance and leadership	Total
Web platform	9	9	5	9	7	5	2	4	11
Apps	14	12	8	18	6	6	9	8	26
Guidelines	9	9	3	5	9	10	10	11	20
Framework	3	2	1	5	4	2	1	1	5
Media	9	12	1	12	2	2	3	4	14
Community of practice	3	3	2	3	4	6	0	1	6
Services to reach society	8	5	7	8	6	8	7	9	12
Awareness and training campaigns	23	19	5	20	14	7	8	12	28
Plans and Strategies	6	5	8	6	7	9	6	15	16
Call centers	0	1	2	5	0	0	1	1	7
Collaboration methods and technologies	5	2	1	10	10	5	4	9	16
Alert systems	3	5	0	2	3	0	0	1	5
Incentives	0	0	1	1	2	1	0	1	2
TOTAL	92	84	44	104	74	61	51	77	168
Percentage	55%	50%	26%	62%	44%	36%	30%	46%	

As mentioned, four solutions have been piloted for in-depth characterization. These solutions are described in Table 3. For a detailed account of the piloting and the results see section 2.5.

Table 3 Solutions selected for piloting of in-depth characterization

Solution name	Solution type	Brief description	Country
Lazio advice app	App	An app used to record and survey people exposed to risk during heat waves. Medical doctors can identify and register people at risk in their region, or people that think they are at risk can register themselves.	Italy
VISOV	Media	Virtual operations support team that monitors social media communication, e.g., Facebook and Twitter. In case of crises, the team provides advice to the population through Twitter and cooperates with French authorities by creating collaborative maps.	France
Ertzaintza App	App	The app facilitates new means of communication with the police through any mobile device and through various channels such as SMS, email, telephone, or WhatsApp.	Spain
The Red Cross Preparedness Guard	Services to reach society	The preparedness guard system is a method and process for an NGO (Red Cross) to organize volunteer efforts in local communities during emergency situations.	Norway

2.4.1 DATABASE STORING THE CONTENT OF THE CATALOGUE

The content for the initial catalogue is stored in AirTable, which is an online collaborative tool that gives all project participants the updated information about the solutions and cases. AirTable is chosen as the documentation platform as it is an environment that allows for a useful overview of the solutions, as well as the possibility to insert new solutions as the project continues. Moreover, AirTable allows gathering information from external actors, through forms that directly updates the information in the catalogue (see Figure 11 and Annex C for screenshots of AirTable with solutions). Furthermore, the tool may be distributed to partners in a convenient way for the creation of structured content, with capabilities for import or export in standard structured formats, facilitating incorporation of results from WP2 and use of catalogue content in the Knowledge Platform.
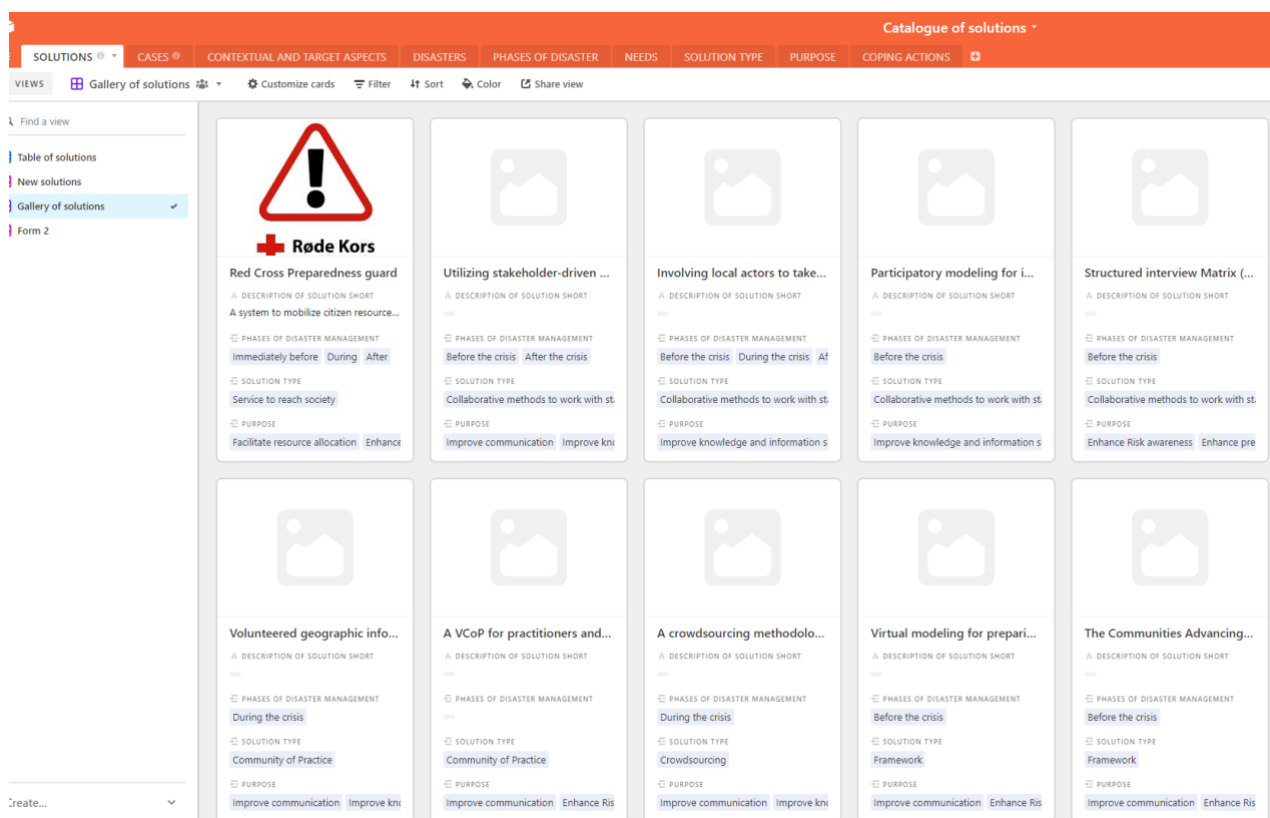
Figure 11 Screenshot of the collaborative AirTable database where content for the catalogue is stored

2.4.2 EXAMPLES OF REPRESENTATION OF SOLUTIONS IN THE ENGAGE KNOWLEDGE PLATFORM

As already stated, the design of the catalogue of solutions, as part of the ENGAGE Knowledge Platform, is work conducted within WP5 and D5.5. However, considering that WP3 provides the content for the catalogue, and the iterative development between design and content creation, the representation of the content is briefly described in this section. In the following, we provide screenshots of how a solution might be represented in the catalogue, using the Red Cross Preparedness Guard as an example. Note that some of the text used in the screenshots is "dummy" input. For detailed and up-to-date information gathered on the solution in the example, see section 2.5. In the first screenshot, Figure 12, a potential design of the front page for a solution is represented. In this example, some notable features are defined. First, the main categories from the information structure are reflected in different panes (Description, Guidelines, Purpose and outcomes, Lessons learned, Record management). Moreover, key basic information is provided in columns as well as highlighted text boxes. To facilitate a seamless search process, similar solutions are provided in the bottom section so users can easily browser further.

Figure 12 Example representation of the solution start page in the catalogue of solutions

To show more detailed information, the screenshot for Guidelines for the implementation of the solution is represented in Figure 13. As can be seen, the main elements reflect the sub-categories within the information structure category 'Guidelines'. Namely, degree of transferability, degree of modifiability, important factors for implementation, and important factors for use. As mentioned, this will be determined by a research partner in ENGAGE, based on the available data collected. The twofold information regarding degree of transferability and modifiability in both an ordinal scale (low – medium – high) and a text description is provided. Notably, the balance of providing in-depth information and reducing the text load is handled using the interactive button:

Figure 13 Mock-up representation example showing guidelines

Figure 14 shows the expanded view of important factors for implementation, where each context factor is described more in detail. This section of the representation is oriented towards providing the context to the solutions, by highlighting for example the differences between recruiting citizens in a large community versus a smaller community, which could be regarded as contextual aspects (see section 5.1. for a conceptual discussion on the context of solutions).

Important factors for implementation

Socioeconomic status	Gender		Size of community	Age of population
Social bonds	Perception of responsibility		Relationship between NGO and first responders & authorities	Topography (possibly part of spatial proximity)
Spatial and temporal proximity	Coping skills			
Material conditions	Level of trust			

LESS...

Depending on the size of the community in which the solution is implemented, different recruiting strategies must be used. E.g., in a small community people are often familiar with one another so capable volunteers may easily be assessed. In larger areas a more thorough assessment process of volunteers is needed.

Administration of the list and the training of citizens is somewhat resource intensive.
A person from the more established groups of volunteers is needed to organize the volunteers from preparedness guard in emergencies.

The municipality is expected to pay for costs (food etc.) related to mobilizing the preparedness guards during emergencies.

Rural areas and cities require different recruiting strategies. In larger communities, existing volunteers who have already been approved to work as volunteers are recruited rather than ordinary citizens, such as volunteers that go to visit prisoners.

Age of population where the solution is implemented is a context factor for what type of actions that are required, e.g., care, shopping, transport from the volunteers.

Topography/spatial proximity also influence the type of actions, e.g., transport, shopping, longer distances/harder to reach areas case of black outs.

Gender: The volunteers were often 50+ and Caucasian, white and some who volunteers/organized from before in other areas. In psychosocial care 50+ women Caucasian.

The collaboration status/practice between emergency first responders and the organization operating the solution is important. In this particular context, the emergency first responders are interested in collaborating with the NGO.

LESS...

Figure 14 Mock-up representation example of the expanded view on important factors for implementation

The lessons learned from the information gathering is synthesized and presented in a simplified and informative matter, as can be inspected in Figure 15. The objective is to highlight challenges of the implementation and use, based on real cases of application.

The Preparedness Guard
Red Cross Trondheim, 2008
www.thepreparednessguard.no

MATURITY LEVEL
● ● ●
Implemented

LOCATION:

Description   Guidelines   Purpose and outcomes   **Lesson learned**   Record Management

Case: Small municipality in middle Norway

Challenges

Too many recruits:
In one area there were many more volunteers than expected (260 people of 5-6000 inhabitants). This made it difficult to administer and get everyone through training. It was also a challenge that the responsible did not have a plan to organize the volunteers. In this case they needed to find new people to administer the preparedness guard, and in the end only a 100 of the 260 ended up joining.

Ensuring availability for training
The yearly course is held for all volunteers at a set date, and it can also be a challenge that many volunteers are not available to participate.

Ensuring the agreements with authorities
It has sometimes been a challenge to get the municipality to sign an agreement for being responsible for the costs that need to be covered in an emergency (e.g., food).

Unwanted volunteers
You can get volunteers that are not fit to be volunteers, and it may be difficult to identify these, and to handle situations where they are not allowed to be part of the preparedness guard (have been situations where volunteers threaten to go to the media).
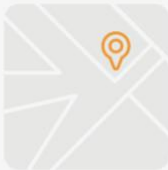
Updating the register
It may be challenging to update the register to remove dead/sick/uninterested. There is no formal process for updating the system/list of persons. It is based on local administrations own ad hoc work process.

Lack of diversity of volunteers
Mainly white middle-aged people sign up, and it has been a challenge to involve minorities.

TARGET END-USER:
Non-governmental organization (NGO)

TARGET POPULATION:
Volunteers   PG recruits

HAZARDS:
Extreme weather
Social disruption
Pandemic
Nature related events
Critical services dependencies

SOLUTION TYPE:
Services to reach society

Phase:
Before
Immediately before
During
After

Figure 15 Mock-up representation of the lessons learned of the solution

2.5 DETAILED SOLUTIONS

For the initial catalogue of solutions, a limited set of solutions were selected for in-depth characterization to ensure a closely matched approach with the validation work of the project. It was also important to pilot the process of collecting and analyzing empirical data on a few solutions, to ensure a well-functioning process and enable corrections before a larger number of solutions are selected and characterized in-depth. The process is explained in detail in Section 3.3.2.

The selection of a handful of solutions for the pilot of an in-depth characterization was based on initial criteria obtained in first consortium brainstorming. The criteria were (a) availability, (b) maturity, and (c) using the solutions of ENGAGE end-user partners. The latter criterion results from end-user meetings that concluded that a beneficial start of the validation and characterization was to start with ENGAGE partners. Accordingly, the selected solutions for piloting the in-depth characterization process were:

The Red Cross Preparedness Guard. The preparedness guard system is a method and process for a non-governmental organization (Red Cross) to organize volunteer efforts in local communities

during emergency situations. It is a low-threshold opportunity for citizens to participate in volunteer work, as the people that sign up for the preparedness guard will only be contacted in case of emergencies and have one day basic training a year.

Lazio advice app – heat wave active health surveillance. Health care professionals such as family doctors, general practitioners and primary care services carry out surveillance and patient care during heat waves. Among the applications of the Lazio Advice app, it allows health responders to monitor vulnerable subjects at higher risk during heat wave events. For all patients aged 65+ a graded heat risk score is calculated each summer based on socio-demographic and health characteristics from administrative and health registries. General practitioners and health care professionals (general practitioners, primary care units, healthcare operators involved in telemedicine\call center) carry out home visits and tele-monitoring when heat wave warnings are issued. A questionnaire on their health status and any additional health intervention are included in the database and where needed, additional care is provided. For summer 2021 the Lazio Region has adjusted its heat plan to account for COVID-19 restrictions and distancing protocols in place also in the health system, and for heat waves the Lazio advice tele-assistance platform has been used integrating a previous web-based monitoring system. Adherence of patients and GPs is on voluntary basis, while regional health services provide health assistance to all 65+ patients where required.

Ertzaintza App. The main objective of the app is to create a communication channel between citizens and the Ertzaintza. The app facilitates new means of communication with the police through any mobile device and through various channels such as SMS, email, telephone, or WhatsApp. A very important feature is that the app keeps the anonymity of people (if they wish) to increase collaboration. Another important aspect is that the app works 24 hours, that is, users can communicate with the police whenever they need it.

VISOV – Virtual Operation Support Team (VOST). Virtual operations support team that monitors social media communication with French authorities in cases of crisis – what they call social media in emergency management (#SMEM). VOST applied to emergency management and disaster recovery is an effort to make use of new communication technologies and social media tools so that a team of trusted agents can lend support via the internet to those on-site who may otherwise be overwhelmed by the volume of data generated during a disaster (see also Visov.org).

In the following the preliminary results from the pilot of in-depth characterization are described. For the Lazio advice app, the Ertzaintza app and VISOV, the information is collected through one interview for each solution as well as analyzing documents. For the Preparedness Guard data collection was done in two interviews, one information meeting, one workshop, and analyzing documents was provided. Only the results from the in-depth characterization categories (Purpose and outcome, Lessons learned and Guidelines) are provided here.

2.5.1 RED CROSS PREPAREDNESS GUARD

Purpose and outcomes – *Solution description*. The Red Cross Preparedness Guard (PG) is a system for recruiting and mobilizing citizens that the Red Cross might contact for help if there's a crisis. This is a list of volunteers that have agreed to be contacted for support on short notice during emergency situations. The volunteers should be people that are interested, are willing to participate in courses once/twice a year, that can take care of themselves and others. The list could also include existing members already engaged in other tasks who, in addition, wish to volunteer in PG during a crisis. PG supports a wish to organize efforts in the local communities, to enable competent volunteers to help in situations and to avoid potentially unwanted spontaneous volunteers.

The main aim of PG is to facilitate local resource allocation during emergencies through having several volunteers that are easily reachable and prepared to contribute. A secondary goal has

been to recruit volunteers to RC. This will enhance preparedness possibilities in a local region and capitalize on social networks and relationships. One case implementation of PG is also planning to have social gatherings for the volunteers to strengthen these social networks and relationships. In all, an aim of the PG is also to empower governance and leadership of volunteers in emergency situations.

Volunteers gets a basic level of coursing and could get the possibility of additional courses. PG is a low-hanging participation opportunity for citizens that wish to help in case of crisis, but do not want/have time/capacity for volunteering on a regular basis. PG could also be linked to municipalities through "Collaboration agreement with municipality on preparedness".

The capabilities and physical resources available of the volunteers can also be listed. Typical activities that volunteers can help with in a crisis through this solution are transport of people, material, equipment, for example in relation to support centers. Also, the collection of clothes, foods and other vital resources have been done for victims that has had to evacuate. Other tasks have been to provide food for first aid professionals and other volunteers.

Purpose and outcomes – *Coping actions*. Volunteers have enabled the following actions during actual events: Transport of people, material, equipment, collecting clothes, foods and other vital resources, directing traffic, providing food, organizing alarming of other citizens and acting as guard, psychosocial aid, operating evacuation centers, information sharing to citizens (Relative-hotline), and simple search and rescue. A main element was that the preparedness guard volunteers enable the rescue teams and formal arrangements focus on their important tasks.

Purpose and outcomes - *Added benefits*. In addition to the main actions and goals of the solutions, some implicit outcomes were identified, for example that more citizens gained knowledge of first aid. Volunteers that contribute to crisis are likely to have a better opportunity of post-crisis psychosocial support compared to if they were spontaneous volunteers, considering the enrolment in the professional support system of the NGO. Lastly, a generally raised risk awareness in the community was expected due to the campaigns as well as the magnitude of the number enrolling for the preparedness guard list.

Lessons learned - *Evaluation from cases*. Evaluations were performed on a national level in 2014 and in 2017. The evaluation's main findings from 2014 point out that the big question is "what should the guards be used for?" which for local associations may appear somewhat unclear. Furthermore, the evaluation pointed out that:

»   it is difficult to operate the activity

»   in several places, progress has stagnated due to a lack of information and courses

»   crises occur rarely, thus the emergency guards are not being used and are prone to leave the PG list

»   there is an interest in taking responsibility for and activating the emergency responders once they are enlisted

Additionally, evaluations are derived from analysis of cases. We will draw attention to one of the cases in this text. A pilot project for the PG was carried out in 2009, in a County in Western Norway and the experiences from this pilot has been evaluated. The evaluation showed that:

»   Active persons can get bored of there being no alarms because no big events happen

»   PG is always dependent on the availability of enthusiastic volunteers

»   Risk of great excitement at first, which cannot be maintained over time

Calculations made in 2008 showed that to have 20 persons from the list in continuous effort, you need 300 names on the list. People get sick, scared, some are on holiday etc. Overall, accumulation of 12 years of experience shows successful results.

Lessons learned - *Challenges*. From the case in a small municipality in Mid-Norway we highlight some of the challenges identified. First, too many recruits - In one area there were many more volunteers than expected (260 people of 5-6000 inhabitants). This made it difficult to administer and get everyone through training. It was also a challenge that the responsible did not have a plan to organize the volunteers. In this case they needed to find new people to administer the preparedness guard, and in the end only a 100 of the 260 ended up joining. Second, ensuring availability for training - The yearly course is held for all volunteers at a set date, and it can also be a challenge that many volunteers are not available to participate. Third, ensuring the agreements with authorities - It has sometimes been a challenge to get the municipality to sign an agreement for being responsible for the costs that need to be covered in an emergency (e.g., food). Fourth, unwanted volunteers - You can get volunteers that are not fit to be volunteers, and it may be difficult to identify these, and to handle situations where they are not allowed to be part of the preparedness guard (there have been situations where volunteers threaten to go to the media). Fifth, updating the register - It may be challenging to update the register to remove dead/sick/uninterested persons. There is no formal process for updating the system/list of persons. It is based on local administrations own ad hoc work process. Lastly, Lack of diversity of volunteers - Mainly white middle-aged people sign up, and it has been a challenge to involve minorities.

Lessons learned - *Requirements*. From the national evaluations, some notable requirements are exemplified in the following paragraph.

» *Basic requirements* - Four courses must be attended (see approval of courses below). The volunteers must attend a yearly course, training, or other competence enhancing efforts. PG volunteers will get the opportunity to attend one yearly training. The volunteers will get an ID-card and a RC-vest.

» *Alerting systems* - All approved PG volunteers must be included in the organization's alerting system, and a system must be created that quickly provides feedback on how many PG volunteers are active in the alert system at all times.

» *Approval of courses* - The courses that the PG volunteers have completed should be registered in a uniform system, so that it is easy to get an overview of the number of approved courses. The volunteers must attend four courses (i) First-aid course, (ii) Basic course in psychosocial first aid, (iii) Introduction to the Red Cross and (iv) Introduction to emergency preparedness

Guidelines – *degree of transferability*. The degree of transferability of this solution is regarded as high by researchers based on analysis of information from evaluation reports and interviews with developers and implementers of the solution. Accordingly, it is perceived as possible to transfer this solution to other contexts, bearing in mind the context factors identified (see important factors for implementation and use). Information obtained in interviews, however, suggest that it will be difficult to transfer the solution to an authority.

Guidelines – *degree of modifiability*. The extent to which this solution is modifiable is regarded as high. Through interviews it became clear that there have been several modifications of the original concept in different local Red Cross organizations. The variations include a range from the original concept of recruiting volunteers to qualifying already volunteers in the Red Cross to join the Preparedness Guard.

Guidelines – *Important factors for implementation*. Based on interview material and internal reports, depending on the size of the community in which the solution is implemented, different recruiting strategies must be used. In larger communities, a more thorough assessment process of volunteers is needed, e.g., existing volunteers who have already been approved to work as volunteers are recruited rather than ordinary citizens. In a small community people are often familiar with one another so capable volunteers may easily be assessed. Some material conditions and resources are needed. Through cooperation agreements, the municipality is expected to pay

for costs (food etc.) related to mobilizing the preparedness guards during emergencies. Administration of the list and the training of citizens is somewhat resource intensive. Age of population where the solution is implemented is a context factor for what type of actions that are required, e.g., care, shopping, transport from the volunteers. Topography/spatial proximity also influence the type of actions needed, e.g., transport, shopping, longer distances/harder to reach areas in case of black outs. Further, the volunteers were often 50+ and Caucasian, and some were already volunteers/organized in other areas. In psychosocial care, gender plays a role as the volunteers signing up for this task are often 50+ women Caucasian. The relationship between NGO and first responders and authorities is important. In this context, the emergency first responders are interested in collaborating with the NGO, and there is an established level of trust between these actors. Lastly, Perception of responsibility is also important with regards to the expectations that citizens are perceived to have to the RC. In Norway, the RC are expected to be visible and to participate in emergency situations.

2.5.2 LAZIO ADVICE

Purpose and outcomes – *Solution description*. The solution is designed for fighting the consequences of heat waves. Especially, it targets a reduction in the mortality of elderly people which is associated with the temperature rise by monitoring elderly people with risk factors (e.g., cardiological risks) to be monitored. The solution is an app to record add survey people at risk. It is used by the people at risks themselves, doctors, or healthcare operators.

The solution is composed of the following elements:

» The app is named Lazio advice.

» Web system which includes the possibility to register and monitor people at risk.

» A work process for use by epidemiologists, medical doctors, and health care operators.

The organization involved identifies risk factors and indicators during heat waves. Medical doctors can identify and register the people at risk in their region, or the people that think they are at risk can register themselves. When there is a heat wave, a warning is sent out by the system informing the medical doctor and health care workers about the severity (Level 1 – Level 3). Following the doctor and health care worker contact the people at risk to monitor and surveil their health. The solution was developed precisely for this purpose, and it is the only one available for surveillance of people at risk during heat waves. Following the heat waves of 2003 and the risen awareness about death due to heat the solution was introduced in 2006. At that point it was based on a web platform and the collaboration of medical doctors, who identified the patients at risk. However, it was not very effective, so it was looked for other opportunities for identifying the patients and a better characterization of them (including risk factors, social ties etc.). Last year an app was introduced to monitor patients with COVID-19 and was considered useful also for recording people at risk in case of heat waves and it was incorporated in the original solution.

Lessons learned – *challenges*. From the characterization, one main challenge was identified, which involved limited collaboration of doctors, which was on a voluntary basis. Therefore, the surveillance and recording were extended to other health care workers. To accommodate this challenge - adjustments of the app and approach are still possible, such as a link to reach people responsible for policies and related authorities and operators.

Lessons learned – *evaluation from cases*. Each year there is an evaluation of the effectiveness of the solution and since 2006 there were a lot of improvements. The new app represents a big improvement, because it allows the contribution of other health care operators. The best effectiveness indicator is the impact on mortality. Things improved for higher temperature risks (Level 3), but not as much for less extreme temperatures. There was no evaluation of costs, even though of course the organization is operating under funding constraints.

The solution is not deemed to be very resource intensive as it is in part depending on voluntary contribution.

Guidelines – *important factors for implementation*. The solution is applied at a regional level. The region includes very different environments, from small country villages to large urban areas, to agricultural lands. This means that a lot of contextual factors are different. For example, in rural areas the medical doctors are more in contact with the population. While in urban areas the elders are typically more isolated. Other important aspects are digital literacy (this is important for both categories people at risk and operators), social bonds (elders that have strong social bonds vs. elders that are isolated), threat perception (when on the news it is reported that the heat wave is dangerous, and many people are at danger). Risk awareness plays an important role for both health operators and citizens. It is likely that people are concerned about risks during a heat wave. Active participation of health care operators and the right engagements is important.

Guidelines – *degree of transferability and modifiability*. The degree of transferability was regarded as high but needs adaptation. For example, roles and responsibilities of medical doctors may be different in different contexts. Moreover, it is easily modifiable because it is based on different components.

2.5.3 ERTZAINTZA APP

Purpose and outcomes – *Solution description*. The main objective of the app is to create a communication channel between citizens and the Ertzaintza. The app facilitates new means of communication with the police through any mobile device and through various channels such as SMS, email, telephone, or WhatsApp. A very important feature is that the app keeps the anonymity of people (if they wish) to increase collaboration. Another important aspect is that the app works 24 hours, that is, users can communicate with the police whenever they need it. This application has several functionalities:

» Provide information to the citizens: Advice on security, locations of the nearest police stations and news and issues of citizen interest.

» Promote citizen collaboration. Users can send photos and videos instantly to alert about various incidents.

Emergencies: The app offers a service to contact emergency services. The app diverts the calls to the 112 center (emergency number). The development of the app arose in response to the need to establish transparency policies with citizens and to establish continuous communication between the Ertzaintza and citizens.

Purpose and outcomes – *Coping actions*. The app was used during the pandemic to facilitate the following coping actions:

» Citizens request for help with a problem

» Communication of the citizen to the Ertzaintza of incidents or breach of security measures

» Report on sanitary or administrative measures.

» Collect complaints from citizens and their degree of satisfaction

Lessons learned – *Challenges*. The health alarm due to COVID posed significant challenges for the proper functioning of the tool:

» The increase in calls, SMS, emails, WhatsApp required an increase in the number of operators, which required a lot of organizational work.

» Many of the operators needed training as they were not familiar with the application.

» 	The use of WhatsApp as a communication channel requires one person per phone line, thus limiting the communication with many people. In order words, the solution does not allow 'multi-tasking'.

The challenges posed by the increased number of communications were solved by increasing the number of staff and operators and carrying out effective cooperation within the team.

Lessons learned – *Evaluation*. In February 2020, the Ertzaintza received 261 communications from citizens, while in November 2020, they received 28,385. The significant increase in app users shows the effectiveness of the app. During the pandemic, the app became a communication channel between citizens and the administration. Many trade associations and different economic sectors used the app to obtain information on the new security measures. The ERTZANZA app was the most-used channel during the pandemic in the Basque country. The institutions and different media supported it. It became the principal information source of the COVID pandemic.

In general, the use of the app has been correct. False information does not usually arrive. On counted occasions, people with mental disorders misuse the application.

Many people use the app to call the emergency service instead of 112 (emergency telephone number).

Guidelines – *important factors for use*. The use of the app is anonymous. Thus, the information deduced from the data do not have socio-economic details on the app users. However, several factors:

» 	Digital training: A minimum knowledge of technologies is required

» 	Age: Older adults do not usually use the app, since they use traditional means such as the 900-telephone line

» 	There seems to be no difference in the use of the app between rural and urban areas.

» 	Socioeconomic status (Citizens require a minimum of knowledge about technologies, and resources to buy the technologies and associated services).

» 	Perception of responsibility (The app allows citizens to send pictures and videos at any time, if the perception of responsibility is high, they will use the app more)

» 	Level of trust (if the citizens do not trust the authority, they will not use the app)

Guidelines – *degree of transferability*. The degree of transferability is regarded as medium. It is possible to transfer this solution to other contexts where citizens have enough digital and technological knowledge

Guidelines – *degree of modifiability*. The degree of modifiability is regarded as medium. The solution is flexible and can be adjusted according to situation/context. This was shown during the last years where the app served a new purpose as a communication channel for the pandemic. Considering the ICT development needed, resources for changing is foreseen.

2.5.4 VISOV

Purpose and outcomes – *Solution description*. VISOV is an association made up of citizens who are all volunteers. The VISOV has a range of action based on three axes:

» 	The dissemination of civil security culture through social media

» 	Assistance to disaster victims, interfacing with the authorities

» 	Support to the authorities through web monitoring and, if necessary, the creation of collaborative maps

The purpose of the use of social media in emergency situations is to facilitate dialogue between crisis managers and emergency services on the one hand, and citizens on the other. This can allow the benefit from feedback directly from the field. Daily, in "active standby" mode, volunteers exchange views in VISOV rooms using the WhatsApp application. The volunteers are invited to post sensitive information spotted on the web that may be of interest to other volunteers or structures present such as the fire brigade or the crisis center of the Ministry of the Interior. On Twitter, volunteers (and supporters among citizens) have the habit of copying @ VISOV1 and systematically adding the hashtag #MSGU to report any significant or urgent tweet. (Visov.org).

The in-depth characterization identified issues in obtaining data for the deadline of the initial catalogue due to availability and access to relevant informants working in the crisis management domain. This shows that there might be difficulties in obtaining results from all solution characterizations and that due time should be allocated for pursuing other channels or obtaining other types of information.

2.6 INFORMATION SECURITY AND ETHICAL ASPECTS

The data stored on the collaborative AirTable shall not contain any raw data from interviews, but rather the abstracted and analyzed data without sensitive information or personal data. Security sensitive information is, as described in D8.2, not to be collected and will thus not be included in the catalogue. Informants providing information through interviews will do so based on informed consent, following the data protection process for the project, as described in D6.1, and the applicable data protection regulations on EU and national level. Prior to representation in the catalogue of solutions, information providers should be allowed to give their final acceptance of the publishing.

However, AirTable does collect personal data of collaborators on the platform. As of the time of writing this deliverable, only project members are accessing AirTable. The project will, in accordance with the Joint Controller Agreement of ENGAGE decide on the need of a data processor agreement. This will be especially relevant if external collaborators are invited to participate directly on the platform.

3 APPROACH AND PROCESS TOWARDS THE INITIAL CATALOGUE

While Chapter 2 provided an overview of the status of the catalogue, the present chapter describes our approach and work process towards the initial catalogue. The development of the first version of the catalogue was conducted through several interrelated steps, using a combination of methods and sources, such as workshops and interviews with end-users, consortium meetings, internal workshops on important questions, and piloting of processes. Moreover, the initial catalogue builds on and develops further work done in the other work packages.

Chapter 3 is divided into four main sections, which describes central processes of developing the initial catalogue: (a) the process of getting initial feedback from end-users and the KI-CoP, (b) the process of developing the information structure of the initial catalogue, (c) the process towards creating the catalogue content, and (d) the process of providing input to the design and function of the catalogue.

3.1 WORKSHOPS WITH END-USERS AND THE KI-CoP

Based on the findings from WP1, WP2, WP4, and WP5, we formed the first approaches to the information structure of the catalogue. To test our initial approaches, we arranged two workshops, one with end-users and another with the KI-CoP. One of the goals was to collect input to both the process of developing the catalogue information structure and the catalogue content.

3.1.1 END-USER WORKSHOP 25 MAY 2021

The initial set up of a tentative catalogue was subject to an end-user workshop arranged on 25 May 2021. The participants were the end-user partners in ENGAGE. The main objective was to conduct an early evaluation of the approach and selection of solutions, as well as preparing for an external KI-CoP workshop to progress further.

The end-user workshop was based on a scenario developed around communication issues in the context of the COVID-19 pandemic. The participants were given the following scenario in advance as preparation:
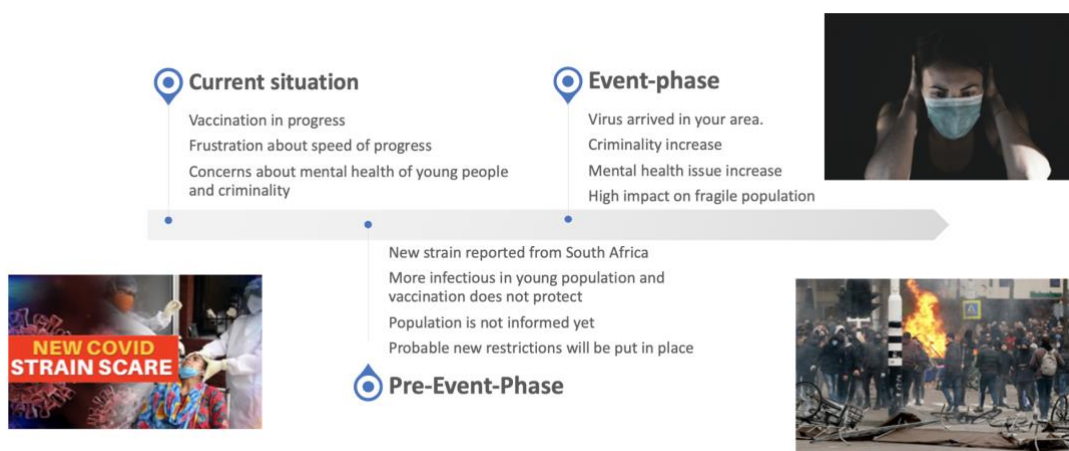
Figure 16 Snapshots of the scenario applied to the workshop

The participants were asked to provide their expert opinions on the following questions:

The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020/2014-2020) under grant agreement n° 882850.

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Open questions related to the solutions

» How applicable are the presented solutions to your work?

» What information would be useful to make such judgment?

Open questions related to the catalogue

» How would you like to see that solution organized/presented?

» How would you select a solution?

» What information would you require?

» Which solution would you choose?

Alongside the scenario, we prepared a mini catalogue of solutions, which included a variation of solution types, for example apps, social media, awareness campaigns and volunteers. The full list can be found in Annex D. The end-user workshop was designed to provide feedback on several aspects concerning the catalogue of solutions. The key takeaways when it comes to the information structure of the catalogue are highlighted in the following table:

Table 4 Key takeaways from the end-user workshop regarding the catalogue information structure

Information structure of the catalogue
The validation and evidence behind fronting the solutions is important to bring to attention early. This is both a general impression for the catalogue of solutions and Knowledge Platform, but also on the specific solutions. For example, the knowledge platform should state that it concerns validated or mature solutions.   Important aspects to cover in characterization of solutions are   » Validation status/data   » Targeted end-user   » Targeted population

These key takeaways have been addressed in the main category of 'Basic information' (targeted end-user, targeted population) and the 'Lessons learned' category (validation status/data). How the input has been operationalized into the catalogue information structure is described in sections 3.2.1 and 3.2.3 respectively.

3.1.2 KI-CoP workshop 14 June 2021

Drawing on the results from the end-user workshop held in May, we arranged a KI-CoP workshop, iterating the process of getting feedback and evaluating the initial approach and setup of the catalogue.

The KI-CoP event ("Societal Resilience Hub") was held 14 June 2021 and designed as a workshop to provide feedback to the project. The aim of the workshop was to simulate an event in which the end-users could select a solution and adapt to their context. For this purpose, ENGAGE developed a scenario with a before-phase and during-phase to cover different disaster cycles. A key element of the scenario was to include an acute crime event to facilitate discussion on the limits and borders of citizen participation (see Figure 17). Another key element of the design of the workshop was to involve different types of end-users (researchers, first responders, authorities) from different countries and societies, to provide different backgrounds and perspectives to the subject.

Figure 17 Snapshots of the event-phase scenario

For the KI-CoP event, a series of mini catalogues were developed, where solutions assessed as mature were included and presented according to needs. The presented solutions were somewhat different between the various scenarios. One example of these mini catalogues:

Table 5 Mini catalogue developed as a basis for scenario application - before phase

The participants were asked to discuss and answer the following questions:

Involvement of citizens of the society:

1) What actions would you take to prevent the situation from occurring?

2) How do you want to be supported by the society?

3) Who can help you in your intent to get a high vaccination rate?

Select and adapt an existing solution that could fit your needs:

1) Which solution(s) do you choose, and why?

2) What type of information would you need to make a good decision?

There were several important results from the KI-CoP workshop with regards to what kind of information that was deemed important to include in the catalogue. Key takeaways from the KI-CoP related to the information structure of the catalogue are presented in Table 6.

Table 6 Key takeaways from the KI-CoP workshop concerning the information structure

Information structure of the catalogue
»   Help the user make a contextual comparison of where the solutions have been applied, and their own context (i.e., have a good context description on relevant aspects).
»   Considering that where solutions have been applied as an important element, cases of solutions are objects that needs attention in the characterization.
»   The characterization should include:
»   Cases – applications of a solution
»   Notions regarding the resource intensiveness
»   Describing cost/effectiveness
»   Impact/outcomes of applying the solutions
»   Prerequisites (listing specific requirements for the solution to work well)
»   Validation status (scientific validation, if possible, especially in the health domain)

The key takeaways from the KI-CoP workshop provided input to the setup of several categories within the information structure. They have been addressed in the main categories 'Lessons learned' (evaluation from cases, validation status) and 'Guidelines' (context description). Sections 3.2.3 and 3.2.4 elaborate on how these key takeaways have been operationalized into the catalogue structure.

With the feedback from end-users and the KI-CoP as a point of departure for further work, we developed an information structure for the initial catalogue of solutions. For clarity, the following description of the process is divided into the current main categories of the information structure of the catalogue, beginning with the category of basic information.

3.2 DEVELOPMENT OF CATALOGUE INFORMATION STRUCTURE

In addition to the results from the two aforementioned workshops, the work of defining an information structure for the catalogue builds on results from WP1 and WP2. On the one hand, the case studies and surveys conducted in WP1 constitute a society-oriented perspective. On the other hand, the identified needs of authorities and first-responders and identified solutions in WP2 constitute the formal perspective. Additionally, initial validations (WP4) and the collaborative work on developing the Knowledge Platform, and the user interface (WP5) is intertwined with the WP3 efforts. In addition, brainstorming sessions within WP3 and across work packages have been central. The details of how previous work has been operationalized for the catalogue of solutions is described in this chapter.

Findings from the other WPs so far have been further developed in task 3.1 and operationalized for the purposes of setting up the current catalogue information structure, as described in Chapter 2. Annex A may also be conferred for an overview of the categories in the catalogue information

structure, a short description of these, the type of information for each category, which work package the specific category originates from and the work package that will be the main responsible for collecting information for each category. Several of the subcategories consists of lists of descriptions, that should be chosen from to characterize the solutions. These are in AirTable "drop-down"-lists, and it is possible to choose multiple descriptions where appropriate. The rest of the subcategories are mainly open descriptions, where an explanation of the content to be provided is available in the templates for solution descriptions in Annex F and Annex G, and in AirTable. As the descriptions of the solutions will be based on further empirical data collection, the sub-categories presented in this chapter may be subject to change. For example, if new descriptive factors are found, these will be added, and if some descriptions are assessed as less useful, these may be removed. These potential changes will be presented in future deliverables of WP3. The details of how it has been operationalized as part of the work is described in this chapter.

3.2.1 BASIC INFORMATION

One of the aims of WP3 is to characterize a selection of solutions in-depth, however, the catalogue of solutions will include a greater number of solutions in total. An important challenge that became clear in the discussion the KI-CoP workshop (see 3.1.1 above), was the balance between providing in-depth information on the one hand, and brief and basic information on the other. The advantage of the former is that there is rich information available, but it can also be overwhelming. While the advantage of brief and basic information is that it is easy to get an overview and one avoids information overload. However, more information may be needed to make an informed choice about whether the solution is relevant for the user.

Accordingly, we have set up a broad category of basic information with subcategories that will be collected for all solutions in the catalogue, which in sum will give a good overview of the solution in question. Thus, although not all solutions in the catalogue will be described in-depth, there will be basic information for every solution. The intent is that this information will be presented for each solution in the catalogue with links to further information for those interested in knowing more for the solutions that are characterized in-depth.

Based on the end-user and KI-CoP workshops, work done in WP1, WP2, WP4 and interactions between WP3 and WP5, we have defined twelve categories of basic information that will be collected and presented in the catalogue of solutions. Most subcategories stem from work in WP2, where we have identified promising solutions that may improve interaction between authorities/ emergency organizations and the civilian population.

Among the subcategories of 'Basic information', we have **solution name** and a **short description** (100 words) to highlight the main essence of the solution. Moreover, we have **solution type**. In the work of identifying and collecting solutions in WP2, the identified solutions were structured according to a solution typology. A solution can for example be a web platform, guidelines, an app, or an awareness and training campaign (see full list in Annex B, table 11).

Another subcategory is **purpose**. An important aspect that was analyzed in WP2 was the specific purposes or benefits that the solutions help to achieve when improving the interaction of authorities and emergency organizations with the civil society (population). In total, based on the work of collecting promising solutions, WP2 identified eight interaction purposes that solutions aim to address (see D2.2 for more information): (i) improving communication with society, (ii) enhancing society's risk awareness, (iii) facilitating resources allocation from and to society, (iv) improving information and knowledge sharing, (v) enhancing preparedness, (vi) capitalizing upon social networks, (vii) improving the society's health and mental outlook, and (viii) empowering society in governance and leadership activities. This list of purposes has also been used in WP4 with some modifications. For the catalogue of solutions, we have merged the two lists (see Annex B, table 16), for the sake of simplicity.

Considering the target group of the catalogue, the needs and expectations of first responders and authorities are important to take into account when developing the information structure. Disasters are complex situations that require the involvement of all the stakeholders with different roles and responsibilities. In this vein, the involvement of society in dealing with crises is necessary to cope with complex disaster situations. However, to properly use the population's abilities and capacities in dealing with crises, it is necessary to know what emergency services and authorities need and expect from the communities so that they can better respond and recover from disasters.

Accordingly, WP2 identified a list of needs and expectations the emergency organizations and authorities need and expect from the population to cope better with crises (see the full list in Annex B, Table 23). The subcategory **'Needs of first responders'** is based on this list. Thirteen needs were identified that reflects the needs of these actors in relation to the interaction with citizens.[2] The list is based on a survey that was carried out to identify and prioritize the needs and expectations of emergency organizations and authorities. In addition, semi-structured interviews were carried out to understand better what and why they have these needs and expectations and the current barriers or limitations when involving the population in managing crises. The identified aspects that are deemed as important by first responders and authorities, give directions for selecting solutions and representing solutions in a way that resonates well with the aspects.

Moreover, identified solutions in WP2 are categorized after which **phases of disaster management** (see Annex B, table 13) they are relevant for, as well as **applicable disasters/ hazards** (see Annex B, table 14). We also collected **links to more information**, which will be included in the catalogue so that it is available in case a user of the catalogue wants to know even more. In addition, the end-user workshop (see 3.1.1) and WP2, underlined the importance of knowing the **target population** (see Annex B, table 12) and the **target end-user** (see Annex B, table 12) of the solution. We define target population as the group the solution seeks to target. For example, whether there is a specific group of volunteers, and/or a group of people at risk during crisis that the solution aims to help. While target end-user is the initiator, implementer and/or organizer of the solution.

Lastly, from the studies of WP1, focusing on the bottom-up approach and citizens perspective, it became clear that it is necessary to add the localization of the solution because there are important differences between societies. Therefore, we seek to include information about the **geographical location** of solutions. Overall, the main category of basic information includes the following subcategories as presented in Figure 18:
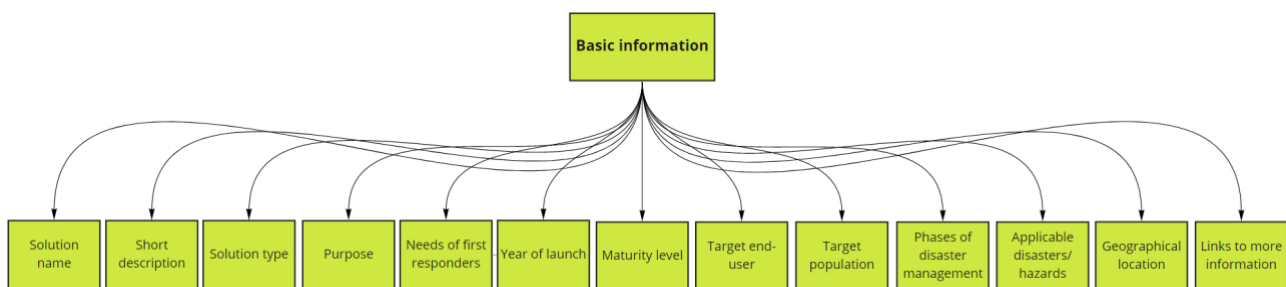
Figure 18 Basic information with sub-categories

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[2] These 13 needs are in WP3 further grouped into five categories that will be implemented in the Knowledge platform to guide users of the catalogue to find relevant solutions for their needs, see section 3.3.4 and Annex B, Table 23.

3.2.2 PURPOSE AND OUTCOMES

As mentioned, a selection of the solutions in the catalogue will be characterized in-depth. Thus, in addition to the basic information, there are three other central categories that constitute the information structure. One is what we have labelled 'Purpose and outcomes', which focuses on what the solution may achieve (Figure 19). This is highly related to aspects that enhance societal resilience and is therefore incorporated into the information structure of the catalogue of solutions.

One of the descriptive subcategories is **long description**. This subcategory provides, as the name implies, details on the solution collected during in-depth characterization – its nature, use and overall aims.

Another subcategory is **coping actions** (see Annex B, table 17), which are actions intended to adapt to a crisis for overcoming its adverse effects. The guiding theoretical assumption of the preliminary model developed in WP1 for assessing societal resilience is that both coping actions of citizens and the relief action of formal disaster management take place in a larger social context. Thus, by identifying coping actions it will also be possible to identify relevant elements of the particular social context. WP1 has underlined the need to distinguish between the degree of formalization and the degree of organization in time of the coping actions. An example of a coping action could be transportation of victims from the location of an accident to an ad hoc emergency center.

The third and last subcategory is **added benefits**. By this category we seek to highlight whether there are any additional benefits other than the overall aim and purpose of the solution. Such added benefits are identified based on collected in-depth data material through for example interviews with interviewees that have first-hand experiences of using a specific solution. In turn, this information is analyzed by researchers in ENGAGE. Information within this subcategory can also be taken one step further and consider whether the in-depth data material include identified or potential societal impact.
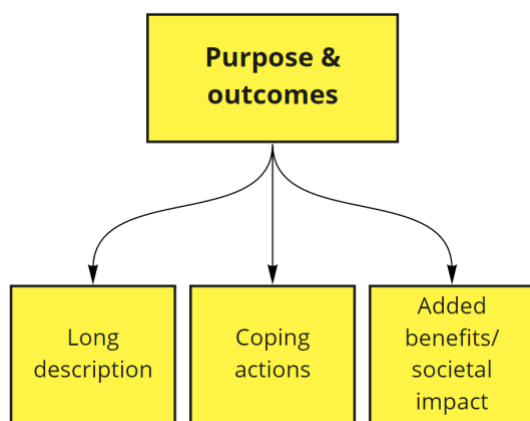
Figure 19 Purpose and outcomes with sub-categories

3.2.3 LESSONS LEARNED

'Lessons learned' is a category where we pay special attention to specific cases where the solution has been used in practice (Figure 20). In other words, we will here describe in-depth different applications of solutions to address the highlighted importance of addressing different cases. By having a case-specific category – and not only generic categories for the solution as a whole – we solve the issue of how to present detailed information about a specific case where the solution has been used, in addition to more general information about the solution overall.

Considering the ENGAGE focus on the informal resilience inherent in citizens, it is important for the catalogue of solutions to consider the needs and expectations of the population. Solutions, and

their implementation, can be a departure point for assessing societal resilience and for explaining and predicting resilience and readiness, regardless of the nationality of target populations. An internet-based panel survey in WP1 shows that when zooming in on each society, differences can be found in attitudinal factors associated with resilience. The study shows that the social context of different societies may involve differences in risk perceptions. Therefore, instead of trying a global approach to resilience promotion, a regional-based approach is needed to adapt and adjust to local context, both within each country and between countries. The information structure of the catalogue should therefore be able to reflect such regional variance, by focusing on cases; this in addition to the geographical localization of the solution that is a part of basic information (see 3.2.1).

The first subcategory is **evaluation from cases**. As described in subsection 3.1.2, findings from the KI-CoP workshop included that it is essential to include evaluations from specific cases of the solution, and that the impact and outcome of applying the solution is presented. If available, information about validation of the solution will be added. This category will include a short description of the relevant context in which they were implemented, such as description of the geographical area, and number of inhabitants. Furthermore, both workshops with end-users and the KI-CoP respectively, highlighted the importance of knowing the status of the solution in question. More specifically, it is perceived as crucial and relevant for users to understand the validity and/or applicability of the solution in question. Thus, in addition to the maturity category under basic information, the evaluation from cases can provide additional information.

Furthermore, there are two more sub-categories, **challenges**, and **requirements** from cases. As highlighted in the KI-CoP workshop, aspects such as resource intensiveness, cost and effectiveness will be presented for both these subcategories, while the prerequisites for the solution to work well will be included in the sub-category requirements. The information in these sub-categories will also be presented with relevant contextual information.

In addition, should there be a specific solution that is included in the ENGAGE validation activities performed as part of WP4, we will include a short excerpt of the results under lessons learned, along with a link to the ENGAGE Knowledge Platform with more information about the validation activities.
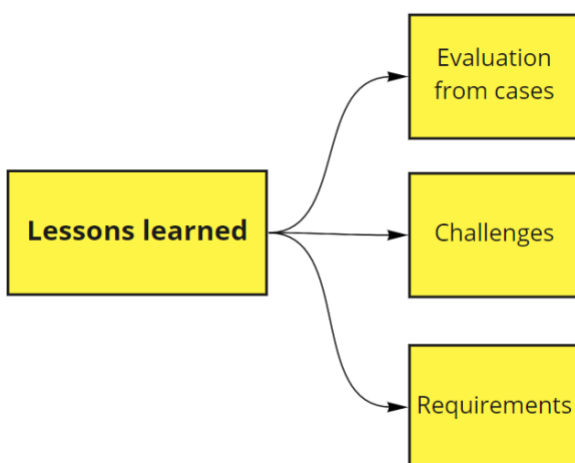
Figure 20 Lessons learned with sub-categories

3.2.4 GUIDELINES

An important part of the catalogue of solutions, as defined by the DoA, is to develop and include guidelines for the implementation of solutions. These guidelines should integrate target and contextual aspects, and dynamics that may contribute to societal resilience. In other words, the

contextual particularities of a solution should be acknowledged and considered before a solution is adapted and implemented in other contexts. Thus, the last main category 'Guidelines' is included, which draws on the lessons learned from different cases of each solution (see Figure 21).

Based on the study of historical case studies, WP1 developed a preliminary model for assessing societal resilience, including methods for enhancing societal resilience. The aim of the model is to provide a toolset to show how a certain number of conditions enable citizens to overcome crises depending on the specific social context in which they take place.

WP1 identified seven main groups of contextual aspects from the historical case studies: spatial and temporal proximity, social bonds and group membership, trust and mistrust in formal disaster management, level of alert and preparedness, gendered roles and identities in crisis situations, material conditions and socio-economic status and cultural conditions, values, and bonds. Inspired by this finding, WP4 formed a list of contextual and target aspects (see Annex B, table 18). When characterizing solutions based on collected data, we can use this list to identify relevant important factors for implementation and use. In WP4, there has been a distinction of the aspects that may be considered contextual aspects and/or target aspects. However, when characterizing the solutions, this distinction will not be made (see Chapter 5 for a further discussion). Note that the list is of preliminary and can be extended based on findings from the in-depth characterization of solutions.

Because the preliminary model in WP1 is on a higher level of analysis, it has been necessary to operationalize the categories of contextual and target aspects, that address the focus on specific solutions for the catalogue. Although the preliminary model developed in WP1 will still be of value when analyzing the larger picture, operationalization is important for the data collection and content creation for each selected solution. Contextual aspects have therefore been operationalized into two categories, namely, (1) **important factors for implementation** and (2) **important factors for use**. The former addresses relevant factors of the context when considering implementing a solution. The latter concerns considerations on factors of the context that influences how the solution functions when in operation. Moreover, descriptions on whether such solution could easily be transferred to other context are provided (**degree of transferability**), as well as how easily it could be modified (**degree of modifiability**).

As mentioned in Chapter 2, these categories necessitate a high degree of analytical involvement as to delineate the information needed from the collected raw data. Thus, producing this kind of information depends on access to empirics through document studies and interviews, and an analysis of this by a research partner. These four intertwined aspects resonate with the modelling of contextual and target aspects in WP1 and are also subject to further work. Further discussion regarding contextual and target aspects, and their relation to solutions and societal resilience is provided in section 5.1.
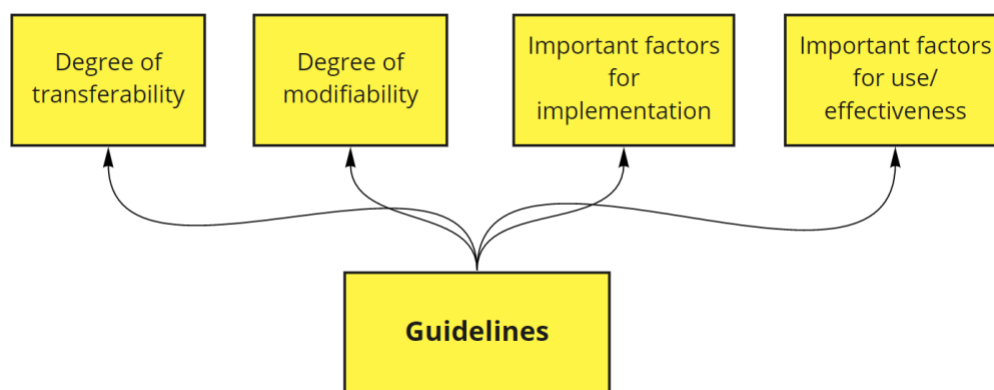
Figure 21 Guidelines with sub-categories

3.2.5 Record Management

The last main category is 'Record management' (Figure 22). The information provided here is both for internal and external purposes. Regarding the former, it is a way to track latest changes and whom to contact if there are any questions. Accordingly, we have the subcategories of **status**, **author(s)**, and **reviewer(s)**. These are part of an internal quality assurance, where status include different steps of the work from "to do" and in "progress", to "review" and "ready for publishing (see full list in Annex B, table 21). Moreover, as part of the quality control, all solutions will be reviewed by someone else in ENGAGE, other than the author(s). For external purposes, **last revision date** will be visible for each solution in the final catalogue so that users of the catalogue can see when the information was last updated.
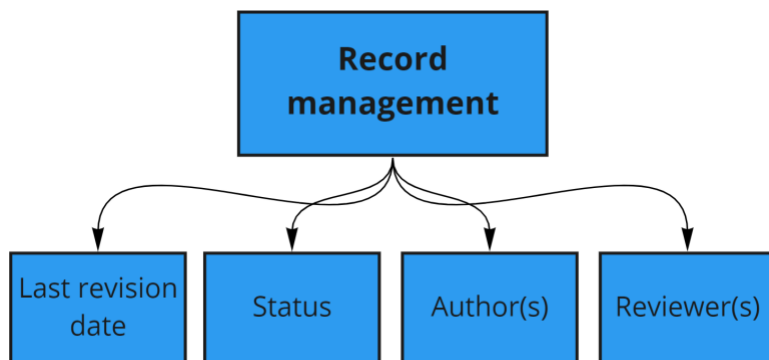
Figure 22 Record management with sub-categories

3.3 Creating the initial catalogue content

The creation of content for the catalogue is closely connected to the work of developing the structure. Thus, the workshops with end-users and the KI-CoP for example also provided valuable input to the process of creating catalogue content. In addition, steps directly related to developing the content were taken.

There were two important phases in this work, (a) compiling solutions identified in WP2 and discussing selection criteria, and (b) selecting four solutions and pilot the characterization process. In the following, these phases are described accordingly, before results from the pilots are highlighted.

3.3.1 Compiling solutions and selection criteria

An important step in creating content for the initial catalogue was to compile and synthesize the identified solutions in WP2 into a common structure. The solutions identified in WP2 were acquired through seven sources: (i) a systematic literature review, (ii) review of European projects and international reports, (iii) review of existing case studies, (iv) an Internet-based survey sent to end-users, (v) information gathered at an end-user workshop, (vi) information gathered at a KI-CoP workshop, and lastly, (vii) semi-structured interviews with first responders, NGOs and authorities in seven countries (France, Israel, Italy, Norway, Romania, Spain, and Sweden).

Initially, the raw data files based on these seven sources were compiled in one joint excel sheet to streamline and align the collected information. Naturally, the raw data files varied with regards to the type of information for each solution. For example, the information gathered through interviews provided more an overview of existing solutions with a basic description of the solution. While the information gathered through the different workshops also included ideas and discussions on what could have been a solution. Therefore, all solutions identified were structured

within the same columns and given a new compiled data ID. Having streamlined the information from the seven sources, the excel sheet was imported into AirTable (see section 2.3.1 above).

First proposition of criteria – Project-wide consortium brainstorming

Considering the broad list of potential solutions identified and collected in WP2, the next important step was to discuss selection criteria for the solutions that should be characterized in-depth. A first draft of main dimensions of potential selection criteria was developed, as a basis for brainstorming in consortium meeting (see Table 7).

The main idea was that a solution for this phase of the project is regarded as promising if it is (1) documented rich information and/or ease of access to rich documentation/data, (2) accessible to other actors and contexts, (3) corresponds to needs of authorities and first responders, and/or (4) have demonstrated positive outcomes. We aimed at choosing 2-5 selection criteria.

Table 7 First draft dimensions of potential selection criteria

Selection criteria dimensions	
Pragmatic	High level of detailed information available in present data
	Assumed ease of access to rich information
Extent of use	Technology Readiness Level, from ideas to implemented and validated – level of maturity
Assumed applicability for phases of crisis management	Planning
	Preparation
	Acute
	Recovery
Holistic vs. specific	That we should cover heterogenous solutions (in total)
	That we should go in-depth on selected areas
Relations with societal resilience	Explicitly or implicitly relates to contextual and target aspects
	Socioeconomic
	Addressing the needs of authorities (WP2 findings)
	Addressing the needs of the population (WP1 findings)
	Addressing the gaps between needs of authorities and population
	Addressing interests of the KI-CoP and/or end-users
Which end-users could benefit from/apply the solution	Municipal, regional, national, or international level
	NGOs

Based on the consortium brainstorming session on the proposed dimensions, three selection criteria were highlighted, as seen in table 8.

Table 8 Key results from brainstorming session with the consortium

Selection of solutions criteria
The most important elements as selection criteria were regarded as:

3) Maturity of the solution (i.e., not considering only proposed or informal solutions)

4) Applicability to other contexts (a priori judgment)

5) Availability of documentation

An additional point stems from the bottom-up perspective in ENGAGE. In the abovementioned cross-sectional study in WP1, trust was highlighted as a central component. Moreover, the findings showed that some of the surveyed societies reported little trust in governments and varied trust toward emergency services, health services, and other stakeholders relevant for disasters and emergencies. Although societies are culturally different when it comes to the level of generalized trust, trust can be fostered through appropriate risk communication initiatives that value transparency, accuracy, simplicity, and timing. Since trust is a major component in societal resilience and is even found in this study to serve as a predictor of societal resilience, promising solutions are also those that take existing or non-existing trust relations into account.

3.3.2 PILOT OF IN-DEPTH CHARACTERIZATION OF SOLUTIONS

While WP2 will continue searching for other promising solutions and continue to collect basic information for current solutions in the catalogue, WP3 focuses on the in-depth characterization of a selection of these solutions. In the process of creating content for the catalogue, we have created several templates for different purposes. First, we have a basic information template (presented in Annex F), which can be sent to end-user so that they can fill out information about their own solutions, as well as guiding the continued data collection in WP2. Most of the subcategories under basic information have lists which will be used to categorize the different solutions (see Annex A and B for a complete overview). Second, we have an interview template that will be used by partners, translated into the first language in question (e.g., if the interview is conducted in Spain with Spanish interviewee, it will be natural to translate the template into Spanish first). This template is to ensure that we strive to collect the same information across countries (see Annex E). Lastly, we have an in-depth characterization template that will guide the in-depth data collection and compilation in WP3, before it is uploaded into AirTable (Annex G).

To ensure that the templates and data collection process work as intended, we have piloted the process of in-depth characterization of four solutions. In the following, we will describe the selection of these four solutions and the experiences of the pilot.

Selection of solutions for pilot

For the initial catalogue of solutions, a limited set of solutions were selected for in-depth characterization to ensure a closely matched approach with the validation work. It was also important to pilot the process of collecting and analyzing empirical data on a few solutions, to ensure a well-functioning process and enable corrections before a larger number of solutions are selected and characterized in-depth.

The selection of a handful of solutions for the pilot of an in-depth characterization was based on initial criteria obtained in first consortium brainstorming. The criteria were (a) availability, (b) maturity, and (c) using the solutions of ENGAGE end-user partners. The latter criterion results from end-user meetings that concluded that a beneficial start of the validation and characterization was to start with ENGAGE partners. Accordingly, the selected solutions for piloting the in-depth characterization process were the VIZOV, the Ertzaintza APP, the Red Cross Preparedness Guard, and the Lazio advice – Heat wave app.

Method for characterizing

Having selected the four solutions, the next step was to begin the collection of data. There are different types of information (Figure 23), in which the different parts are obtained by various information types:

Types of information

Factual – based on provided information	Empirical – based on qualitative inquiry	Analytical – ENGAGE coding

Primary source   Documents   Interviews   Analysis
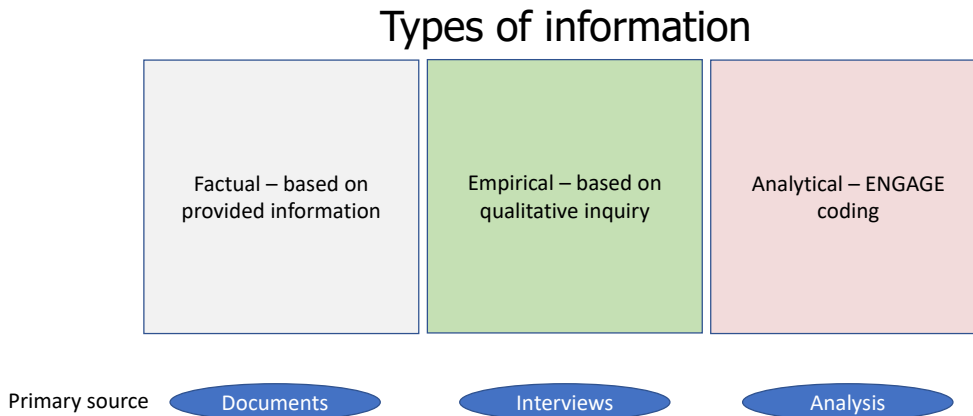
Figure 23 Types of information and their sources

Our main input was empirical information through qualitative interviews with end-user informants. Qualitative research interviews are appropriate when the aim is to gain in-depth understanding of concepts, opinions, and experiences (Kvale & Brinkman 2009) and useful when the aim is to explore and understand contextual conditions of the phenomenon under study (Yin 2009). Therefore, semi-structured interviews were conducted to gain insights on the solutions selected for further inquiry.

Respondents were selected strategically and purposefully (Flyvbjerg 2006) based on their knowledge of the solution. The prepared template represents a general script (Kvale & Brinkman 2009) and gives a thematic structure to the interviews. However, semi-structured interviews employ a mix of structure and flexibility in the situation and allows respondents to elaborate on specific topics or add topics that they find relevant.

Although it will be too ambitious to collect information systematically from all stakeholders involved in a specific solution, we aim, as far as possible, to have these three perspectives covered when contacting potential interviewees: (i) the developers, who can describe or document what the solution is expected to achieve and how it is planned to be used, (ii) the implementers, those who have used the solution in a case, possibly made adaptions, and (iii) those impacted by the solution, authorities/emergency organizations, citizens, who can describe how the solution is working in practice for them. In the piloting, we interviewed primarily the developers and the implementers.

Before the interview, the informants were given appropriate and exhaustive information about data protection, privacy, and ethical aspects in accordance with applicable governing documents and procedures in ENGAGE.

3.3.3 EVALUATION AND FUTURE WORK BASED ON PILOTS OF IN-DEPTH CHARACTERIZATION

General experiences from the test interviews

First experiences with the interview template proved its flexibility in capturing detailed data from solution providers without losing its capacity to adapt to very different contexts. The template enabled the interviewer to understand not only the concrete application context, but also the wider societal context in which solutions are deployed. Questions are formulated in a way that transcend

the language barrier in the sense that they were understood without further context by interview partners.

Interviewing citizens

During the piloting, different types of end-user informants were interviewed. However, the analysis of data collected with the bottom-up approach of WP1 shows the importance of gathering the citizens perspective. For example, a cross sectional study based on internet panels provided data for identifying needs and expectations of citizens (for more information, see D1.2). For the initial catalogue, the findings clearly showed the importance of addressing citizen perspectives in the characterization of the solutions. Furthermore, the study showed the importance of identifying variances and commonalities between societies concerning preparedness, individual resilience, and risk perception. Data collection from citizens will thus be sought as part of the further in-depth characterization of solutions.

3.3.4 TRIGGERING QUESTIONS

The final catalogue of solutions will contain many solutions and a lot of information. It will therefore be necessary to help a user to navigate in the catalogue. Accordingly, we are working on creating pathways to guide a user to relevant solutions based on a few trigger questions. This is inspired by various guidelines, especially the EU project DARWIN, which created "triggering questions" as part of the DARWIN Resilience Management Guidelines[3] (see also Lay and Branlat, 2014, on the use of triggering questions). The aim of DARWIN was to capture the essence of issues users should think about or try to address, as well as help users adopt a resilience-oriented perspective with these triggering questions (DARWIN Resilience Management Guidelines, 2018, p. 11). For ENGAGE, the trigger questions we aim to develop have a different purpose, namely that of asking relevant questions so that a user of the catalogue may find relevant solutions for his/her situation to enhance interaction between authorities/first responders and the civilian population.

One example of how triggering questions may be implemented in the catalogue could be to use the abstracted list of needs of first responders. This gives us a total of five overarching needs from first responders and authorities, which will correspond to a presented path into specific areas of the catalogue. The triggering question could thus be presented as

"I would like to …

- … communicate with or alarm citizens"
- ... organize & coordinate volunteers"
- … improve autonomy and proactiveness of citizens"
- … improve preparedness level among citizens"
- … involve society in decision-making"

When developed, these trigger questions will be used to create pathways from the landing page of the catalogue solutions to different subsets of solutions.

3.4 INPUT TO THE DESIGN OF THE CATALOGUE

As mentioned, there is a close relationship between the work of developing the catalogue information structure and content, and the design of the Knowledge Platform. Accordingly, there is

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[3] The Darwin Resilience Management Guidelines (DRMG Book) are available at: https://h2020darwin.eu/wp-content/uploads/2018/08/DRMG_Book.pdf

an ongoing iterative process with inputs between the work done in WP3 and WP5. See D5.5 for more information about the design and layout of the catalogue and the ENGAGE knowledge platform.

The approach for developing the design of the catalogue was based on several methods and means, including

» Using collaborative asynchronized platforms across partners

- Figma

- Miro

» Previous projects, such as the EU-project DARWIN

» Dedicated project meetings

» Joint use of end-user and KI-CoP workshops

» Contributions from partners on catalogue information structure

» User testing involving end-user partners

3.4.1 WORKSHOPS

The two workshops with end-users and the KI-CoP respectively were designed to provide input to the layout of the catalogue/user interface (see description of the workshops in section 3.1 above). Inputs regarding the design of the catalogue of solutions resulting from the workshops with end-users and KI-CoP, held in May and June 2021, accordingly, can be summarized as follows:

» End-user selection of solutions from the mini catalogue was primarily conducted by looking at the validation status of the solution in question

» Selection of solutions is primarily done by comparing an application with the decision-maker's domain and application area, as well as relating to the question of validation. For example, one solution was deemed not transferrable due to differences in contextual factors

» The decision-maker will want to make their own judgements of applicability, and should be given information to support the decision, not make the decision.

» The boundaries of citizen participation influence the choice of solutions. The more extreme an event is, and the more acute, the less citizen participation in the event itself is wanted. Nevertheless, the question of monitoring and having situational overview of volunteering is crucial

» The mini catalogue was structured with using broad statements from a subject first-person perspective. This was an attempt to simulate a flow into the catalogue based on needs of first responders and authorities. The feedback from the end-users was that the questions/statements was in line with a logical flow into the catalogue

» A challenge is to balance on the one side the in-depth information, with the con of having to read a lot of information, and on the other side having shallow, basic information, with the con of not showing important documentation

3.4.2 USER TESTING

In addition to the workshops, user testing that involved end-user partners to give feedback on the design of the catalogue was arranged. As part of this user testing, a WP5-led physical workshop with WP3 participation was conducted with one of the end-user partners in the project 21 and 22 September 2021.

Because WP3 is responsible for the catalogue content and structure, while WP5 is responsible for the design and visual layout of the catalogue and the knowledge platform, it is necessary to have a close dialogue. Therefore, a joint user testing provided an opportunity to discuss issues across the two WPs, as well as crucial input from an end-user standpoint – both in terms of content and design. Central issues that were debated, and which have implications for both WP3 and WP5, were among others whom we envision to be a target user, when to use the catalogue more specifically, search functionality, how to present information and in what format. These issues have been important to keep in mind when structuring the catalogue and considering the content creation (e.g., for whom are we creating content?). See D5.5 for further description of the user testing session.

4 GUIDELINES FOR CREATING CONTENT FOR THE CATALOGUE

So far, we have demonstrated the structure and content for the initial catalogue of solutions. The initial catalogue provides an – as the name implies – initial selection and documentation of the societal resilience solutions in ENGAGE. A broader characterization is foreseen to take place as the maturity of the approach and results of the project progresses. Therefore, an important objective and result of the initial efforts of task 3.1 was to develop processes for selection and characterization of solutions to pursue throughout the project.

The complete selection and characterization process of ENGAGE could be summarized in these steps as shown in Figure 24:
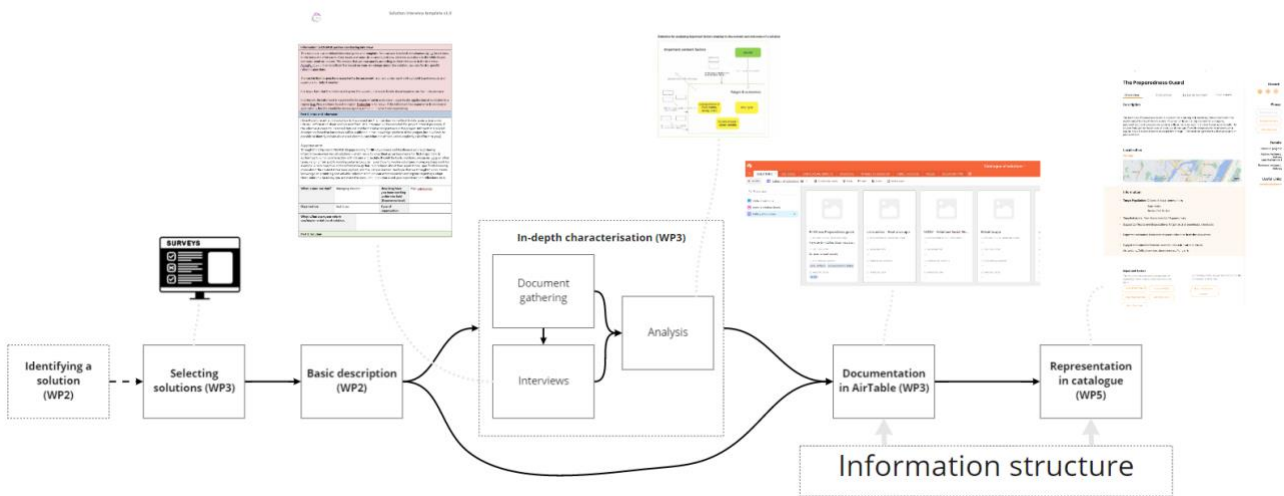
Figure 24 Complete selection and characterization process

In the following, the proposed steps are presented in more detail in three overarching processes, (1) selection & role allocation, (2) characterization, (3) documentation.

4.1 SELECTION AND ROLE ALLOCATION

This section consists of selecting between the full set of solutions, and when selected, allocating responsibilities and roles for the description and documentation (see Figure 25).
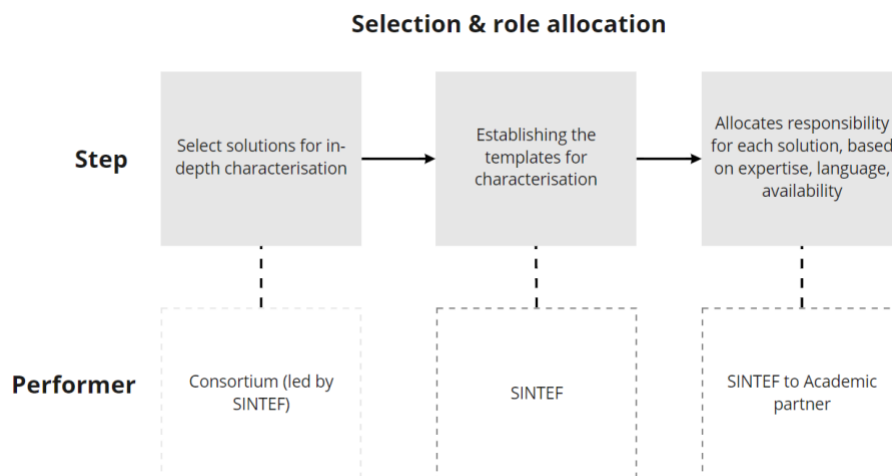
Figure 25 Steps in selection and role allocation

4.1.1 SELECTING BETWEEN THE FULL SET OF SOLUTIONS

The first step, considering that most solutions are already identified in past efforts of the project,[4] is to select between solutions to decide between (a) no further documentation, (b) basic description and representation in catalogue, (c) in-depth characterization and representation in catalogue. The gross list of solution is narrowed down to a net list of solution by following criteria:

6) is addressing a need from first responder or authorities (**yes**/no)

7) is of a high maturity (proposed – **planned** – **implemented**)

The selection of solutions for the catalogue is subsequently based on qualitative criteria, formed as questions (Q1-Q4 below), which will be subject to expert judgments considering the available knowledge on the solution:

Q1   Do you think this solution could be applied to other regions/contexts? (transferability and modifiability)

Q2   Do you think it will be possible to gather information regarding its use and outcomes? (availability)

Q3   Do you think this solution could have a high societal impact? (effectiveness)

Q4   It is difficult to answer the questions because of current lack of information – but I believe this solution is interesting (yes/no)

The criteria are applied to a simplified DELPHI-inspired process (see Figure 26) for selecting solutions. A Delphi method is a formal consensus method to lead to collective decisions where individuals select the 15-20 solutions, they would rate the highest. Considering Q4, the solutions with "yes" would be candidates for basic descriptions before a new round of consideration for in-depth characterization will be pursued.[2] The ranked list of solutions based on the aggregated selections are candidates for in-depth characterization. Note that these two categories might not be mutually exclusive; we could envision a solution that is without much information still is rated high by the consortium, it will then be subject to in-depth characterization.

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[4] During the progress of the work in the project new solutions are foreseen to be identified, both with regards to the work in WP2 and WP3. However, all partners are encouraged to suggest solutions through a defined process. If an ENGAGE partner discovers an interesting solution, an AirTable Form should be filled with Basic information of the solution. SINTEF and TECNUN will decide, based on initial understanding, whether the solution should be pursued further, and consult the project consortium and/or KI-CoP as deemed necessary, to choose between (a) no further documentation, (b) basic description and representation in catalogue, (c) in-depth characterisation and representation in catalogue.
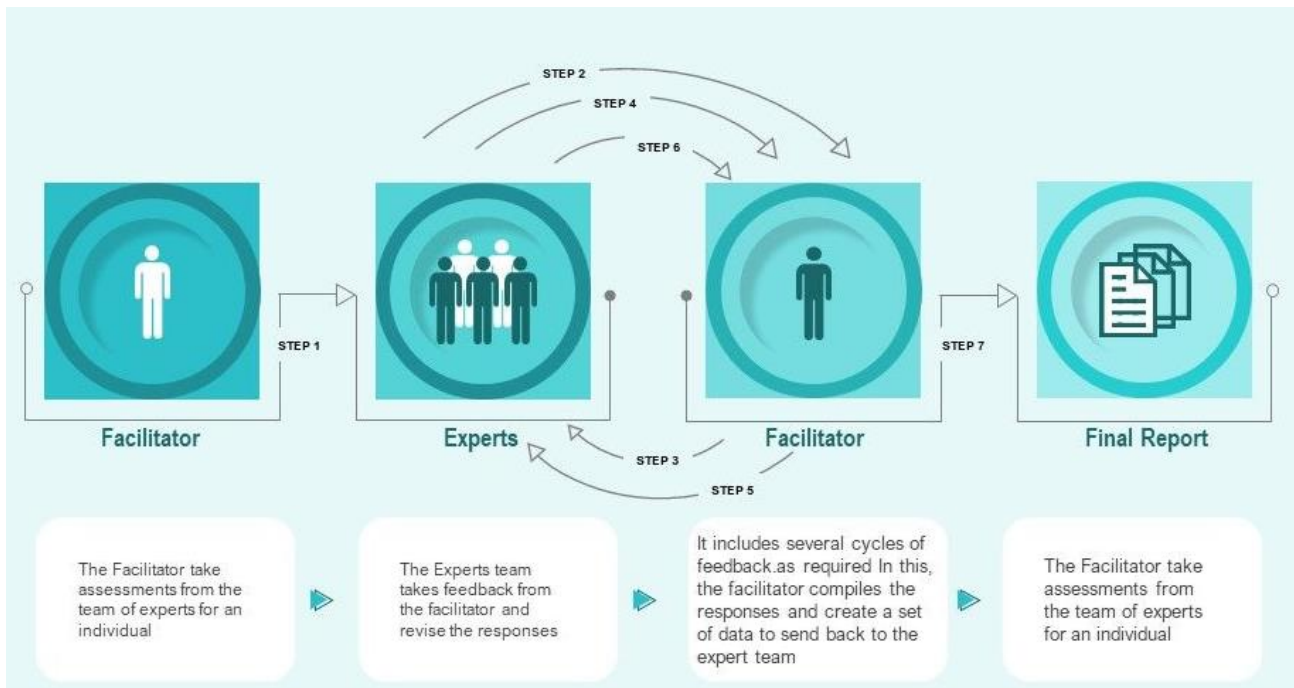
Figure 26 Illustration of a Delphi method (From https://www.slideteam.net/delphi-method-to-provide-final-report-based-on-responses.html)

To reach consensus, four cyclic steps form the DELPHI-process. The first step (i) is to agree on criteria and achieve a consensus towards these. This is done by a discussion consortium wide. Secondly (ii), a compiled, condensed, and simplified dataset is formed and sent to the whole consortium/End-user partners and/or the KI-CoP to survey individual feedback. Each participant is expected to select the 15-20 most promising solutions based on the criteria decided in step 1. Subsequently (iii), analysis of individual feedback will be carried out. The facilitator of the selection will aggregate all individual responses to show the descriptive statistics, including the mode and the variation. This will be sent to participants of the individual survey. The last step (iv) is concerned with discussions and converging to consensus. Considering that there will most certainly be some discrepancies in the rating, the gaps will be addressed and discussed among the participants, facilitated by the facilitator. If the discrepancy is very large, a new poll will be administered, and the process continues until satisfactory level of consensus. Lastly, (v) the final findings will be reported.

4.1.2 ROLE ALLOCATION

When the most promising solutions are ranked, in-depth characterization will commence with 5 solutions in bulk rounds. Decisions on advancing with subsequent rounds of characterization will be based on remaining resources, time, and validation of the catalogue. For each bulk of solutions, SINTEF establishes the set of developed templates to be used for the solution. Thereafter, an academic partner is given the responsibility of pursuing the characterization. The choice of partner is based on availability of the partner, the expertise, language alignment, and assumed ease of access to relevant data.

The responsibility for the selected solutions for basic descriptions is assigned to TECNUN. Solutions selected for basic descriptions are subject to information-gathering as part of the second cycle of the WP2 tasks.

4.2 IN-DEPTH CHARACTERIZATION PROCESS

When solutions are selected, the characterization of the solutions follows (see also Figure 27 for an overview). The academic partner responsible for the characterization initiates a data gathering with available documents. Then a template could be distributed to the relevant person or organization with experience or insight of the solution. Interviews will in most cases be necessary to obtain the rich descriptions for developing the lessons learned from the solution. Considering that the total amount of data and analysis might be gathered from different sources and with different methods, an analytical summary need to be done and documented in a template (see section 4.3).
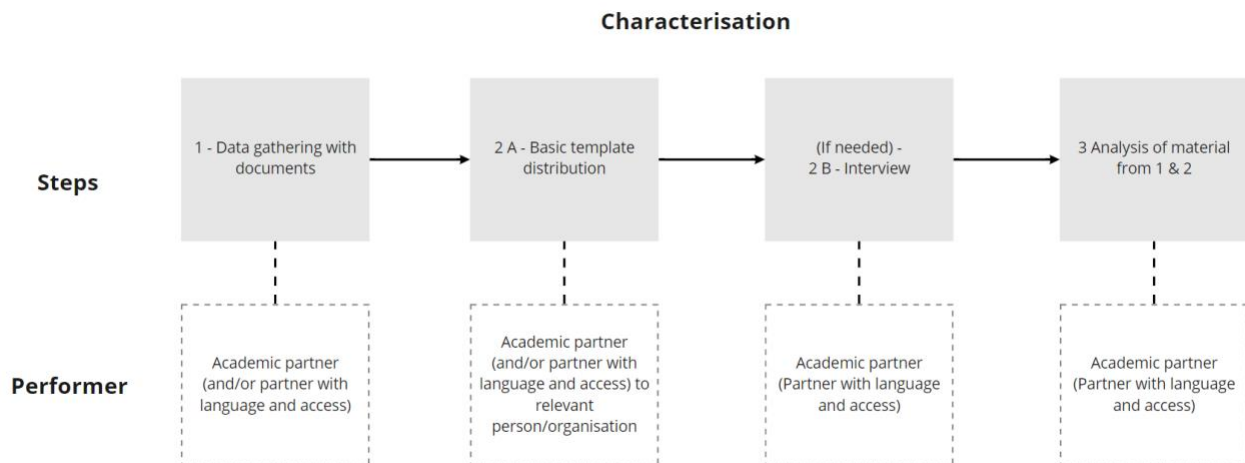
Figure 27 Steps in characterization

The main questions we want to ask when we are characterizing the solutions are:

» Basic information – what is the aim, name, and overall description of the solution?

» Purposes and outcomes – what can the solution achieve?

» Lessons learned – what have we learned from cases of the solution?

» Guidelines – what is important to consider when choosing to implement and use the solution?

Answers to the questions may need different methods and data depending on the solution and the information that is available. As previously mentioned, we should aim, as far as possible, to have these three perspectives covered: (1) the developers, who can describe or have documented what the solution is supposed to do, how it's supposed to be used; (2) the implementers, those who have used the solution in a use case, maybe made adaptations, (3) those impacted by the solution, authorities/emergency organizations, civilians - who can describe how the solution is working in practice for them. The sources of information for (1), (2), (3) are diverse and overlap. One method, for example interviews, might help us collect insights on the 3 perspectives, although depending on who you interview, it might be more cantered on one or the other. Considering this, the choice of method and approach between Step 1, 2a and 2b shown in Figure 21, and even other methods is important.

The analysis varies in the degree of analytical involvement of the researcher. One could distinguish between various levels of analysis, although with overlap. Basic descriptions of the solutions, for example name, require little or no analytical involvement, and could be gathered directly from solution providers or –users. Synthesizing and summary of reports require some analytical efforts, for example knowing the specific aims of the catalogue and the descriptions of relevant elements. Sources of information could describe these initially with a guidance (e.g., as in Step 2a). Lastly, what we have considered high analytical involvement, is analyzing context factors, modifiability,

and transferability, and analyzing raw data from informants regarding these elements. This will be carried out by a research partner.

Considering the high analytical involvement, this calls for an analytical framework. As a brief presentation, looking at Figure 28, the diagram shows the relations between the questions we are asking ourselves and the informants when considering the overall targets and aims of the solution, and how the implementation and effectiveness is influenced by the context of its use. Highlighting these aspects are crucial for achieving the contextual guidance of the catalogue. The context factors are not conceptually categorized into implementation or effectiveness, but rather seen as ways to organize our findings. For example, in the interview situation, we might ask "Consider your region where you have applied the solution. What characteristics of the population do you consider as important for how to use the solution?" and get the answer "in our region we had to take great care in defining the tool because we need to use more time to reach elderly". Inductively, we can then determine that age of population is an important context factor for the use of the solution.
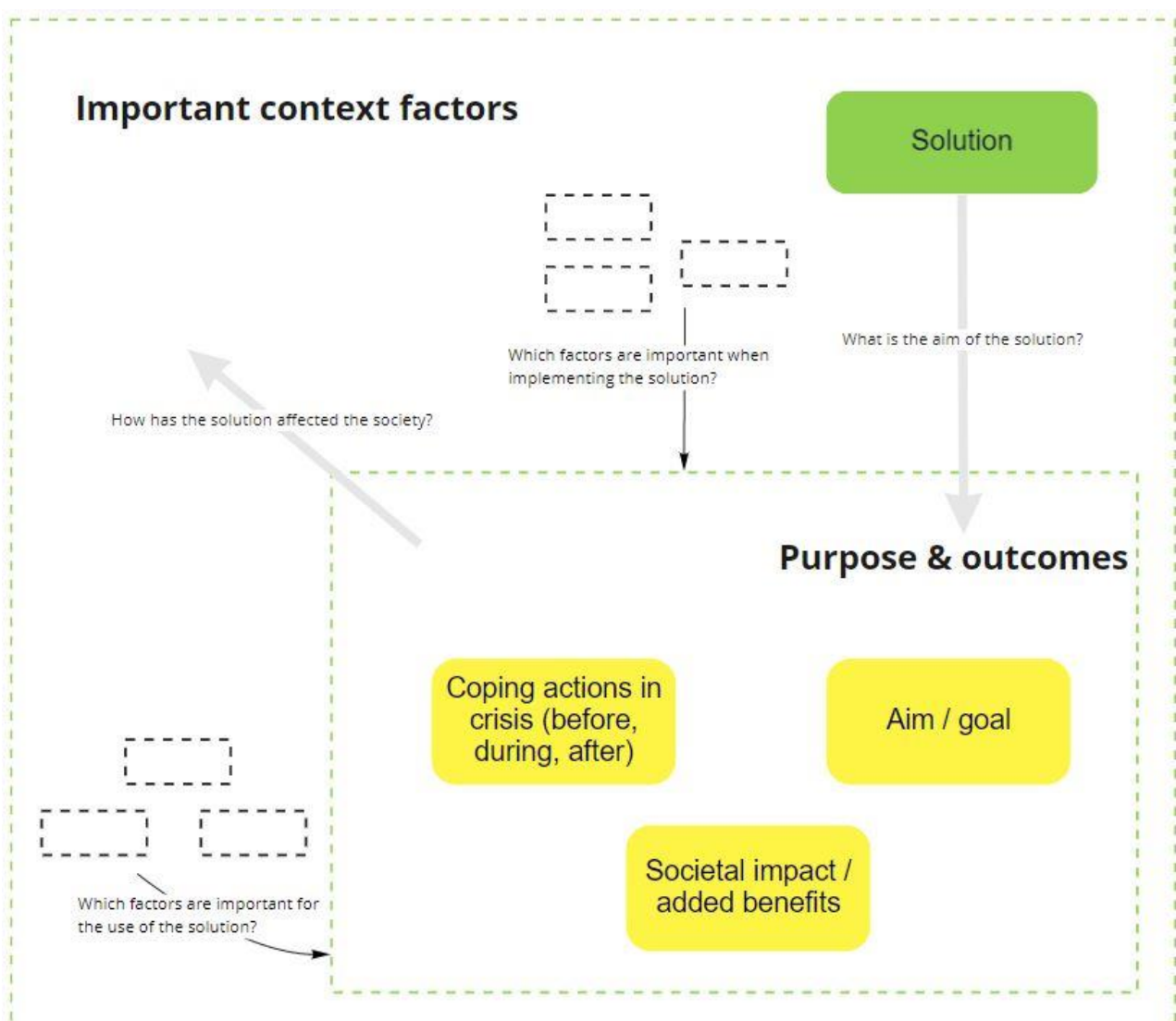
Figure 28 Analytical framework of in-depth characterization

4.3 DOCUMENTATION

Finally, the findings of the systematic characterization should be documented. It is advisable to not wait until the end, but rather progressively document the findings. See Figure 29 for an overview of this process.
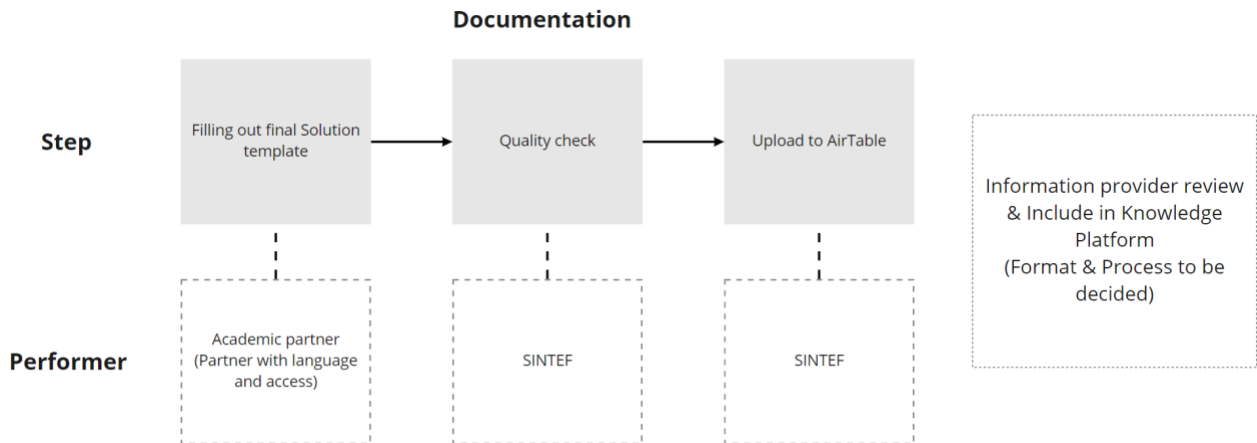
Figure 29 Steps in documentation

The responsible partner ultimately consolidates the input and analysis and fills out the Solution Template (see Annex G) ensuring data protection aspects. SINTEF will conduct a quality check including content validation as well as ensuring data protection compliance.

In the next step, the template is uploaded to the AirTable cloud environment by SINTEF.

Prior to representation in the catalogue of solutions, information providers should be allowed to give their final acceptance of the publishing.

5 MOVING AHEAD – DISCUSSIONS AND FURTHER WORK

To sum up, the overall aim of ENGAGE is to link informal resilience inherent in society with the formal efforts of authorities and first responders. We have developed an initial catalogue with the objective to summarize, highlight, and provide implementation guidance for solutions that could help key actors tapping into more of the potential of civil society. In this section, we will address some conceptual discussion points and then more concretely address matters of importance for the next steps of the project.

5.1 CONCEPTUAL DISCUSSIONS – TOWARDS UNDERSTANDING HOW SOLUTIONS CONTRIBUTE TO SOCIETAL RESILIENCE

For the initial catalogue, efforts have been made to investigate empirically a subset of solutions that are aiming for contributing to societal resilience, see section 2.5. Several discussions could be made to situate our findings and approach in a broader conceptual perspective. First, we will discuss the nature of solutions and the emphasis on increased interaction between societal groups, including, authorities, NGOs and the population. Then we will broaden our view on solutions, discussing its relation to the "context", and what context could mean when speaking of solutions. Lastly, discussions towards understanding the eclectic nature of societal resilience – and how solutions might contribute to resilience potentials follows. The discussions should be seen as initial points of departure for further inquiry and development.

5.1.1 ARE SOLUTIONS INCREASING INTERACTION WITH SOCIETY OR INCREASING SOCIETY'S AUTONOMY?

In the context of the ENGAGE project solutions are seen as a means for interaction. A relevant question in this regard is whether such solutions should only be focusing on enhancing the control and command enforced by formal organizations such as first responders. Indeed, on the one hand, the highest ranked first responders' need for the public's behavior was to ensure compliance and adhering to command from the formal authorities. On the other hand, one of the specific contextual aspects identified in the society-oriented case studies of WP1 is the autonomy of initiative and self-organizing from society. This was exemplified with the Utøya case, where several communities and NGOs acted quickly and contributed to successful rescue and aid.

This gap leads us to question whether a solution by default should be oriented towards increasing the top-down interaction, control, and command of formal authorities. The ENGAGE notion is that often, yes, it could be a concrete issue on increasing the interaction between the formal and informal actors. For example, how can we reach out to a minority group with important information that is solved by a 'solution' (e.g., manning of the police with minority contact person).

However, the approach is also more general and of an idealistic nature. There are resources that lie embedded in citizens that are not tapped into, or leveraged to their full potential, by first responders and/or authorities. This view allows for the premise that a 'solution' might in some cases not be directed to enhance the extent of interaction/top-down penetration of command or control. Rather, it could also be a 'solution' to enable first responders and authorities to foster the autonomy of the citizens. The aim would in these cases be to increase the publics capacity to deal with adversity as individuals or a social group. Moreover, this also allows the analysis of 'solutions' to be sensitive to a particular context/situation.

5.1.2 THE CONTEXT OF SOLUTIONS

A pivotal feature of the ENGAGE project is to sensitize solutions to a context, and thus acknowledging the situated and dynamic nature of resilience. Contextual and target aspects are operationalized in the catalogue in different ways. Contextual aspects are in the catalogue operationalized and popularized in the subcategories 'important factors for use/effectiveness' and 'important factors for implementation' of a solution. Target aspects are addressed through the main category 'purpose and outcome' such as 'description of solution', 'purpose' and 'coping skills'. These aspects are not directly described in the catalogue as these are theoretical and analytical concepts, and do not serve the practical purpose of the catalogue. However, in future work it will be decided how these aspects may be presented in the Knowledge Platform – and how this may be reflected more directly in the representation solutions in the catalogue.

While we have gathered empirical data and structured the information into the catalogue structure, the collected data can be analyzed further and on a higher level of analysis. For example, the contextual and target aspects can be understood as dimensions of the society that we assume relates to societal resilience – indirectly or directly. Contextual aspects are seen as conditions enabling individuals, social groups, or other groups of society to act before, during or after a crisis for coping with it. They refer both to a specific social context that is enacted during a crisis and to the structure of society. The idea is also that solutions for interaction primarily are oriented towards certain target aspects, while operating within a context – or contextual aspects (see Figure 30).
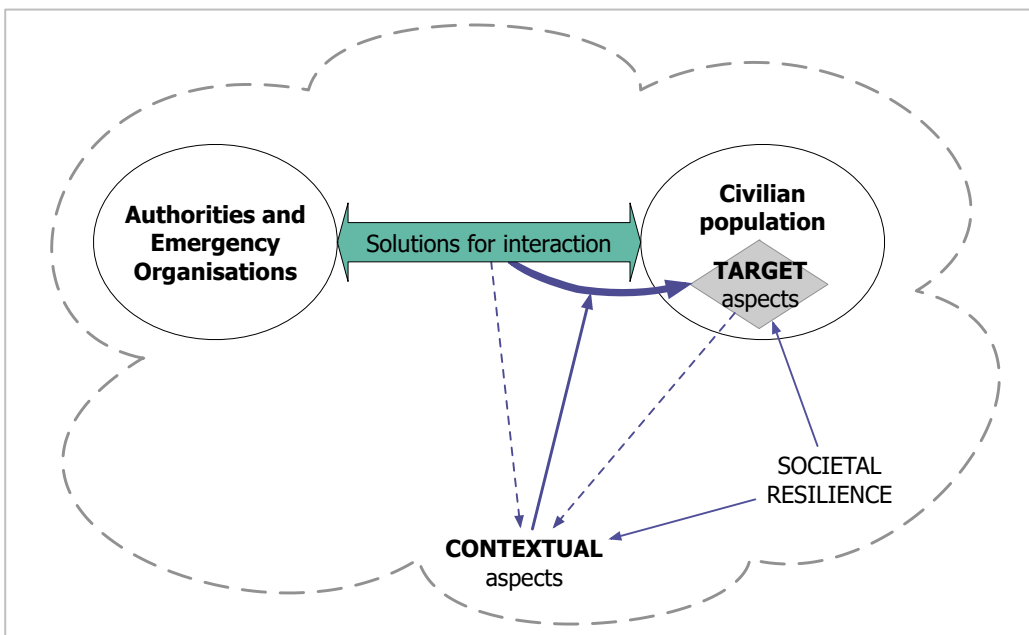
Figure 30 Initial model showing solutions' relation with contextual and target aspects

Whether the aspects are contextual or target in relation to societal resilience is determined by the presumed degree of modifiability for the context it is applied to. 'Trust in formal institutions' will be a contextual aspect for a given context (e.g., a crisis), but might be a target aspect in the case of a long-term preparation phase, targeted by (presumably) another solution.

Moreover, contextual and target aspects are not linear in their relationship with societal resilience – more is not always better. For instance, too much trust in that the police take care of the crisis intervention might hinder a relevant response from a citizen. Or that citizens do not give important information to the police, given that they may have better precondition for evaluating an action.

An example of a solution analyzed with regards to contextual and target aspects, is the Red Cross Preparedness guard system (see Figure 31). The analysis is based on the preliminary results of the in-depth analysis described in section 2.5. From the subcategory 'Long description' of the solution,

the Red Cross Preparedness Guard is described as a low-threshold activity that has been established primarily so that residents in their own municipality can contribute with simple and important tasks in their local environment if a serious incident occurs. In other words, it is a way of utilizing unused resources among persons not volunteering regularly.
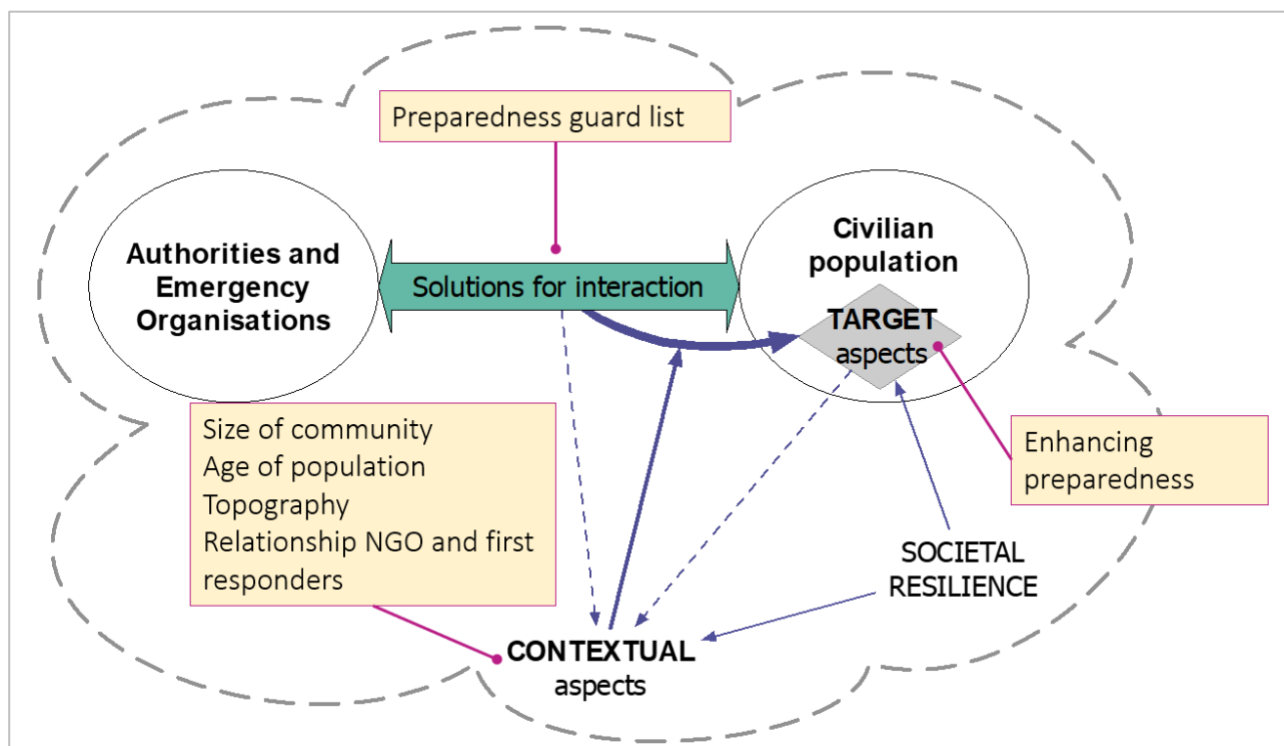
Figure 31 Example of a solution with contextual and target aspects

The example in figure 31 above shows how the Red Cross Preparedness Guard solution can relate to target and contextual aspects. Those features that may be considered contextual aspects are gathered from the subcategory 'Important factors for implementation', and the target aspect is found by an overall analysis of the main category 'Purpose and outcomes'. Table 18 in Annex B lists the different categories of important factors for implementation and use. These are the categories identified as contextual and target aspects thus far in the project. This list is also used for the analysis of target aspects. In the analysis, target aspects are found by identifying the factors that the solution may influence directly or indirectly.

In Figure 32, how the solutions operate through the target and contextual aspects is visualized. To achieve the outcomes, the solutions are expected to influence target aspects. The outcomes could be conceptualized as being resilience potentials, ultimately enable coping actions of the society in a crisis. The conceptual model in Figure 32 incorporates these aspects, moving from top to bottom.
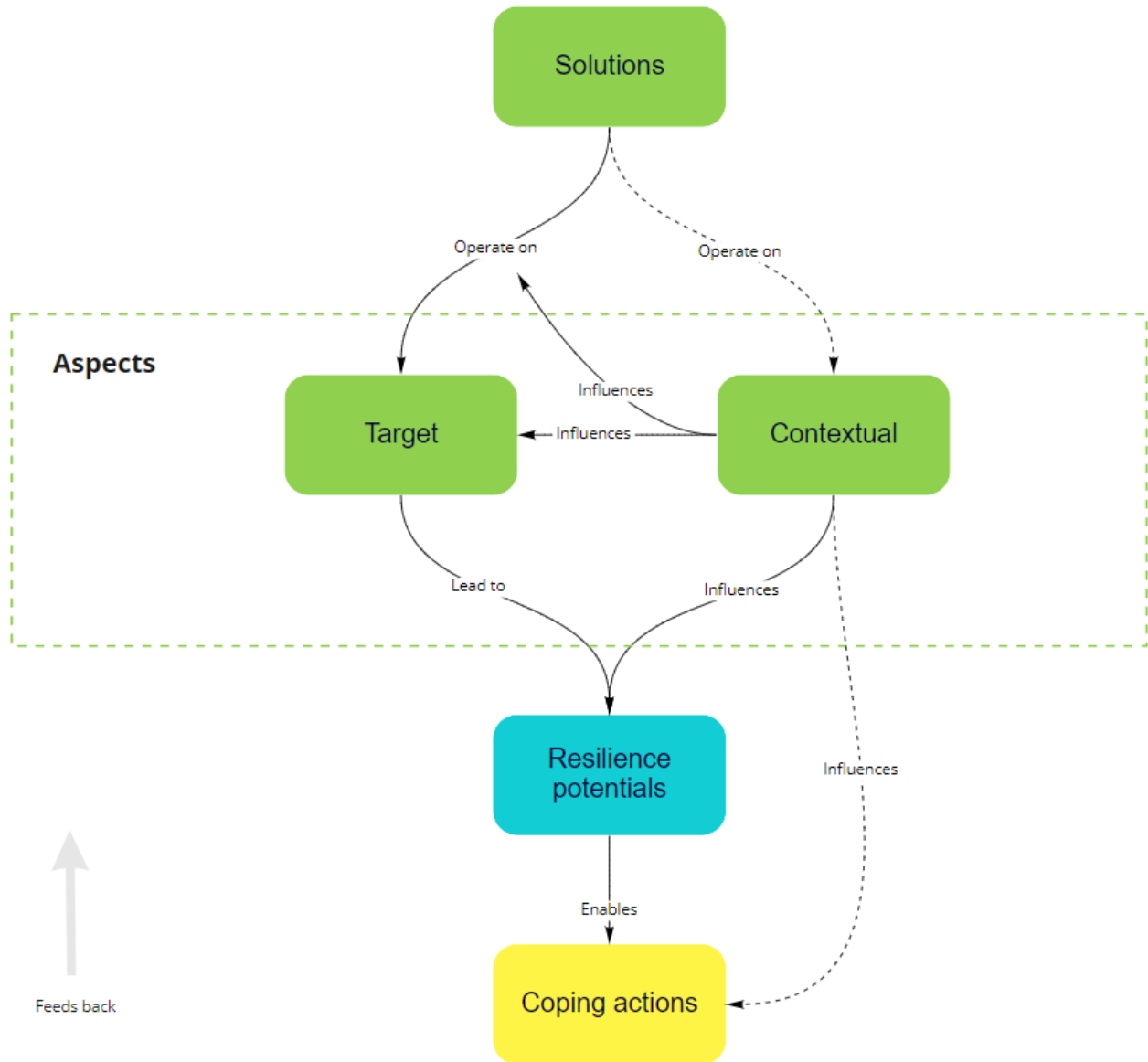
Figure 32 Concept model: Solutions and their path towards benefits and coping actions

Figure 33 exemplifies the model in Figure 32 with the results from the Preparedness Guard (PG). We see how this solution operates on the target aspect 'enhanced preparedness'. This target aspect is identified from the results in section 2.5. The results showed that the solution aims to facilitate local resource allocation during emergencies through having several volunteers that are easily reachable and prepared to contribute. PG also supports a wish to organize efforts in the local communities, and to enable competent volunteers to help in situations and to avoid potentially unwanted spontaneous volunteers. An added benefit from the PG is also that more citizens gained knowledge of first aid.

A contextual factor may be for example be 'size of community'. Different recruitment strategies are sought in large and smaller communities. In smaller communities, people are more often familiar with one another so capable volunteers may easily be assessed, whereas in larger communities a more thorough assessment process of volunteers is needed.

Another contextual aspect of Preparedness Guard is 'social bonds'. This aspect influences the target aspect (enhanced preparedness) through shaping/identifying the type of preparedness tasks that are needed. For example, elders that have strong social bonds and elders that are isolated will have different needs of support in an emergency. Another aspect of social bonds is that in some communities there might already exist networks of friends or neighbors with skills or

equipment that could be valuable for a given crisis. These networks may be utilized both for recruitment and during emergency. The target aspect 'enhanced preparedness' is thus influenced with regards to the efficiency of the solution. For example, a local community with strong social networks could be more easily reachable and willing to engage in the PG. Lastly, the social bonds could influence the actual use and leveraging of the solutions' **resilience potential**. The strong relations may enable successful coordination and compliance/willingness to participate in the actual crisis scenario.

The contextual aspect 'social bonds' thus may both influence the target aspect and may also have a direct influence on the resilience potential. These factors will together facilitate actual preparedness and ultimately influencing the way different actors can cope with a crisis.
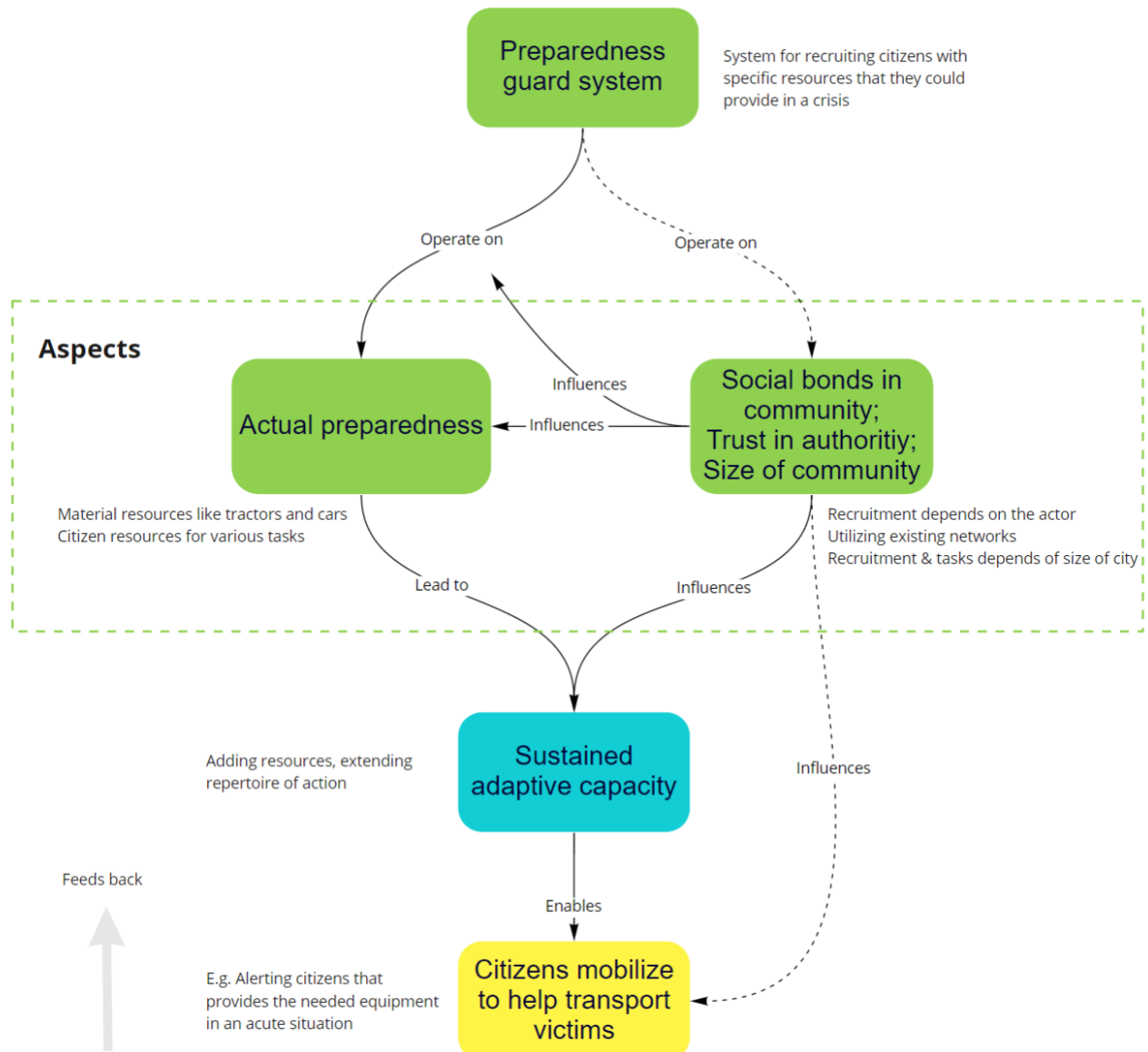
Figure 33 Example of a solution with related examples of aspects, resilience potentials and coping actions

5.1.3 SOCIETAL RESILIENCE POTENTIALS

The conceptual discussion in the preceding section introduced the term 'resilience potential', which needs some elaboration and discussion. From the outset, an ambition of characterizing resilience in a unified matter is challenging. The term and concept of **resilience** has proliferated in recent years, conveying a multitude of meanings, premises, and underlying rationales, and is extending in

scope. Already in 2008, Roe and Schulman (2008) asked: "at this rate, what isn't resilience?". This is a challenge not at least for **societal resilience**, which also may be conceived as an aggregate of "resilience" at other, more demarcated, and tangible levels.

We argue therefore that it makes sense to approach societal resilience with a perspective comprising different approaches to the resilience concept. Furthermore, the aim is to use this perspective to analyze how solutions might contribute to resilience, without purporting to classify the solution in a strict scientific sense.

Accordingly, societal resilience emerges in the nexus between a diversity of more narrow **resilience potentials**, with different objectives and productive factors. The different potentials may be overlapping, be indifferent to each other, and they may be interrelated in a contested or dialectical manner. Therefore, as a collection, they are eclectic rather than coherent in a strict scientific manner. This is not considered a problem related to the pragmatic purpose of using the term to illustrate a potential contribution from a solution in the catalogue of solutions. In other words, rather than pursuing a unified and specific perspective on the concept of societal resilience, we conceptualize how solutions might enable a diversity of potentials for societal resilience.

What the **solutions** all have in common is that they are all limited to representing a resilience potential which cannot be realized without proper **contextualization** (thereby referring to "contextual factors" of the solution). However, for some of the potentials, even when contextualized, resilience will by definition be limited to a potential, not a promise. That is, as an emergent rather than an automatically resultant property of the solutions presented in the catalogue. Furthermore, the potential contributions to societal resilience from citizens are intertwined with potential contributions from many other and diverse sources, underlining the importance of contextualizing the solutions. The overall effect stems from interactions, not from alignment. We could further divide the potential in to three specific resilience objectives in the context of implementing solutions:

»   Enhanced preparedness, in which the locus is a risk/crisis management process (Stavland and Bruvoll 2019)

»   Sustained adaptive capacity, in which the locus is a complex sociotechnical system (of systems) (Woods 2019; Grøtan, Antonsen and Haavik 2021)

»   Collective survival and growth, in which the locus is a community with inherent bonds despite diversity, rather than conformity (Weick and Sutcliffe, 2007)

Again, using the example of the Red Cross Preparedness Guard, Table 9 shows how analysis of the resilience potential could be made to exemplify the various elements that it could achieve:

Table 9 Example of an analysis of resilience potential of a solution (Red Cross Preparedness Guard)

Preliminary analysis of resilience potentials of the solution Red Cross Preparedness Guard
Related to Enhanced Preparedness (risk/crisis management process) »   validation of risk assessments from a stakeholder perspective »   resources for emergency preparedness and recovery »   identification of possible saturation/exhaustion the escapes the attention of the "curve"
Related to Sustained Adaptive Capacity (complex sociotechnical system) »   Identifying couplings and spill-over effects »   Identifying outdated models »   Observe and report saturation, cascade effects etc.

» Add resources, extend repertoire of action
» Report on successful adaptations
Related to Collective survival and growth (social community)
» Help calibrate needs and expectations
» Help explain limits and prioritizations to maintain trust
» Facilitate and amplify (calibrated) reciprocity
» Intervene towards unjust/ badly calibrated "performance standards"

As we gain experience from the future characterization of (numerous) solutions as they are applied across contexts, and the revised modelling on societal resilience from the work in T1.4, further analysis and conceptual development could be pursued. It can then further sensitize the understanding of the varied potential of societal resilience related to solutions identified in ENGAGE, and to substantiate such claims through scientific underpinnings.

5.2 ISSUES AND FURTHER WORK TOWARDS THE FINAL CATALOGUE

The work conducted thus far is part of the task 3.1. For the next period, the focus on the catalogue of solutions will heavily rely on the content creation as per guidelines and concepts developed and documented in the present deliverable. Task 3.3 starts after initial validation efforts of ENGAGE and will therefore begin with a revision of the suggested approach. The final catalogue will then be documented in D3.3. The present result is, as the name implies, an initial catalogue. Implicitly this reflects an idea of developing the shell for a final innovation, and thus have inherent limits.

First, few solutions have been in-depth characterized. The focus has been oriented towards piloting the process of in-depth description and analysis of the applications of solutions, rather than mass-producing content – risking ending up with all the effort spent in the wrong direction. Considering the integration role within the task, it has been a challenge to consolidate the approaches of the project especially considering COVID-19 implications on the collaborative work. Thus, there are uncertainties regarding the alignment of conceptual apparatus. Further, obtaining sufficient sustainability of the catalogue that transcends the project's timeline is integral for its societal impact. The work has been started through identifying potential ideas for maintenance, system updates and further content creation that transcends ENGAGE project, for example through the KI-CoP. Inspiration and experience from the DARWIN Wiki (https://h2020darwin.eu/tag/wiki/) are used to form these ideas.

Further work towards the final catalogue (D3.3) thus encompasses, although not limited to, enhancing the basic information level & pursuing in-depth descriptions of several solutions, further maturing of a common conceptual apparatus and approach for the project, and validating the approach and content. In the following, specific areas of attention are listed.

» **Developing new content – populating the catalogue**. A major piece of further work is to develop content along the lines of the guidelines provided in Chapter 4 to provide substantial content to the final catalogue.

» **Changing the information structure**. When embarking on content creation in a larger scale, and learning from validation, the need for changing the information structure of the catalogue might arise. Two specific challenges could be foreseen: (1) When new levels of a category (e.g. a new solution type) arises from the empirical data, it would be beneficial to revise already classified solutions according to the changed typology. This could lead to high workloads especially if new information is needed on the already characterized solutions, and potentially

exhausting information providers. A mitigating action is to aim for only one round of revisions, after validation efforts of WP4. (2) Intermediate levels of abstraction might be required to define classes of solutions at a finer grain than the current large categories, to allow especially for comparisons across situations. A mitigating action for the workload is to avoid data reduction in the databases. When more rich/raw data is still available, the data may more easily be reclassified.

» **Conceptual development**. Results of the in-depth characterization should support the epistemic objectives of ENGAGE. Analysis of the broad solution characterizations should be made across the gathered data. Its implications for WP1, WP3 and WP4 should be investigated especially. What can we learn from all the lessons learned from applications of the solutions? This work will also include the analysis of contextual and target aspects, and considerations of how these analytical aspects should be presented in the Knowledge Platform, e.g., in the form of "info-pages". Conceptual development of the framework related to societal resilience to situate solutions within this context.

» **Triggering questions**. The work on developing appropriate questions for guiding the user of the catalogue in the knowledge platform should be pursued through collaboration with WP5 and using end-user testing.

» **Analyze gaps in needs**. Further analyze the potential gaps between society and first responders & authorities needs and expectations of each other. To gather information about this, data collection with citizens in relation to the in-depth characterization of solutions will be pursued. Communication aspects as undertaken for T1.4 will also be assessed, and necessary changes to the catalogue of solutions will be made.

» **Achieving sustainability of the catalogue**. The catalogue will not be successful without continuous updating and validation. The Knowledge Platform will be maintained for 3 years after the end of the ENGAGE Project. Addressing the sustainability at the end of the project is crucial for societal impact. This will be done through consortium-wide brainstorming and, importantly, seeking the commitment and interest from the KI-CoP.

» **Analyzing gender and diversity aspects**. As the characterization of solutions across contexts is amplified, analyses should be made, to understand the implications of, and effect on gender and diversity, as joint efforts with WP1 empirical findings and conceptual modelling.

» **Innovative & informal solutions**. In the initial catalogue, more mature, promising solutions are selected, based on our findings from end-user workshops and the criteria developed in this regard. The potential for providing less mature - more innovative & informal solutions, such as the AI Chatbot blueprint developed in D3.2, should be considered as part of the catalogue and/or the Knowledge Platform. However, the approach of ENGAGE enables contextual adaptations of solutions. This could be considered innovative in and of itself, for example when one organization combines existing solutions with additions from other solutions.

In addition to these points, there are aspects of the work in WP3 that are closely related to the work in other work packages of ENGAGE:

» **Consolidation of terms (across work packages).** The project should focus on establishing common understanding of concepts and terms, to align our approaches. Attempts to align concepts are done through various activities of WP3. The challenge is further addressed through ongoing and planned processes in the project to align the project's common approach to terminology and conceptual understandings.

» **Align future developments with the Knowledge Platform (WP5).** Iteratively develop the catalogue's information structure and design in close collaboration with WP5 and the development & programming timeline for launch in 2022.

» **Validation of the approach (WP4).** Some specific areas would be important to see from a validation perspective (WP4). The procedure and analytical frameworks, elements and structure should be revised after especially validation efforts:

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- General design and approach of the catalogue in helping a decision-maker

- The filtering mechanisms based on needs, smart searches

- Solution type taxonomy

- The way the catalogue provides contextual guidance.

» **Dissemination of the catalogue (WP5).** The catalogue of solutions should be carefully disseminated and marketed through multiple channels. A key enabler in this regard is the KI-CoP that would facilitate dissemination through their multidisciplinary and international impact. Conferences like the annual EENA conference and other seminars through the DRS cluster are important channels of dissemination. Providing booklets of the catalogue or other communication material should be considered.

6 REFERENCES

DARWIN Resilience Management Guidelines (2018). DARWIN Resilience Management Guidelines (DRMG Book). DARWIN, Horizon 2020, the European Union's Framework Programme for Research and Innovation under grant agreement no. 653289. https://h2020darwin.eu/wp-content/uploads/2018/08/DRMG_Book.pdf

Flyvbjerg, B. (2006). "Five Misunderstandings About Case-Study Research" in Qualitative Inquiry Volume 12 Number 2 pp. 219-245

Grøtan T.O., Antonsen S. and T. K. Haavik (2021) Cyber Resilience: A Pre-Understanding for an Abductive Research Agenda. In Matos, F. & al (eds) Contributions to Management Science: Resilience in a Digital Age. ISBN 2021 978-3-030-85953-4. Springer Nature. (In press)

Kensing, et al. (1998). MUST: A method for participatory design. Human-computer interaction, 13(2), 167-198.

Kvale, S. & S. Brinkmann (2009). Interviews. Learning the craft of qualitative research interviewing. 2nd edition. Thousand Oaks, California: Sage

Lay, E., & Branlat, M. (2014). Noticing Brittleness, Designing for Resilience. In C. P. Nemeth & E. Hollnagel (Eds.), Resilience Engineering in Practice: the Road to Resilience. Farnham, UK: Ashgate.

Roe, E. and P. Schulman (2008). High Reliability Management. Operating on the Edge. Stanford University Press.

Stavland, B. and J.A. Bruvoll (2019). Forsvarets Forskningsinstitutt (FFI: Norwegian Defence Research Establishment). In Norwegian: Resiliens – hva er det og hvordan kan det integreres i risikostyring? [Resilience – what is it and how can it be integrated in risk management?] FFI rapport 19/00363. 2019. https://publications.ffi.no/nb/item/asset/dspace:6458/19-00363.pdf

Visov (n.d.). Webpage. http://www.visov.org/virtual-operations-support-teams/

Yin, R.K. (2009). Case study research: design and methods. Thousand Oaks, California: Sage

Weick, K.E. and K. Sutcliffe (2007). Managing the Unexpected. Resilient Performance in an Age of Uncertainty. Second Edition. Jossey-Bass, Wiley.

Woods, D. D. (2019) Essentials of resilience revisited. In Handbook on resilience of socio-technical systems. Ruth, M. and S. Goessling-Reisemann (eds). Edward Elgar Publishing. 2019 DOI: https://doi.org/10.4337/9781786439376.
https://www.researchgate.net/publication/330116587_4_Essentials_of_resilience_revisited

The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020/2014-2020) under grant agreement n° 882850.

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ANNEX A: OVERVIEW OF CHARACTERISTICS IN AIRTABLE

Table 10 lists the **main categories**, the **subcategories/characterizations**, the **type of information** for each category, **source of subcategory** and **source of content**. These have all been described in detail for each category and subcategory in Section 3.2. Parts of the characterization of solutions are based on predefined lists, as indicated in the column for **type of information,** and these are listed in Annex B. Figure 32 describe the first three aspects of Table 10.

Table 10 Overview of characteristics in AirTable with categories, type of information and sources

| Key elements	Subcategory/ Characterization in AirTable	Type of information	Source of subcategory	Source of content
Basic information	Solution name	Open text	WP2	WP2
	Short description	Open text	WP2	WP2, related to long description
	Solution type	Defined list (Annex C, table 11)	WP2	WP2
	Purpose	Defined list (Annex C, table 16)	WP2	WP2
	Needs of first responders	Defined list (Annex C, table 23)	WP2, WP3	WP2
	Year of launch	Year	WP2	WP2
	Maturity level	Defined list (Annex C, table 15)	WP3	WP2
	Target end-user	Defined list (Annex C, table 12)	WP2, WP3, end-user WS	WP2
	Target population	Defined list (Annex C, table 12)	WP2, WP3, end-user WS	WP2
	Phases of disaster management	Defined list (Annex C, table 13)	WP2	WP2
	Applicable disasters/ hazards	Defined list (Annex C, table 14)	WP2, WP3	WP2
	Geographical location	Open text	WP1	WP2
	Links to more information	URL	WP2	WP2
Purpose & outcomes	Long description	Open text	WP3,	WP3, related to short description
	Coping actions	Defined list (Annex C, table 17)	WP1	WP3
	Added benefits	Open text	WP2, WP3, WP4	WP3
Lessons learned	Evaluation from cases	Open text for each case	WP3, end-user WS, KI-CoP WS	WP3
	Challenges	Open text for each case	WP3	WP3
	Requirements	Open text for each case	WP3, KI-CoP WS	WP3
Guidelines	Important factors for implementation	Defined list (Annex C, table 18)	WP1, WP3, WP4 KI-CoP WS	WP3
	Description of important factors for implementation	Open text	WP3, KI-CoP WS	WP3
	Important factors for use	Defined list (Annex C, table 18)	WP1, WP3, WP4 KI-CoP workshop	WP3
	Description of important factors for use	Open text	WP3, KI-CoP WS	WP3
	Degree of transferability	Defined list (Annex C, table 19)	WP3	WP3
	Description of degree of transferability	Open text	WP3	WP3
	Degree of modifiability	Defined list (Annex C, table 20)	WP3	WP3
	Description of degree of modifiability	Open text	WP3	WP3
Record management	Last revision date	Date	WP3	WP3
	Status	Defined list (Annex C, table 21)	WP3	WP3
	Author(s)	Name	WP3	WP3
	Reviewer(s)	Name	WP3	WP3
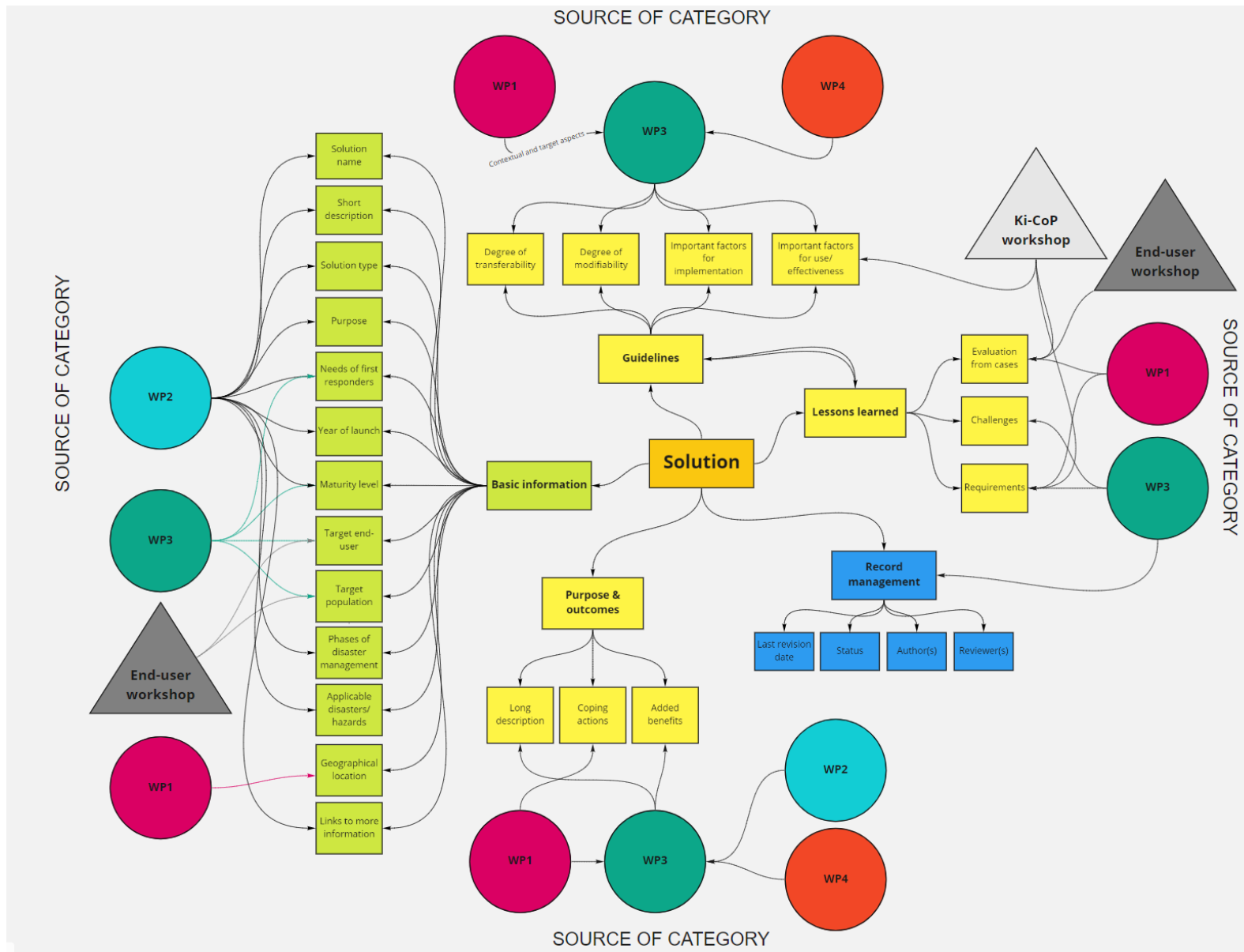
Figure 34 Overview of sources of categories for the catalogue information structure

ANNEX B: DEFINED LIST FOR CHARACTERIZATION

Annex B contains the initial lists that will be used for characterizing the solutions and demonstrates the different aspects that have been deemed relevant and important for solutions, as described in Ch 3. New aspects may be added to each list when new solutions are characterized. See also Table 10, in Annex A.

Table 11 Solution types

Solution types
Web platforms
Guidelines
Media
Services to reach society
Plans and strategies
Collaboration methods/technologies
Incentives
Apps
Frameworks
Community of practice
Awareness and training campaigns
Call centers
Alert systems

Table 12 Target population and target end-user

Targeted population and target end-user
Citizens
Citizens group at risk
Volunteers in general
Volunteers with special capabilities
NGOs
First responders
Authorities

Table 13 Phases of disaster management

Phases of disaster management
Before
Immediately before
During
After

Table 14 Applicable disasters/hazards

Applicable disasters/hazards
Extreme weather
Nature related events
Social disruption
Critical services dependencies
Pandemic
Generic

Table 15 Maturity level

Maturity level
Implemented
Planned
Proposed

Table 16 Purpose

Purpose
Improve communication with society.
Enhance society's risk awareness
Facilitate resources allocation from and to society
Improve information and knowledge sharing with the society
Enhance society's preparedness to deal with crisis
Promote social networks
Improving the society's health and mental outlook
Empower society in governance and leadership activities.
Improve society's involvement in dealing with crisis

Table 17 Coping actions

Coping actions
Transport of people, material, equipment
Collecting clothes, foods, and other vital resources
Directing traffic
Providing food
Organizing alarming of other citizens and acting as guard
Psychosocial aid
Operating evacuation centers
Information sharing to citizens (Relative hotline)
Simple search and rescue
Monitoring and keeping under surveillance citizens at risk
Self-reporting
Health care assistance

Table 18 Important factors for implementation and use

Important factors for implementation and use
Socioeconomic status
Religiosity
Family status
Communality
Social bonds
Spatial and temporal proximity
Informality and crisis management
Level of alert and preparedness
Material conditions
Gender
Cultural conditions
Risk awareness
Threat perception
Perception of responsibility
Perception of response
Coping skills
Level of trust
Sense of preparedness
Actual preparedness
Beliefs
Age of population
Access to training
Digital literacy

Table 19 Degree of transferability

Degree of transferability
High
Medium
Low

Table 20 Degree of modifiability

Degree of modifiability
High
Medium
Low

Table 21 Status

Status
To do
In progress
Ready for review
Review completed – change needed
Review completed – no change needed
Ready for publishing

Table 22 Needs of first responders and authorities

Needs of first responders and authorities
Communicate with or alarm citizens
Organize & coordinate volunteers
Improve autonomy and proactiveness of citizens
Improve preparedness level among citizens
Involve society in decision-making

Table 23 Needs of first responders and authorities from WP2, and adaption in WP3

Needs of first responders & authorities from WP2	Catalogue version in WP3
1. Act under the instructions and rules of the authorities and emergency services and follow their recommendations,	Communicate with or alarm citizens
2. Limit their activities to the ones they could do and do not put themselves at risk,	Communicate with or alarm citizens
3. Civilians play a crucial role in post-disaster activities such as relief and recovery activities, restoring ordinary life and adapting to the new conditions,	Organize & coordinate volunteers
4. Self-organize themselves and provide assistance to each other,	Improve autonomy and proactiveness of citizens
5. Civil society should not expect that emergency responders and authorities will solve all their problems; they should learn how to solve problems independently and be proactive in self-protection, and self-adaption to the situation,	Improve autonomy and proactiveness of citizens
6. Provide primary needs to both emergency services and evacuees such as shelter, warm clothes, food, water, etc. Also, help in logistical aid,	Organize & coordinate volunteers
7. Join volunteering organizations to better coordinate and manage all their effort,	Organize & coordinate volunteers
8. Provide information and facilitate the process of information gathering about the disaster situation through official communication channels,	Communicate with or alarm citizens
9. Civil society should know about the emergency plans and how to find updated information,	Communicate with or alarm citizens
10. Civilians should share credible information as soon as possible,	Communicate with or alarm citizens
11. Alert the emergency services when a disaster occurs,	Communicate with or alarm citizens
12. Provide emergency organizations and authorities with local knowledge about the event and the involved people,	Communicate with or alarm citizens
13. Be well prepared before the crises, having essential resources, knowing how to act in each case, etc.	Improve preparedness level among citizens
14. Be calm during the crises and try to continue life as usual	Improve preparedness level among citizens
15. Help to restore ordinary life: how business should be adapted, how schools should be adapted, etc.	Organize & coordinate volunteers
16. Be part of the strategical decision-making processes to feel the co-responsibility of the taken actions.	Involve society in decision-making
17. Have social solidarity	Improve autonomy and proactiveness of citizens
18. Sign cooperation agreements with civil society and businesses to facilitate the availability of resources,	Organize & coordinate volunteers

ANNEX C: SOLUTIONS IN AIRTABLE

Annex C shows an excerpt of the solutions as they appear in AirTable. The list contains examples of the solutions that have been identified in WP2, and shows how open descriptions ("Description solution (long)") and lists ("Solution type") are used in AirTable, see also Annex A and B.

	A Solution name	Ab Description of solution (long)	☰ SOLUTION TYPE
1	Red Cross Preparedness guard	The Red Cross Preparedness Guard is …	Service to reach society
2	Utilizing stakeholder-driven approach to define the indicators to assess the …	This solution proposes utilizing a stak…	Collaborative methods to w
3	Involving local actors to take part in the disaster resilience planning	This solution allows local actors in rur…	Collaborative methods to w
4	Participatory modeling for improving risk awareness			Collaborative methods to w
5	Structured interview Matrix (SIM) technique to improve risk awareness and p…	SIM is an effective technique to enha…	Collaborative methods to w
6	A participatory and transformative method for building community resilienc…	Participatory and transformative meth…	Collaborative methods to w
7	Community based groups to design and plan the community resilience actio…	This solution suggest applying comm…	Community of Practice
8	Timebank: each person provide its time for response and recovery activities	This solution helps in providing an alr…	Community of Practice
9	Volunteered geographic information (VGI)	VGI is the harnessing of tools to creat…	Community of Practice
10	A VCoP for practitioners and volunteers	This solution proposes a VCOP where …	Community of Practice
11	A crowdsourcing methodology with the help of social media to gather infor…	A crowdsourcing methodology with t…	Crowdsourcing
12	Virtual modeling for preparing to emergencies	This solution provides a virtual space …	Framework
13	The Communities Advancing Resilience Toolkit (CART)	This toolkit engages community repre…	Framework
14	The NFIP's community rating system (CRS) program	Community Rating System (CRS) is a v…	Governmental program
15	Web app to access to get information about past events and current resilien…	This web-app solution allows citizens …	Web app
16	Operationalising Psychosocial Support in Crisis (OPSIC project) (actions for …	The solution represents a practical gui…	Guidelines
17	Operationalising Psychosocial Support in Crisis (OPSIC project) (volunteers p…	The solution provides key principles t…	Guidelines
18	Operationalising Psychosocial Support in Crisis (OPSIC project) (social media…	The solution identifies aspects to be c…	Guidelines
19	Operationalising Psychosocial Support in Crisis (OPSIC project) (emergency …	This solution provides guidelines on …	Guidelines
20	Smart Mature Resilience (SMR project)	The European Resilience Managemen…	Guidelines
21	Placard Interchange	A solution to raise awareness to clima…	Guidelines
22	National Institute of Standards and Technology	A solution that involves a community-…	Guidelines
23	UK government	The solution provides guidelines to th…	Guidelines
24	Collective Conviction: the story of Disaster Action	The book explains how to manage ps…	Book
25	DRIVER+ (Driving Innovation in Crisis Management for European Resilience)	The Center of Expertise is a communit…	Community of Practice
26	DRIVER+ (Driving Innovation in Crisis Management for European Resilience)	CMINE, Crisis management Innovatio…	Community of Practice
27	UNDRR (United Nations Office for Disaster Risk Reduction)	The Hyogo Framework for Action 200…	Framework
28	UNDRR (United Nations Office for Disaster Risk Reduction)	Making Cities Resilient 2030 program …	Framework
29	CARISMAND project - Culture and Risk Management in Man-made and natu…	Carismand Cultural Map provides a cu…	Framework
30	European commission	ECHO and DIPECHO Programme is a s…	Funding program
31	DRIVER+ (Driving Innovation in Crisis Management for European Resilience)	The DRIVER+ project offers a reposito…	Portfolio of solutions
32	ANYWHERE project: innovating the management of weather emergencies	This project provides self preparednes…	Tool
33	An app for flood management	A mobile app that shows users in Jap…	Mobile app
34	A platform for crisis management based on social networks and person to p…	This solution aims at information shar…	Web platform

Figure 35 Extract from the AirTable database, used for storing of content for the catalogue of solutions

ANNEX D: MINI CATALOGUE END-USER WORKSHOP

Annex D gives more information about the solutions that were provided as a basis for discussion for the end-user workshop 25 May 2021, as described in section 3.1.1.

Table 24 Mini catalogue of solutions provided for the end-user workshop scenario

Solutions to apply before the event

Apps

»   "City connect"

»   Municipalities use this app to distribute information for the public according to the specific area in which they reside, and they allow them to distribute also information bottom-up.

»   DSU app

»   It is accessed by more than 1 million people and contains useful information on risk prevention and management.

»   My112, AlertaCops, 112SOSDeiak

»   for the population to communicate with the emergency services

Social media

»   Accounts on Facebook, Tiktok, Twitter, Instagram and Youtube

Awareness campaigns

»   Campaigns to inform people how to deal with the COVID and related restrictions. These campaigns are developed in neighbors, schools, retired people, etc.

Volunteers

»   "The community emergency and resilience team" - in rural municipalities and includes volunteers from the community that help in facilitating crises and helping to make the community ready for the disaster before it – and after.

»   Volunteers from passion - a program that aims to increase resilience at the community level by training paramedics

Solutions to apply during the event

Alert system

»   "Text messages"

»   Warn the population through text messages. This could be based on their location or to the whole population.

App

»   "Epidemiological diary"

»   For the public to list all the people they see daily, so if they do not feel well, they can notify them before making the corona test. To make sure that they will not meet other people before they let them know whether they are positive or not.

»   BeReady Caravan

»   A portal that is constantly updated with various guides related to different types of risk – it has been used quite a lot during the pandemic as it reports a series of guides on how to behave

during the pandemic based on particular scenarios

»

Call centers

» "Covid Call center"

» for information and questions regarding the Corona virus. It provides information and instructions to people, such as when to quarantine themselves, what to do if they have symptoms. The call center made phone "triage."

» Information hotline

» This line is not for emergencies, but for information. This is also very effective because it reduces the number of non-emergencies calls for the emergency line

Media

» Press conferences, newspapers and TV, webinar about COVID

Volunteers

» "Corona loyals"

» EMS trained what they defined as "corona loyalists", who oversaw mediating the information for community members.

» "Community patrols"

» Community patrols formed from volunteers to help the police

ANNEX E: INTERVIEW TEMPLATE

Information to ENGAGE partner conducting interview
This template is a combined interview guide and template. You can use it as both simultaneously, or insert data in the template afterwards. Grey boxes are more structured questions, whereas questions in the white boxes are more semi-structured. This means that you can modify according to their relevance in the interview. Actually, it would be beneficial that based on your knowledge about the solution, you add/revise specific relevant questions. The **text in bold is questions expected to be answered,** and text underneath without bold is guidewords and questions for help if needed. It is important that the informant is given the opportunity speak freely about experiences from the case. In principle the informant is expected to be experienced in a *case* – a particular application of a solution in a region (e.g., Preparedness Guard in region Trøndelag in Norway). If the informant has experience from several applications, he/she should be encouraged to reflect on his/her total experience.

Part 0: Intro and informant
[Give the informant an introduction to the project and the interview incl. ethical & data aspects & provide ENGAGE information sheet and consent form. The interview will be recorded for project internal purposes, if the informant consents. Personal data will not be shared across partners in the project. Inform that analyzed descriptions based on interviews will be published in the knowledge platform of the project, but it will not be possible to identify individuals or used direct quotes/citations of text, unless explicitly asked for it to you.] *Suggested intro:* Through the EU-project ENGAGE (Engage Society for Risk Awareness and Resilience) we are gathering information on what we call *solutions* – which could be described as various means for first responders & authorities to enhance interaction with citizens and society. It could be tools, methods, processes, apps or other types, ranging from public warning systems to guidelines on how to involve volunteers in preparedness work for example. A core objective in this information gathering is to learn about their applications, specifically knowing more about the context it has been applied, and the lessons learned. We hope that we through this can create knowledge on promising and valuable solutions that can lead other countries and regions to perhaps adopt these solutions. So today, you are invited to speak about solution X and your experience and reflections on it.

What is your position?		How long have you been working within the field (Experience level)	
Organization		Type of organization	

What is/has been your role in use/implementation of solution:	

Part 1: Solution

Tell us a little bit of [the solution]: - What does it do? - What targets/aims has the solution?	
Did you select the solution among others? - Take it from the start and tell us how and why - Did you select between others, if so, what were the criteria? - Why did you choose/develop this solution? - Where did you find it?	

Part 2: Implementation experiences – lessons learned

Could you tell us a bit on the implementation process and what you learned through it?	
What were the challenges? - If so, how did you accommodate them? - If you were to implement it again – what would you do differently?	
Has the solution been changed based on lessons learned from use? If so, how?	

Part 3: Context of use

Could you please tell us a little bit of your organization and the role it plays in your society? How do you think this influences the outcome of [the solution]?	
Could you tell us a little bit about the area/region/culture that you are operating within, aspects that are relevant for the use of such tool? (Guide words): Typical aspects: size of city/area, sociodemographic – age / gender / minority / etc, Topography, Digital literacy, Social bonds & networks, resources/material, Religiousity, Risk awareness, Trust, General Preparedness level, Risk level etc. Another way of asking: Consider a region with [context factor x, e.g., high religiousity, large city] how would the solution work, why?	
Which of these aspects of the context would you regard as most important for HOW [THE SOLUTION] WORKS?	
One of the ideas of the project is to provide recommendations for use of solutions in other countries and context. Do you have any remarks on what would be especially important to consider for this solution?	
Part 4: Outcomes of the application of the solution	

Has the solution been evaluated? What were the benefits of applying it? … in terms of cost … in terms of influence on risk or preparedness … in terms of achieving the aims … How *should* it be evaluated?	
How, if possible, to define resource intensive is the solution, in terms of cost and personnel needed?	
Has the solution been used in a crisis? What was the outcome? …. before, during, after? … what actions of citizens did it facilitate?	

Part 5: Close the interview

Is there anything you would like to add? **Thank you very much for your time! Can we contact you again if we would like more information?**	

Part 6: Analysis (for the researchers to fill in)

On the *solution* itself answer these parameters briefly.

Degree of *transferability* to another contexts:

Degree of *modifiability* of the solution:

Relevant contextual & target aspects (from list below):

Additional/new contextual & Target aspects:

Coping actions relevant:

Other comments and notes:

| Created by: | *<name/Partner>* | Date: | *<date>* |

List of contextual aspects
- Socioeconomic status
- Religiosity
- Family status
- Communality
- Social bonds
- Spatial and temporal proximity
- Informality and crisis management
- Level of alert and preparedness
- Material conditions
- Gender
- Cultural conditions
- Risk awareness
- Threat perception
- Perception of responsibility
- Perception of response
- Coping skills
- Level of trust
- Sense of preparedness
- Actual preparedness
- Beliefs

ANNEX F: SOLUTIONS BASIC INFORMATION TEMPLATE

Information to ENGAGE partner
This template seeks to gather information from end-users or providers of a solution.

Solution name	

Basic information of the solution	
Solution description (Short) (Max 100 words)	
Solution type (e.g., web platforms; guidelines; media; services to reach society; plans and strategies; collaboration methods/technologies; incentives; apps; frameworks; community of practice; awareness and training campaigns; call centers; alert systems)	
Target population There may be different subcategories here: - Is there a group of volunteers to be engaged/targeted? - Is there a group of people at risk during crisis that the solutions aim to help? - Other?	
Target end-user Who is initiating/implementing/ organizing the solution?	
Expected benefits/Overall aim/goal of the solution What are the expected outcomes/benefits (e.g., Improve communication; Enhance Risk awareness;	

Facilitate resource allocation; Improve knowledge and information sharing; Enhance preparedness; Capitalize social networks & relationships; Improve health and mental outlook; Empower society, governance, and leadership; Improve population trust towards authorities and emergency organizations; Improve society's involvement in dealing with crisis)	
Phases of disaster management (before; immediately before; during; after; all phases)	
Applicable disasters/hazards (e.g., extreme weather; nature related events; social disruption; critical services dependencies; pandemic)	
Geographical location Where has the solution been implemented by country and/or city if relevant (applications of the solution)	
Links to more information	

Created by:	<name/Partner>	Date:	<date>
Checked by:	<name/Partner>	Date:	<date>

ANNEX G: SOLUTION IN-DEPTH CHARACTERIZATION TEMPLATE

Information to ENGAGE partner
This template seeks to consolidate information on a solution based on various sources. Basic information about the solution has been collected and compiled in WP2 (i.e., short solution description, solution type, target population, target end-user, phases of disaster management, applicable disasters/hazards, geographical location, maturity level, year of launch, and links to more information). The template could be filled out by a partner, then seek the input from end-users or experts, and if there are gaps, interviews should be carried out. Send the template to SINTEF for check and update to the AirTable database.

Solution name	
Sources Which various sources are you using to fill out this template? (e.g., interviews, input from end-users, documents received from interview subjects, information online)	

Purpose and outcomes – what can the solution achieve?	
Solution description (Long) This should be a synthesis of the main aim/goal of the solution, the solution type, coping actions and how the solution work in the different phases of disaster management. What is the core aim of the solution? How/in what way is the aim/goal achieved? (Max 500 words)	
Coping actions What kind of actions is enabled by the solution? (e.g., Transport of people, material, equipment; Collecting clothes, foods and other vital resources; Directing traffic; Providing food; Organizing alarming of other citizens and acting as guard; Psychosocial aid; Operating evacuation centers; Information sharing to citizens (Relative hotline); Simple search and rescue; Monitoring and surveilling citizens at risk; Self-reporting; Health care assistance)	
Added benefits Are there any additional benefits other than the overall aim and purpose of the solution? Are there any identified or potential societal impact?	

Lessons learned – what have we learned from cases of the solution? (*it is up to each partner/solution whether there is information from several cases or just one*)	
Evaluation from cases Has there been any evaluation work done in connection to the solution? What was the process(es) and what were the findings? If available highlight the impact and outcome of a solution. If available, add information about validation of the solution.	CASE X
	CASE Y
	CASE Z
Challenges Are there any specific challenges that have occurred in cases of the solution? If available highlight aspects such as resource intensiveness, cost and effectiveness.	CASE X
	CASE Y
	CASE Z
Requirements What *needs* to be in place for the solution to work/function? If available highlight aspects such as resource intensiveness, cost and effectiveness.	CASE X
	CASE Y
	CASE Z
Guidelines (what is important to consider when choosing to implement and use the solution?)	
Degree of transferability High – medium - low	
Describe degree of transferability Describe with a few sentences reasoning behind the degree of transferability.	
Degree of modifiability High – medium - low	
Describe degree of modifiability Describe with a few sentences reasoning behind the degree of modifiability	
Important factors for implementation (Contextual aspects) (e.g., Socioeconomic status; Religiosity Family status; Communality; Social bonds; Spatial and temporal proximity; Informality and crisis management; Level of alert and preparedness; Material conditions; Gender; Cultural conditions; Risk awareness; Threat perception; Perception of responsibility; Perception of response; Coping skills; Level of trust; Sense of preparedness; Actual preparedness; Beliefs; Age of population; Access to	

training; Digital literacy)	
Description of important factors for implementation Describe the important factors with a few sentences that trigger reflection by the reader when considering implementing the solution.	
Important factors for use/effectiveness (Contextual aspects) (e.g., Socioeconomic status; Religiosity Family status; Communality; Social bonds; Spatial and temporal proximity; Informality and crisis management; Level of alert and preparedness; Material conditions; Gender; Cultural conditions; Risk awareness; Threat perception; Perception of responsibility; Perception of response; Coping skills; Level of trust; Sense of preparedness; Actual preparedness; Beliefs; Age of population; Access to training; Digital literacy)	
Description of important factors for use/effectiveness Describe the important factors with a few sentences that trigger reflection by the reader when preparing for the use of the solution	
Trigger questions: you must select <u>one</u> alternative for each question (it will be used for creating paths on the web site	
Needs from first responders (Communicate with or alarm citizens; Organize or coordinate volunteers; Involve society in decision-making; Improve autonomy and proactiveness of citizens; Improve preparedness level of citizens)	
I want to prepare for/mitigate … (*list of disasters*)	
I would like to find solutions that involves/targets citizens … (before a crisis, during a crisis, after a crisis, all phases in a crisis management cycle)	
I would like to reach …	
Record management	

Attachments	
Comments/notes	
Revision history (last revision date)	
Status	

Created by:	*<name/Partner>*	Date:	*<date>*
Checked by:	*<name/Partner>*	Date:	*<date>*