engage

Engage Society for
Risk Awareness and Resilience

Deliverable 2.5 – Revision and update of solutions to improve societal resilience

Authors: Leire Labaka (TECNUN), Sahar Elkady (TECNUN), Eulalia Gómez (TECNUN), Josune Hernantes (TECNUN)

Contributors: Jannicke Fiskvik (SINTEF), Alberto Pasquini (DBL), Tatjana Beuker (DBL), Bruria Adini (TAU), Nathan Stolero (TAU), George Manea (DSU), Maya Battisti (Cittadinanzattiva), Alexis Gizikis (EENA), Alexandra Olson (EENA)

Abstract: ENGAGE aims at linking the informal resilience naturally inherent in societies and citizens with the formal work of authorities to prevent, prepare for, respond to, and recover from disasters. It brings together 15 partners from 9 countries aiming to show how individuals and local practices can interrelate effectively with planned preparedness and response, practitioners, and technology.

In this deliverable, we explore the difference between formal and informal solutions. Furthermore, we characterise informal solutions explaining when they are adopted and used, the role of the citizens in developing these informal solutions, and when and how these informal solutions might become formal. Moreover, how the emergency managers and authorities select the solutions that are implemented is addressed, and the importance of the contextual factors in this selection and

implementation process. Finally, the final list of formal solutions is presented together with an analysis of to what extent the solutions cover the purposes and needs.

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CONTRIBUTORS	DATE
Sahar Elkady / TECNUN **Eulalia Gomez Martin / TECNUN** **Josune Hernantes / TECNUN** **Martina Ragosta / SINTEF** **Jannicke Fiskvik / SINTEF** **Alberto Pasquini / DBL** **Tatjana Beuker / DBL** **Bruria Adini / TAU** **Nathan Stolero / TAU** **George Manea / DSU** **Alexis Gizikis / EENA** **Alexandra Olson / EENA**	PCOS: 30/07/2022 Intermediate: 25/01/2023 External: 17/02/2023 Approved: 28/02/2023
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Members of the ENGAGE Consortium

SINTEF	Stiftelsen SINTEF (SINTEF) NO-7465 Trondheim Norway www.sintef.com	**Project Coordinator:** Matthieu Branlat Matthieu.Branlat@sintef.no
deepblue CONSULTING & RESEARCH	Deep Blue Srl (DBL) IT-00198 Rome Italy www.dblue.it	**Contact:** Alberto Pasquini alberto.pasquini@dblue.it
tecnun Universidad de Navarra	University of Navarra (TECNUN) SP-31009 Pamplona Spain www.tecnun.unav.edu	**Contact:** Leire Labaka llabaka@tecnun.es
TEL AVIV UNIVERSITY אוניברסיטת תל אביב	Tel Aviv University (TAU) IL-6997801 Tel Aviv Israel www.english.tau.ac.il	**Contact:** Bruria Adini adini@netvision.net.il
Røde Kors Trondheim	Trondheim Red Cross (TRC) NO-7465 Trondheim Norway www.rodekors.no/en/	**Contact:** Marita Hoel Fossen marita.fossen@redcross.no
eena EUROPEAN EMERGENCY NUMBER ASSOCIATION	European Emergency Number Association (EENA) BE- 1060 Brussels Belgium www.eena.org	**Contact:** Alexis Gizikis ag@eena.org
DSU	Ministry of Internal Affairs, Department for Emergency Situations (DSU) RO- 010086 Bucharest Romania http://www.dsu.mai.gov.ro www.dsu.mai.gov.ro	**Contact:** Raed Arafat arafatr@smurd.ro
everbridge®	Everbridge Norway (EVBG) NO-0663 Oslo Norway www.everbridge.com	**Contact:** Håkon Straume haakon.straume@everbridge.com
ENS ÉCOLE NORMALE SUPÉRIEURE	Ecole Nationale Supérioure (ENS) FR-75005 Paris France www.ens.psl.eu	**Contact:** J. Peter Burgess james.peter.burgess@ens.psl.eu
ERTZAINTZA	ERTZAINTZA - Departamento de Seguridad – Gobierno Vasco - (ERTZ) ES- 01010 San Sebastian Spain http://www.ertzaintza.eus/wps/portal/ertzaintza	**Contact:** Jesús Alberto Alonso Velasco 06090@ertzaintza.eus

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	Cittadinanzattiva (CA) IT- 00183 Rome Italy www.cittadinanzattiva.it	**Contact:** Annalisa Mandorino a.mandorino@cittadinanzattiva.it
	Azienda Sanitaria Locale Roma 1 (ASL Roma 1) IT- 00198 Rome Italy www.aslroma1.it	**Contact:** Francesca de'Donato f.dedonato@deplazio.it
	Katastrofmedicinskt Centrum (KMC) SE-58330 Linköping Sweden www.lio.se/kmc	**Contact:** Carl-Oscar Jonson carl-oscar.jonson@regionostergotland.se
	NTNU Social Research Ltd. (NTNUSR) NO- 7491 Trondheim Norway www.ntnu.edu	**Contact:** Stian Antonsen stian.antonsen@ntnu.no
	One2Many (O2M) NL-7411 CL Deventer The Netherlands www.one2many.eu	**Contact:** Rachele Gianfranchi rachele.gianfranchi@everbridge.com

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Table of Contents

EXECUTIVE SUMMARY 11

1 INTRODUCTION 12

1.1 SCOPE OF THE DELIVERABLE 12
1.2 OBJECTIVES 12
1.3 SIGNIFICANCE 13
1.3.1 CONTRIBUTION TO THE FIELD OF STUDY 13
1.3.2 SPECIFIC CONTRIBUTION TO THE ENGAGE PROJECT 13
1.4 FIT WITHIN ENGAGE 14
1.5 INTENDED READERSHIP 15

2 BUILDING UPON THE VALIDATION REPORT 4.2 16

2.1 RESULTS PRESENTED 16
2.1.1 CHARACTERIZATION AND DESCRIPTION OF THE SOLUTIONS 16
2.1.2 FUNCTIONALITIES OF THE KNOWLEDGE PLATFORM 17
2.1.3 INCLUSION OF CITIZENS IN THE KNOWLEDGE PLATFORM 17

3 METHODOLOGY 18

3.1 ANALYSIS OF THE CATALOGUE OF SOLUTIONS BASED ON THE VALIDATION RESULTS 18
3.1.1 ANALYSING THE CURRENT LIST OF SOLUTIONS (GAP ANALYSIS) 18
3.1.2 SEARCHING FOR NEW SOLUTIONS 18
3.1.2.1 Primary literature review 19
3.1.2.2 Secondary literature review 19
3.2 SEMI-STRUCTURED INTERVIEWS WITH EMERGENCY RESPONDERS 20
3.2.1 SAMPLING AND DATA COLLECTION 21
3.2.2 INTERVIEW GUIDE 21
3.2.3 INTERVIEW DATA ANALYSIS 26
3.2.3.1 Thematic analysis 26
3.2.3.2 The Borda Count Method 26
3.3 SEMI-STRUCTURED INTERVIEWS WITH CITIZENS 27
3.3.1 SAMPLING AND DATA COLLECTION 27
3.3.2 INTERVIEW SCRIPT AND ANALYSIS 27
3.4 WORKSHOP WITH CITIZENS IN ROME 27
3.5 ETHICAL CONSIDERATIONS 28

4 RESULTS 29

4.1 CHANGES IN THE CATALOGUE OF SOLUTIONS BASED ON THE VALIDATION RESULTS 29
4.1.1 ADJUSTED LIST OF SOLUTIONS 29
4.1.2 GAP ANALYSIS OF SOLUTIONS VS RESILIENCE PURPOSES AND EMERGENCY RESPONDERS' NEEDS 30
4.1.3 THE FINAL LIST OF SOLUTIONS 35
4.2 LIST OF SOLUTIONS 37
4.3 SELECTION OF THE SOLUTIONS BASED ON THE CONTEXT 38
4.3.1 RESULTS FROM THE DECISION-MAKING PROCESS IN THE INTERVIEWS 38

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.

4.3.1.1 Communication experts 38
4.3.1.2 Preparedness experts 38
4.3.2 SCENARIO AND SOLUTIONS RANKING GATHERED FROM THE INTERVIEW 39
4.3.2.1 Improving Communication Scenarios 39
4.3.2.2 Enhancing Preparedness Scenario 41
4.4 FORMAL VS INFORMAL SOLUTIONS BASED ON THE CONTEXT 43
4.5 CITIZEN-DRIVEN EFFORTS 48
4.5.1 EMERGENCY RESPONDERS' PERSPECTIVE 48
4.5.2 CITIZENS' PERSPECTIVE 49
4.6 INFORMAL SOLUTIONS 51
4.6.1 DEFINITION OF INFORMAL SOLUTIONS 52
4.6.2 FROM INFORMAL TO FORMAL SOLUTIONS 53
4.6.3 CHARACTERIZATION OF INFORMAL SOLUTIONS 55

5 FINAL REMARKS 58

6 STRENGTHS & LIMITATIONS 59

6.1 STUDY LIMITATIONS 59
6.2 STUDY STRENGTHS 59

7 CONCLUSIONS 60

8 REFERENCES 61

9 APPENDICES 63

9.1 ANALYSIS OF THE LIST OF SOLUTIONS 63
9.2 INTERVIEWS TEMPLATE [EMERGENCY PERSONNEL] 64
9.2.1 INTRODUCTION 65
9.2.2 INFORMAL SOLUTIONS 65
9.2.3 FORMAL SOLUTIONS: 67
9.3 INTERVIEWS SCRIPT [CITIZENS] 67
9.4 CITIZENS WORKSHOP [ROME], QUESTIONNAIRE 68
9.5 INTERVIEWS CONSENT FORM 69
9.6 LIST OF SOLUTIONS 70

List of Figures

Figure 1 Grey literature review process....19
Figure 2 Scientific literature review process....20
Figure 3 The interview [emergency responders] structure....22
Figure 4 "Improving communication" scenario version 1....24
Figure 5"Improving communication" scenario version 2....24
Figure 6 "Enhancing preparedness" scenario version 1....25
Figure 7 "Enhancing preparedness" scenario version 2....25
Figure 8 Number of solutions per each type (new)....29
Figure 9 Number of solutions per each type (old)....30
Figure 10 Number of solutions per purpose (new list)....31

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.

Figure 11 Change of purposes ranks between the old and new list of solutions. For example: Improving communications (pink line) was ranked number 1 in the old list, which means it was the purpose covered by the highest number of solutions, however, in the new list it ranks the second 32
Figure 12 Percentage of solutions vs purposes 33
Figure 13 Number of solutions per need (the complete description of the needs can be found in Table 7).....34
Figure 14 The change of solutions ranking from one version to another in the communication scenario 41
Figure 15 The change of solutions ranking from one version to another in the preparedness scenario 43
Figure 16 Formality-Informality Framework.....45
Figure 17 Results of the extent of formality of a solution exercise in the semi-structured interviews 46
Figure 18 Emergency responders VS citizens' perspectives 51
Figure 19 Formalization process 54
Figure 20 Johns Hopkins Covid-19 dashboard on the informality-formality quadrants 57
Figure 21 Correlation analysis among the needs and purposes 63

List of Tables

Table 1 The distribution of votes among ranks (Borda count step 2) [9] 26
Table 2 Scores calculation per each candidate place (Borda count step 3) 26
Table 3 Number of solutions per solution type per disaster phase 30
Table 4 Borda rank of each of the solutions in the "Improving communication" set of scenarios...40
Table 5 Borda rank of each of the solutions in the "Enhancing preparedness" set of scenarios.....42
Table 6 Informality criteria based on the interviews.....47
Table 7 Description of needs 63
Table 8 Description of purposes 64
Table 9 List of Solutions (Purpose: P: enhance preparedness, R: enhance risk awareness, RA: facilitate resource allocation, SN: capitalize on social networks, H: Improve health, G: Empower in governance, C: Improve communication, ER: efficient response, QR: quick recovery), (Phase: B: before, D: during, A: after).....70

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Executive summary

Background: Society at large plays a crucial role in dealing with disasters and it has to be part of the preparation, response, and recovery processes of the crisis. To fully utilize the potential of society in dealing with crises, it is essential to improve the collaboration and interaction of authorities and emergency organizations with other and informal parts of society to efficiently respond and recover from crises. For that to happen, authorities and emergency organizations set and use a group of practices, guidelines, techniques, tools, methods, etc. that help them reach members and groups of society and involve them in crisis management. In this project, we use the term "solutions" to refer to this set of means that emergency responders and authorities can use and implement to reach out to the public and improve their interaction with them. These solutions can be either formal or informal based on who created and used them and whether they were defined beforehand and already included in the formal response mechanisms or on the contrary, they were created or modified on the fly because of the situation. Furthermore, defining how this interaction with society is carried out and what specific purposes are achieved through this collaboration is needed to move further toward this aim.

Goal: This deliverable aims at developing a gap analysis of already identified solutions to identify the needs and purposes not covered so far and identify new solutions to fulfil these gaps. Furthermore, a thorough description of the concepts of formal and informal solutions is provided as well as a framework for their classification. In particular, how informal solutions can be described and characterized will be presented and a special focus will be given to citizens driven efforts. Finally, a framework that describes the formalization process of the solutions is presented.

Methodology: This study has two main targets: 1) updating and completing the list of formal solutions that compose the catalogue of solutions, and 2) better understanding and further elaborating on the description of formal and informal solutions and their development. In order to do that, both quantitative and qualitative research methods were used. For the first part, statistical methods were utilized to identify the existing gaps. Based on that new solutions were identified, through primary and secondary literature sources. For the second part, semi-structured interviews with emergency services personnel and citizens were conducted to gather information and build on the concepts of formal and informal solutions and their characterization.

Results: From the gap analysis we can conclude that the purposes for enhancing citizens' preparedness and improving communication are the ones most covered by the solutions whereas empowering citizens in the decision-making process and quick recovery are the purposes with the least solutions. Based on this gap, new solutions were identified resulting in a total of 112 formal solutions. Regarding the description of formal and informal solutions, legal framework, the uncertainty of the situation, stakeholders, and bureaucratic delay were the aspects that the interviewees mainly identified for differentiating between formal and informal solutions. Furthermore, the list of factors that influence the selection process of formal solutions is defined. Regarding the informal solutions, a useful definition has been for them suggested as well as a characterization to better define them. In relation to this, how the citizens should be involved in disaster management activities from the emergency managers' and citizens' perspectives has been described. Finally, the formalization framework composed of three elements has been defined: informality drivers, formalization enablers, and formalization barriers.

Conclusions: This deliverable provides the project's final list of formal solutions -so far- and deepens the definition and characterization of formal and informal solutions. Furthermore, it explores how contextual factors influence the selection process of a solution to be implemented. Finally, it emphasizes the potential of informal solutions for involving citizens in the disaster management process and for developing and testing future formal solutions.

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1 INTRODUCTION

1.1 SCOPE OF THE DELIVERABLE

Society at large plays a crucial role in dealing with disasters and it has to be part of the preparation, response, and recovery processes of the crisis. To fully utilize the potential of society in dealing with crises, it is essential to improve the collaboration and interaction among the authorities and emergency organizations with with other and informal parts of society to efficiently respond and recover from crises. For that to materialise, authorities and emergency organizations set and use a group of practices, guidelines, techniques, tools, methods, etc. that help them reach members and groups of society and involve them in crisis management. In this project, we use the term "solutions" to refer to this set of means that emergency responders and authorities can use and implement to reach out to the public and improve their interaction with them. We define solutions as any means such as guidelines, practices, processes, strategies, methods, tools, etc. we can apply to reach a desired outcome. This deliverable builds upon deliverables 2.2 and 2.3, in which we identified the formal and informal solutions that improve the interaction between the emergency managers and authorities with the society, and deliverable 4.2, in which we describe the results of the initial validation. Based on these results, this deliverable aims at exploring deeper the definitions of formal and informal solutions as well as covering the limitations found in the initial validation related to the identification of solutions. Information was obtained through interviews with crisis managers and citizens to gather their understanding of formal and informal solutions and their use in disaster management. Interviews were used instead of the focus groups initially envisaged, because they allow for more in-depth discussion and understanding of the topics under investigation, rather than a discussion based on group dynamics and idea sharing. We needed these in-depth discussions to better understand the differences between formal and informal solutions without necessarily validating any specific solutions. Additionally, for the citizens' interviews, we opted for individual interviews to diversify our sources of information. Our partner, DBL, had already conducted a workshop with community members to understand their role in disaster management, so our aim was to gain further insights and perspectives through individual interviews.

1.2 OBJECTIVES

The main objective of this deliverable is to explore further the definition of formal and informal solutions providing a framework for their categorization, covering the gaps identified in the initial validation activities, and defining an updated list of formal and informal solutions.

The specific objectives of this deliverable are:

- Develop a gap analysis about the already identified solutions to identify what needs and purposes are less covered by the current list of solutions. As a result, the needs and purposes that lack solutions or have only a few solutions are identified.
- Identify new solutions to cover the gaps identified in the analysis.
- Better define and describe the difference between formal and informal solutions and develop a framework for their classification.
- Explore more in-depth the informal solutions defining who apply them, when and why, how they are implemented, and the influence of the context in developing informal solutions. In particular, citizens-driven efforts have been analysed in more detail including from the perspective of the citizens.
- Develop a framework to describe the formalization process of informal solutions.

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- Describe how the context influences the selection process of the formal solutions.

1.3 SIGNIFICANCE

The overall aim of the ENGAGE project is to amplify the inherent capacity of citizens by better involving them in disaster management. In this vein, it is essential to improve the collaboration and interaction of emergency organizations and authorities with society to foster society's involvement and better use the capacities of society in dealing with disasters. This research defines solutions as the means to improve this interaction and collaboration of emergency organizations with society. This deliverable elaborates on the definition and implementation of formal and informal solutions proposing a framework to better understand them. Furthermore, the importance of the context and how it influences when deciding what solution to implement is exposed in the deliverable. Finally, the formalization process of the informal solution is described, as it presents the steps, the enablers, and the barriers we encounter when an informal solution is becoming formalized. These conceptualizations and descriptions help to better understand the nature and the role of solutions when dealing with disasters and how they evolve. All these outcomes are the result of interviews conducted with emergency responders and citizens. We want not only to hear the voice of emergency responders' but also the citizens since they are often the source and creators of informal solutions, and thus, it is important to involve them in this study.

This research helps emergency responders to manage disasters hence enhancing community resilience effectively and efficiently by:

- Knowing the existing tools and solutions that may help emergency responders to make informed decisions about which tools to use in specific scenarios.
- Identifying the current gaps in the available solutions helps emergency responders to develop or improve approaches to build future response plans and policies.
- Understanding the role that citizens can play in disaster management can help emergency responders effectively engage with the community and leverage the strengths and resources of residents. Additionally, recognizing the citizens' potential to play a positive role in disaster management can help to eliminate any misconceptions that emergency responders may have about the capabilities and limitations of community members.

1.3.1 CONTRIBUTION TO THE FIELD OF STUDY

In this deliverable, we can identify two main contributions to the field of study. The first relates to the identification and description of solutions that exist to improve the interactions between the emergency services and authorities with the citizens, outlining the existing gaps in the purposes and needs covered. In particular, there are some interaction purposes and needs identified by emergency managers that do not have or have few solutions assigned to them, meaning that there is a potential to be improved in this area. The second one elaborates on the concepts of formal and informal solutions, explaining when and how each of the solutions is used, proposing a framework for their identification and, a formalization framework that explains the process of converting a solution from informal to formal.

1.3.2 SPECIFIC CONTRIBUTION TO THE ENGAGE PROJECT

This deliverable proposes a final list of solutions that will be included in the Knowledge platform (https://engageknowledgeplatform.eu/#/). A basic description of all the solutions is included in this deliverable. Furthermore, the difference between formal and informal solutions presented through a conceptual framework is defined in the deliverable as well as the influence of the contextual factors

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for their implementation. Finally, the process of how an informal solution might become formal is illustrated through a framework. It is worth noting that not only emergency managers' perspective but also citizens' perspective was taken into consideration.

This deliverable contributes directly to the second objective of the ENGAGE project "Identify existing formal and informal solutions for enhancing societal resilience transferable across contexts". Furthermore, it also serves as an input for the third objective of the project "Produce validated actionable knowledge on societal resilience by demonstrating the benefits and impact of the project solutions in different types of disasters […] and geographic conditions".

Related to these objectives, the deliverable will contribute to the following results that the ENGAGE project expects to obtain: A catalogue of solutions for societal resilience (R5), Validated ENGAGE solutions and examples of applications (R6), and ENGAGE knowledge platform (R1).

1.4 Fit within Engage

D2.5 identifies the new list of formal and informal solutions with basic information for each of them. Furthermore, it explores the definition of formal and informal solutions, providing a framework for their classification and proposing a framework for explaining the formalization process of informal solutions. It is related to other work packages and deliverables, mainly, WP1, WP2, WP3, and WP4. As input for this deliverable, we use the results obtained in the following deliverables:

D1.1: The definition of societal resilience and a preliminary version of the societal resilience model.

D2.2: The preliminary list of formal solutions defined in this deliverable, as well as the interaction purposes described to classify the formal solutions.

D2.3: The preliminary list of informal solutions defined in this deliverable.

D2.4: The preliminary list of communication channels and guidelines for authorities and first responders to reach society.

D3.1: The characterization of solutions and how the context influences the selection of the solution to be implemented are used as input for this deliverable.

D4.2: The comments, weaknesses, and suggestions proposed by the experts in the validation activities are taken into account to improve the description of the solutions.

T5.5: The difficulties encountered when uploading the solutions to the platform and the weaknesses identified when searching for specific solutions were considered in this deliverable.

Furthermore, the results presented in this deliverable (D2.5) will be used in the following near-future tasks:

T3.3: Catalogue of solutions and implementation guidelines: the new list of solutions would be taken into account to complete the catalogue of solutions. Furthermore, the detailed characterization of informal solutions would help to include them in the catalogue of solutions.

T4.3: Final Validation of solutions: some of the solutions defined in D2.5 will be validated in the three validation exercises that will be conducted in WP4.

T5.2: Communication and dissemination activities: the solutions identified in D2.5 will be part of the catalogue of solutions and consequently, included in the knowledge platform. Furthermore, the conceptual frameworks developed in this deliverable and the outcomes obtained will be disseminated in scientific journals.

T5.3: Exploitation and contribution to SENDAI, policy, and standardization: how this list of formal and informal solutions could be exploited in the future will be analysed in this task. Furthermore, this list of solutions would contribute to the policies within the SENDAI framework.

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1.5 INTENDED READERSHIP

This deliverable has the following groups of intended readers:

» All the partners in the consortium, could benefit from the findings of this deliverable. The end-user partners could use the identified solutions and utilize the gap analysis to build new solutions to cover their needs. Moreover, they can get insights about the citizens' perspective. The academic partners could build upon the findings of the informal solutions and the impact of contextual factors on the selection process of solutions.
» The project's Knowledge and Innovation Community of Practice (KI-CoP) as they represent a wide range of the stakeholder groups of first responders, researchers, authorities and civil society that the project aims to influence.
» Other researchers who are interested in resilience and disaster management.

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2 BUILDING UPON THE VALIDATION REPORT 4.2

Deliverable 4.2 presents the results obtained from the initial validation activities carried out with the initial outcomes of the project. Three internal workshops with end-user partners and three societal resilience hubs involving KI-CoP members were performed to gather feedback about the initial outcomes of the project. Deliverable 4.2 explains the specific activities carried out and the results obtained in each activity. The comments and feedback gathered from the initial validation activities have been used to improve the outcomes of the project in the second cycle.

2.1 RESULTS PRESENTED

The comments and feedback obtained from the activities have been classified into the following three categories:

- The ones related to the characterization and the description of the solutions,
- The ones related to the functionalities of the Knowledge Platform,
- The ones related to how the citizens are considered in the Knowledge Platform

2.1.1 CHARACTERIZATION AND DESCRIPTION OF THE SOLUTIONS

The decision-makers want to make their judgment about which solution might fulfil their needs to solve their problems. Therefore, the description should characterize the solution to provide support in this decision-making process.

Many experts argue that providing information about the context and the implementation is essential when selecting a solution. The solutions are often selected based on their effectiveness to deal with a given problem and therefore, the platform should facilitate the following information: Have the solution worked in the past in similar events, in other countries? Does the solution address a similar target population? Does the solution need to be adapted based on the context? In which context was it implemented? What resources are needed to implement the solution?

Regarding the description of the solutions, the end-users argue that the following information would be useful to better describe the solution.

- The timing of the solution: determining the duration of implementing the solutions and the duration for the solutions to get any impact.
- Information about who to contact to get more information about the solution.
- Information on how a solution has been implemented exemplifying some use cases.
- Information about the required resources for implementing a solution.
- Information about the validation status if possible (e.g. scientific validation in case of the health domain).
- Information about prerequisites; a list of requirements for the solution to work properly.
- Information on concrete steps to create and use the solution.
- Information about challenges when implementing and using the solutions.
- Information about the solution's reliability level, provided by the solution users.

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2.1.2 FUNCTIONALITIES OF THE KNOWLEDGE PLATFORM

One of the first comments made by the end-users was about the profile of the end-user of this tool. Who is the user of the Knowledge Platform?

Based on this comment, the definition of the profile of the user that is expected to be using the knowledge platform was made together with the experts participating in the validation activities.

The experts suggested that the following functionalities may help them to make decisions more easily:

- Compare similar solutions based on some aspects. Together with this, the platform should facilitate the identification of similar solutions.
- Add more visuals to describe the solution, e.g. videos explaining the solution, its objectives, the results obtained, the challenges faced, charts, infographics, etc.
- Add some scores related to the main factors that can help rate the solutions. These factors might be the easiness of implementation, effectiveness level, number of resources needed, the maturity level of the solution, the degree of adaptability to different contexts, the number of places in which the solution has been implemented, etc.
- The platform should have a section to allow end-users to introduce comments, share solutions with others, and rate them.
- For the sustainability of the knowledge platform, it would be useful to allow externals to include additional information about solutions and also propose new solutions to be included in the platform through a form.

Finally, the filtering options provided by the platform did not help them to get the required information. Therefore, they suggested clarifying the associated text or considering filtering solutions by needs rather than by purposes.

2.1.3 INCLUSION OF CITIZENS IN THE KNOWLEDGE PLATFORM

The experts argued that the project is very focused on the first responders' perspective, and citizens' viewpoint has hardly been represented in the outcomes of the project. There might be discrepancies between what the first responders and authorities think and the perspective of the citizens. How the solutions help in improving the interaction between the emergency services and authorities with the citizens and the effectiveness level of the solutions from the citizens' perspective to fulfil their needs are some of the issues raised by the experts during the validation activities.

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3 METHODOLOGY

This study has two main targets: 1) updating and completing the list of formal and informal solutions that compose the catalogue of solutions and 2) better understanding and further elaborating on the description of formal and informal solutions and their development including both the emergency services' and citizens' perspectives. In order to do that, different research methods were used. For the first part, statistical methods were utilized to identify the existing gaps and based on that, through primary and secondary literature sources, new solutions were identified. For the second part, semi-structured interviews with emergency services and citizens were conducted to gather information and build on the concepts of formal and informal solutions and their characterization.

3.1 ANALYSIS OF THE CATALOGUE OF SOLUTIONS BASED ON THE VALIDATION RESULTS

The solutions included in the catalogue of solutions were analyzed to define existing gaps and based on that to identify new solutions to cover these gaps. A detailed description of the methods applied, and the process followed are described in the following subsections.

3.1.1 ANALYSING THE CURRENT LIST OF SOLUTIONS (GAP ANALYSIS)

We investigated the list of solutions in the Catalogue of Solutions, to have a complete picture of the current state of the solutions and guide our search for new solutions and help improve the Knowledge Platform.

To reach these objectives, we conducted a statistical analysis and utilized visualization techniques to have an idea about the distribution of solutions among different types, needs, and purposes, hence, guiding our search for new solutions. In order to do this analysis, we first revisited the list of solutions and reassigned the solutions to the different needs and purposes. To do this assignment, we restricted the number of assigned needs to 7 (out of 27) and purposes to 3 (out of 9). This restriction results in assigning a solution to only the most relevant and direct needs and purposes, which would also help in adding only the most relevant keywords and filters in the catalogue of solutions in the Knowledge Platform. This assignment was done by three researchers from TECNUN. Each researcher did it separately, then a consensus was reached in a meeting. Based on this assignment, we did a statistical analysis of the distribution of solutions across disaster phases, purposes, and needs. The identified gaps from this analysis were used to direct our search for new solutions.

Moreover, we conducted a correlation analysis between the various needs and purposes. The primary goal of this analysis is to improve the search and filter functionality in the Knowledge Platform by eliminating some needs, merging them, or relating the needs and purposes for a better search. We used Pearson correlation coefficient where correlation coefficient = $\rho(x,y) = \Sigma[(x_i - \bar{x}) * (y_i - \bar{y})] / (\sigma_x * \sigma_y)$. Where σ_x, σ_y are the standard deviation of x and y respectively. $\bar{x}$ and $\bar{y}$ are the mean of X and Y.

3.1.2 SEARCHING FOR NEW SOLUTIONS

The process of finding the various solutions was divided into two categories: primary and secondary literature. Primary literary sources include reports and various national and municipal government publications such as white papers and planning papers (solutions that come from a practice point of view). Primary literature sources are frequently referred to as grey literature since they might be difficult to locate, albeit an increasing number are now available through the Internet. Secondary literature sources, such as books and journals, are referenced academic publications that are the

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most crucial when it comes to establishing thoughts in the context of previous research [1]. These two sources of information align with what we did in D2.2 and D2.4; first, we had practical solutions that came from our partners' end-users and interviews with members of the Ki-CoP; and second, solutions that come from scientific research (European projects and publications).

3.1.2.1 Primary literature review

The following explains the process of obtaining formal solutions in the grey literature. To begin with, the process of searching for new formal solutions started on the web, in particular, social media allows everyone who witnesses or participates in an occurrence to provide real-time information to those on the other side of the planet [2]. Among many social media platforms, Twitter is one of the most popular platforms for curating, evaluating, and summarising crisis-related information in order to facilitate response and decision-making during a crisis with a significant quantity of information available from its large number of users [3].

Twitter data was obtained through an automated approach of data retrieval which provides a small sample of Twitter data (approximately 1% of all tweets) by using computer-assisted qualitative data analysis (CAQDAS) software. The CAQDAS helps with data organisation during qualitative analysis, as well as remaining close to the data, investigating, coding, retrieving data, and searching. CAQDAS aids with continuity, transparency, and methodological rigour. It is widely used in qualitative research to discover the links between several replies [1]. The CAQDAS software searched for tweets on Twitter within a seven days' timeframe according to the hashtags "disaster*" and "resilience" written in any language, and then imported them into a folder project, resulting in 7 solutions. Moreover, bearing in mind that significant data on the web remained, the "snowball" approach was also utilised. This is a data-gathering strategy that is frequently employed when establishing a representative sample from official sources [2]. During that process, 16 more solutions were chosen to be included in the grey literature review (Figure 1).

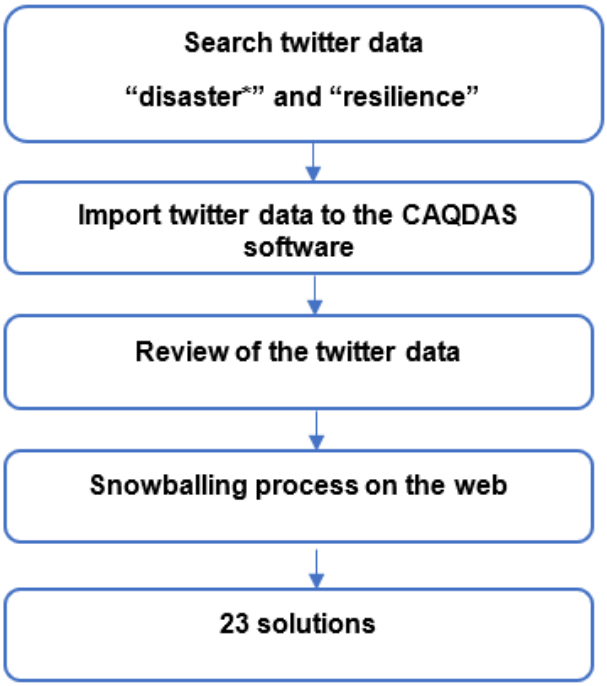

Figure 1 Grey literature review process

3.1.2.2 Secondary literature review

The literature review was chosen as the study method to examine current research papers, theories, and reports [4] outlining solutions implemented to help communities prepare for and recover from disasters. First, we selected a set of keywords and ran several searches. "Resilience," "disaster management," and "solution" were the three primary terms chosen. Then it was conducted an

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advanced query search in the databases Science Citations Index (SCI) and Social Science Citations Index (SSCI). Both are part of the Web of Science Core Collection database (WOS) and are among the most widely used and trustworthy sources for bibliometric analysis [5]. In this work, the search was limited to peer-reviewed journal articles, review articles, conference papers, and book chapters (all published in English), as this is the major mechanism for quality control in most scientific fields when doing impartial knowledge synthesis [6].

All of the abstracts were examined to confirm that the articles mentioned at least one of the following solutions:

- investing in infrastructure such as early warning systems, emergency shelters, and emergency response equipment to help communities prepare for and respond to disasters,
- supporting community-based organizations that provide critical services during disasters, such as food banks, shelters, and medical care,
- collaborating with local businesses and organizations to coordinate disaster response and recovery efforts,
- investing in long-term recovery efforts, such as helping communities rebuild infrastructure and homes after a disaster.

Finally, duplicate articles were deleted, resulting in 48 papers remaining from the original 84 (Figure 2). Subsequently, the abstracts of the papers were thoroughly read to find possible formal solutions, resulting in 23 papers of interest. Finally, these 23 papers were studied in detail and only 3 solutions were found to match the objective of the search.

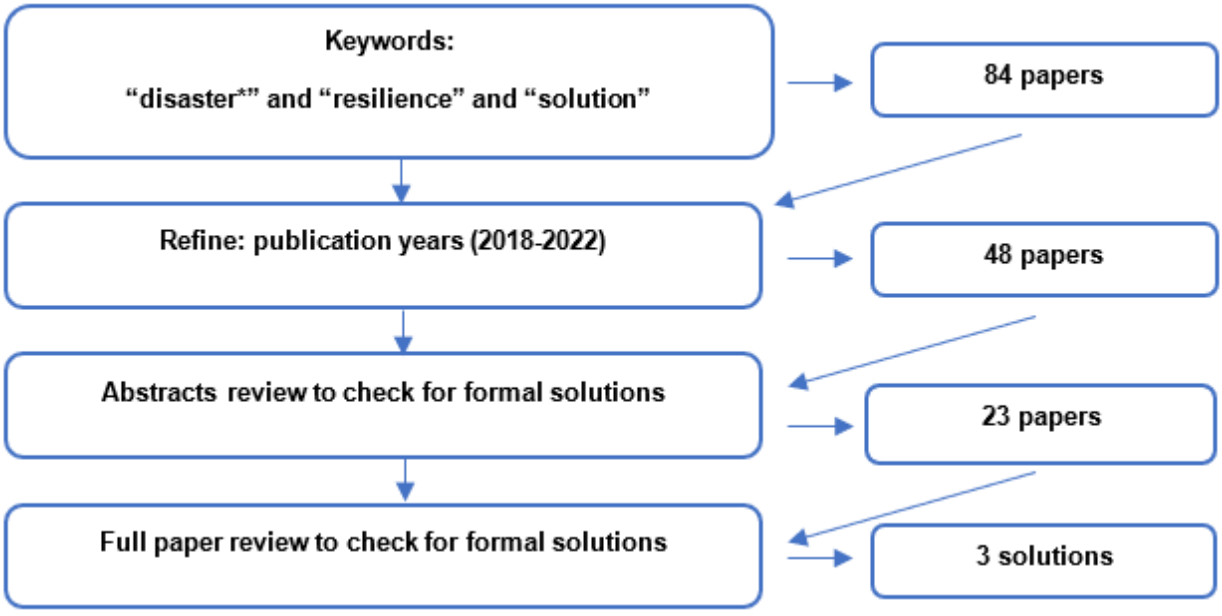

Figure 2 Scientific literature review process

3.2 SEMI-STRUCTURED INTERVIEWS WITH EMERGENCY RESPONDERS

In order to better understand the meaning of formal and informal solutions, and to explore more on how and when each of these types of solutions is used, semi-structured interviews with emergency responders were conducted to gather information.

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3.2.1 SAMPLING AND DATA COLLECTION

Emergency responders who belong to formal organisations were interviewed in the process. Emergency response entities, authorities, non-governmental organisations (NGOs), and private companies with direct relationships with emergencies were the type of organisations that participated in the process. The interviewees belong to organisations in European countries, Australia and Israel. The interviewees were conducted by members of the ENGAGE project. Before the interview, the potential participants were invited to participate in the interview process through email. The email included the information sheet explaining the aim of the interviews and the whole process. Furthermore, we attached a consent form (see appendix 9.5), for them to sign if they agree to participate. Participants had the right to withdraw from the interview at any time. All the interviews template in English to facilitate the analysis process. All the interviews were done through online video calls.

3.2.2 INTERVIEW GUIDE

The interview was divided into four main parts (see the template in 9.2). In the first part, we gather information about the interviewee's relationship with emergencies, their professional trajectory regarding the emergencies, and the different roles and responsibilities they hold. In the second part, we explore the differentiation between formal and informal solutions through a short survey with five examples. In the third part of the interview, we asked the participants about their experience with informal solutions; if they had ever applied them, why, when, how, and what were the limitations. Furthermore, we studied the formalization process of the informal solutions, asking when and why an informal solution becomes formal, and what contextual factors favour the formalization process.

The last part of the interview was related to formal solutions and the selection process of choosing the most adequate solution for a given problem. In the interviews, we investigated how emergency organizations decide which solution to use to handle specific emergencies based on the context of the community where the tragic event is occurring. Below we will explain the examples that were included in the second part of the interviews, followed by the exercises in the last part. Figure 3 summarizes the structure of the interview.

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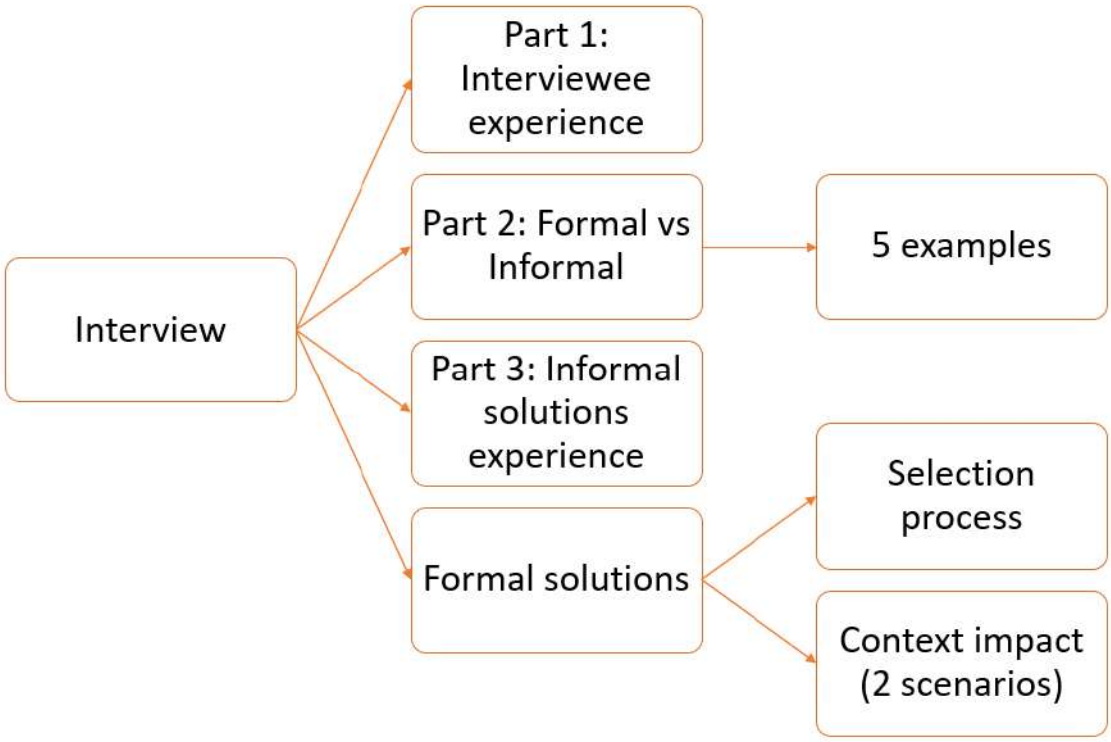

Figure 3 The interview [emergency responders] structure

In the second part of the interviews, the experts were asked to rate the solution from 1 to 5, where 1 meant extremely informal and 5 meant extremely formal. The examples were very diverse aiming to cover the different aspects that define formality and informality: some of them were driven by the citizens and others by emergency responders and authorities, some solutions were backed by a legal protocol other were not, some solutions were repeated several times others were just applied once. Following the five examples are explained:

Example 1: Shortage of surgical masks

In the first stages of the COVID-19 crisis, when there was a huge shortage of surgical masks, to overcome the situation, healthcare workers used homemade cloth masks and reused the surgical masks after treating them with different techniques such as UV rays.

Example 2: COVID-19 lack of bed availability

When COVID-19 hit, the emergency units in the hospital were full of patients and there were no available beds for new ones. So, a doctor in an Italian hospital decided to treat his patients at their houses and give them the required medicines without the need of coming to the hospitals. Then, other hospital staff joined this doctor in his work, and started treating the patients at their houses. Due to the success of the process, the hospital started supporting them and providing the needed resources for the doctors' work to continue.

Example 3: Firefighters' follow-up calls

During the crisis, the fire department officials alert the regional operative cluster by calling the halls of operation instead of using email. They also send an official email to track the action. After 15 minutes they call regional operative cluster again to know if they received the email properly.

Example 4: Church bell

In a small town in Romania, they use the church bell to alert the population during a crisis instead of formal procedures. Due to the high religiosity level of the population, the city hall or the mayor

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contacts the priest of the town to inform him that there is an emergency, and the priest rings the church bell to alert the population.

Example 5: The Basque police app

The Basque police have an official app that aims to provide a communication channel between the citizens and the Basque police. The application facilitates new means of communication with the police through any mobile device and various channels such as SMS, email, telephone, or WhatsApp.

In the last part of the interviews, we developed two situations, the first one addressing the problem of fake news about the COVID-19 pandemic, and the second focusing on a heatwave event. The first situation was focused on solutions related to improving communication, while the second one was related to enhancing the preparedness of the population. These purposes, enhancing preparedness and improving communication, are two of the purposes we identified for enhancing the interactions among community members and emergency organizations to enhance societal resilience (See D2.2 and D2.4). These are the top two purposes covered by the solutions in the Catalogue of Solutions. Moreover, most of the KI-CoP members worked in roles related to these two functionalities, which facilitated the process of finding interviewees. Each of the developed situations had two different scenarios, each one covered different values for each of the contextual factors that define a hypothetical community. The contextual factors we considered in each scenario were the population size, age, religiosity level, percentage of immigrants, digital literacy, and level of trust in the government. Below, we will explain the two versions of the scenarios associated with each purpose.

Scenarios associated with "improving communication" purpose:

The solutions to be ranked in these two scenarios were nine solutions. Two of them were related to volunteers (VOST, and Corona loyals). Three solutions were technology-based (corona dashboard, mobile application, and software to verify information). Another two were related to traditional media (brochures and tv debriefings). And the last two were social media accounts for verifying fake news and a call centre.

Scenario 1:

During the covid pandemic and especially during the vaccination period, there was a spread of incorrect information and fake news about the vaccine. A city (1 million inhabitants) in Europe, tried to stop this spread of fake news because it costs lives. 20% of the population in this city is over 60 years old. It is considered a religious society with 40% of the population defining themselves as religious. 20% of the population has a higher education (University degree). There is 10% of immigrants, and many of them do not speak the official language fluently. 60% of the citizens are digitally literate (having the skills you need to live, learn, and work in a society where communication and access to information are increasingly through digital technologies like internet platforms, social media, and mobile devices.). The city perceives the government as not transparent, and this has resulted in a low level of trust in the authorities. At the moment, the government does not have specific budgetary limitations or preferences regarding the implementation of any type of solution.

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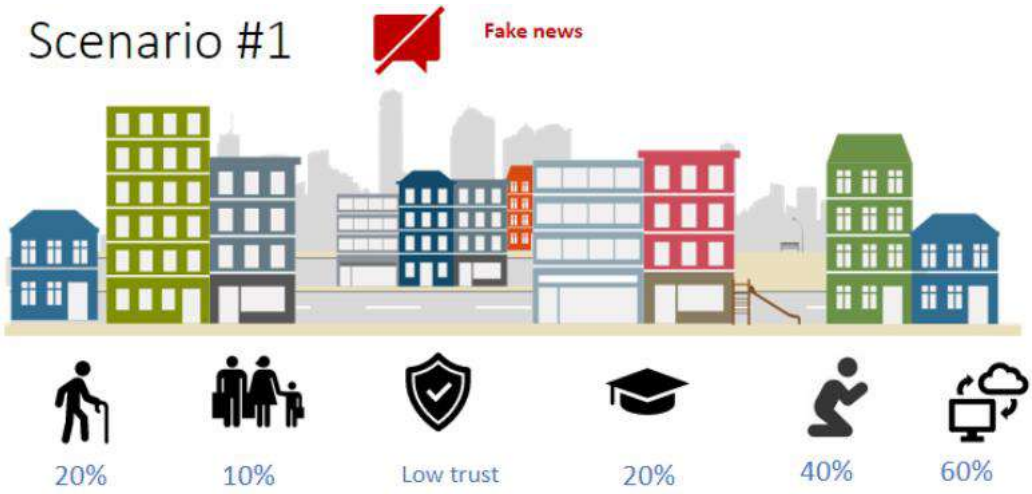

Figure 4 "Improving communication" scenario version 1

Scenario 2:

During the covid pandemic and especially during the vaccination period, there was a spread of incorrect information and fake news about the vaccine. A city (**1 million inhabitants**) in Europe, tried to stop this spread of fake news because it costs lives. 20% of the population in this city is **over 60 years old**. 25% of the inhabitants define themselves as **religious**. 45% of the population has a higher education (**University degree**). There is 25% of **immigrant**s, and many of them don´t speak the official language fluently. 85% of the citizens are **digitally literate**. The government is always transparent with the citizens which have resulted in a high level of trust in authorities. At the moment, the government does **not** have specific **budgetary limitations** or preferences regarding the implementation of any type of solution.

Figure 5"Improving communication" scenario version 2

Scenarios associated with "enhancing preparedness" purpose:

Scenario 1:

A small city (**250,000** inhabitants) in Europe where the weather is usually cold, however, with climate change, the city is facing heat waves and neither the citizens nor the buildings are prepared for such heat. **25%** of the city's population is over 60 years old. All the population of the city is literate. **10%** of the population are immigrants. The majority of the population **trusts** the

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authorities and emergency organizations. At the moment, the government does **not** have specific **budgetary limitations** or preferences regarding the implementation of any type of solution.

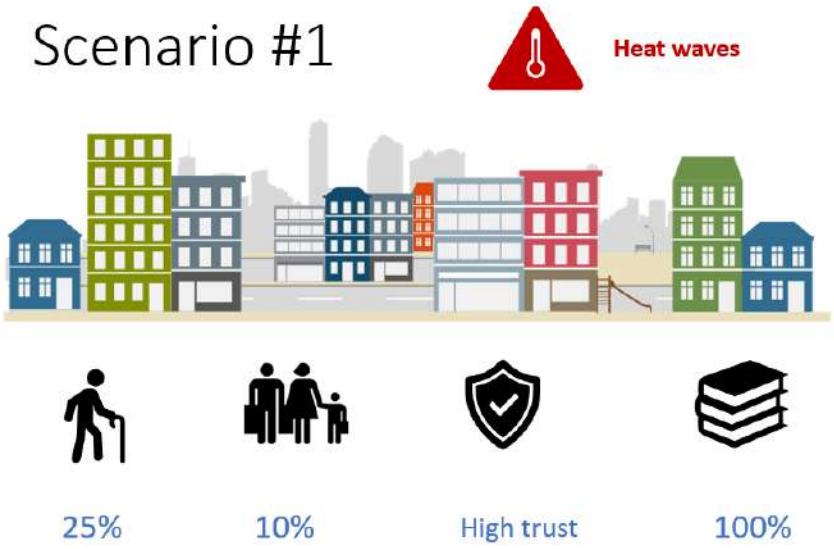

Figure 6 "Enhancing preparedness" scenario version 1

Scenario 2:

A village (**10,000** inhabitants) in Europe where the weather is usually cold, however, with the climate change, the city is facing heat waves and neither the citizens nor the buildings are prepared for such heat. **60%** of the city's population is over 60 years old. All the population of the village is literate. There are **no immigrants** in the village. The majority of the population is **religious**. The village people **do not trust** the authorities that much. At the moment, the government does **not** have specific **budgetary limitations** or preferences regarding the implementation of any type of solution.

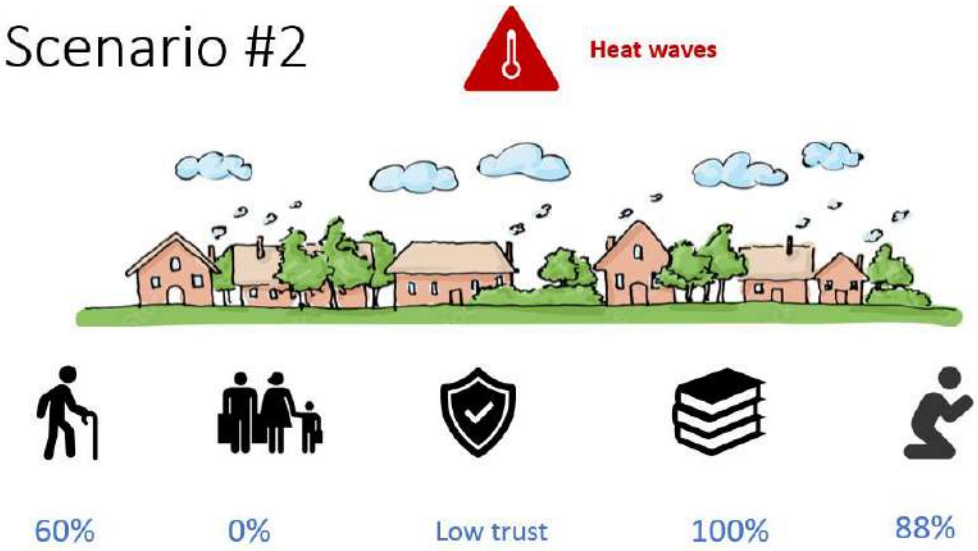

Figure 7 "Enhancing preparedness" scenario version 2

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3.2.3 INTERVIEW DATA ANALYSIS

The analysis of the interviews is divided into three parts. The first one is the thematic analysis which focuses on the analysis of the information the interviewee gave during the interviews. The second is the statistical analysis and visualization of how the participants rate the solutions based on their informality level. The last part is related to the formal solutions ranking section in the interviews; where we wanted to analyse how the selection of solutions differs depending on the context of the community. We used the Borda count method to devise this ranking.

3.2.3.1 Thematic analysis

We performed a thematic analysis [7] to analyze the data collected from the interviews. Our analysis was guided by the central constructs of the interviews and the questions covered within each. As a result, the key themes align with the questions, while sub-themes were identified under each question. For instance, if the main theme was the formalization process, sub-themes such as "barriers" and "enablers" were identified. The codes generated during the analysis correspond to these barriers or enablers themselves, for example, the availability of resources was found to be an enabling factor in the formalization process. Thematic analysis includes the following steps: data familiarization, initial coding, code merging, themes identification, themes revision, and themes naming.

3.2.3.2 The Borda Count Method

The Borda count method is a voting technique that is utilized in a variety of decision-making scenarios. The main idea is to assign a score to each alternative/option depending on the number of votes it receives in a certain rank. The option with the highest score wins the voting ballot, the option with the second highest score comes in second place, and so on [8].

For instance, if there are 5 ($n = 5$) candidate places to hold a meeting, and 100 people are ranking the places based on their preferences, hence, the meeting place would be decided based on the overall ranking of the people. To identify the ranking of the places according to all the participants in the poll, first, all the votes are collected. Second, the frequency of choosing each place in a specific rank is calculated (See Table 1). Third, the points associated with each place per rank are calculated (See Table 2). The total points assigned to each option equals $\sum_{j=1}^{n}\sum_{i=1}^{n}\left[(n-i+1) * freq_{j,i}\right]$, where $n = number\ of\ options = number\ of\ ranks$, i is the rank, j is the option. Finally, by looking at the "Total points" column in Table 2, we can see that place no. 1 ranks first, followed by place no. 3, followed by place no. 2, place no. 4, and finally place no. 5.

Table 1 The distribution of votes among ranks (Borda count step 2) [9]

Place no.	1st rank	2nd rank	3rd rank	4th rank	5th rank
1	19	50	9	20	2
2	21	11	37	19	12
3	32	16	15	35	2
4	20	13	33	21	13
5	8	10	6	5	71

Table 2 Scores calculation per each candidate place (Borda count step 3)

Place no.	1st rank	2nd rank	3rd rank	4th rank	5th rank	Total points
1	19*5 = 95	50*4 = 200	9*3 = 27	20*2 = 40	2*1 = 2	**364**
2	21*5 = 105	11*4 = 44	37*3 = 111	19*2 = 38	12*1 = 12	**310**

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3	32*5 = 160	16*4 = 64	15*3 = 45	35*2 = 70	2*1 = 2	**341**
4	20*5 = 100	13*4 = 52	33*3 = 99	21*2 = 42	13*1 = 13	**306**
5	8*5 = 40	10*4 = 40	6*3 = 18	5*2 = 10	71*1 = 71	**179**

3.3 Semi-structured interviews with Citizens

Similarly, to the previous section, interviews with citizens were carried out to gather the perspective of the citizens regarding their involvement in disaster management activities.

3.3.1 Sampling and data collection

To identify the citizens who participated in the interview we utilised the network of our partner Cittadinanzattiva. We wanted to capture the point of view of two types of citizens; the ones who volunteered in an organization related to disaster management (who has experience with the interview topics), and the normal citizens who deal with disasters without being part of an organized entity. All the interviews were done in Italian by our partner "Cittadinanzattiva" and then were transcribed and translated into English for analysis. Each interview lasted for around 45 minutes. We had five interviews in total, two of them were conducted in person and the other three were conducted over the phone. Participants had the right to withdraw from the interview at any time.

3.3.2 Interview Script and analysis

The interview is divided into three main parts. The first one is about the factors that motivate citizens to participate in disaster response activities. The second is related to how emergency services personnel treat the people who help during a crisis. The third is about how citizens perceive their role in disaster management. Below we will add a question(s) under each idea to guide the interview.

A disaster is defined as an unexpected misfortunate event with potentially catastrophic consequences. A disaster causes widespread human, material, economic, or environmental loss. Disasters cover a huge range of tragedies, from a rail accident where many victims and roads are blocked for hours, to more tragic events such as earthquakes and tsunamis.

The script of the interview could be found in Appendix 9.3. The consent form the participant signed could be found in appendix 9.5 (please note that it was translated to Italian).

The results of the interview were analysed using thematic analysis similar to section 3.2.3.1.

3.4 Workshop with Citizens in Rome

The workshop was organised by our Italian partner "DeepBlue". The workshop took place on the 30th of November, in Rome, in collaboration with an association that aims at raising citizens' scientific culture. The workshop aimed at investigating the citizens' experience in disaster management, particularly, their relationship with authorities; and understanding the extent of their decision-making abilities in the different phases of disaster management.

The workshop lasted for two hours and was conducted in Italian. The workshop included an introductory presentation, an open discussion with citizens, followed by a questionnaire that the participants were asked to fill in. The questionnaire could be found in Appendix 9.4.

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3.5 ETHICAL CONSIDERATIONS

Semi-structured interviews entail several ethical risks, especially when coping with emergencies and disasters. First, the interviewees are not always aware of the data they share with the interviewer due to the nature of a friendly conversation. Furthermore, sensitive issues can cause inconvenience to the interviewee, making the interviewer responsible for these inconveniences that can alter their health and well-being.

Following the protection measures of ENGAGE, which were set in deliverable 6.1, in the analysis of the interviews, we excluded all types of information that could identify the interviewee. All interviewees signed an informed consent form and a data privacy document.

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4 RESULTS

4.1 CHANGES IN THE CATALOGUE OF SOLUTIONS BASED ON THE VALIDATION RESULTS

Based on what was mentioned in Section 2, there is a necessity to adjust the catalogue of solutions. This is going to be an ongoing task till the end of the project, which will be reflected not only in this deliverable (D2.5) but also in other tasks in the project such as T3.3. Here, we are more focused on the solutions and their relationship with the identified resilience purposes and emergency organizations' needs of society (See D2.1, D2.2, D2.4).

4.1.1 ADJUSTED LIST OF SOLUTIONS

In D2.2 (the revised version) there were 169 solutions, throughout the project the list of solutions has changed. First, we kept only the implemented solutions and excluded the planned or proposed ones. This was done based on the end-users recommendations, also, it was hard to find detailed information about the solutions that were not implemented. Additionally, we excluded the solutions that were too generic such as using Radio and TV, and the ones that seem to be like a general recommendation such as dealing with fake news. Moreover, we added new solutions related to the chat-bots (D3.2 and D2.4) and replaced some of the generic solutions with specific running examples. This resulted in a final list of 86 solutions, distributed across different solution types as shown in Figure 8. We need to highlight that the list of solutions in the catalogue keeps changing based on the end-users and Ki-CoP recommendations, so this analysis was done based on the available list on the 1st of October 2022.

Comparing Figure 8 (new list of solutions) to Figure 9 (old list), we can see that the number of the solutions across all the types has decreased except for the "Incentives" type, it remains the same; 2 solutions; and "Apps" type, increased from 25 to 26. Moreover, the "Plans and Strategies" type is deleted from the new list.

Figure 8 Number of solutions per each type (new)

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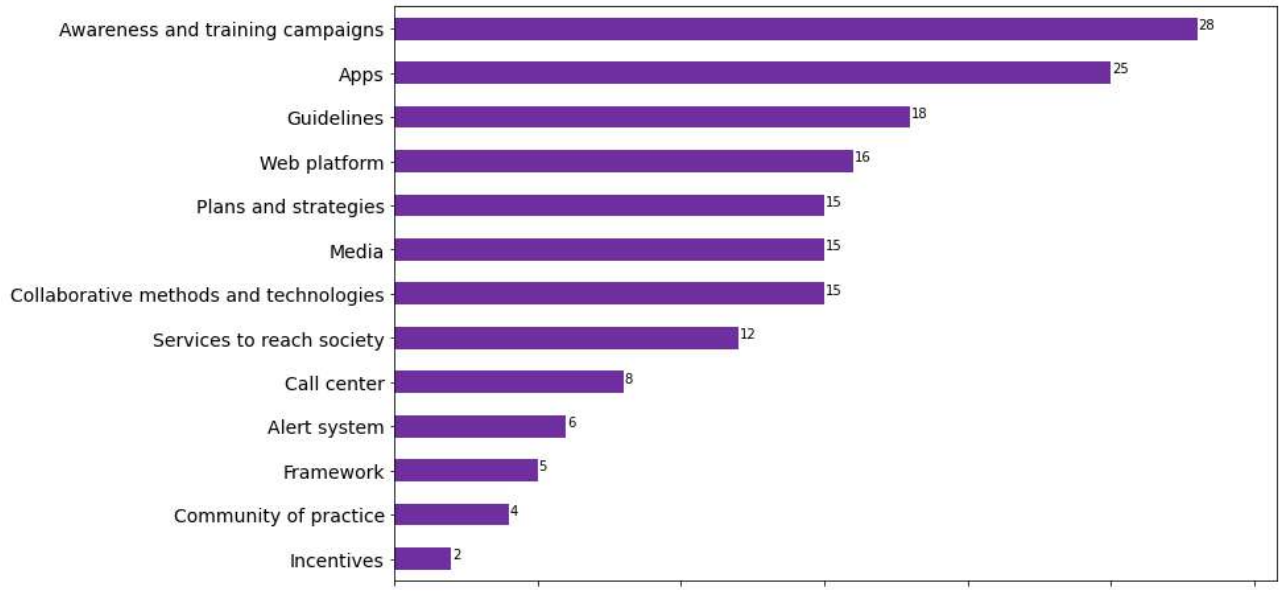

Figure 9 Number of solutions per each type (old)

4.1.2 GAP ANALYSIS OF SOLUTIONS VS RESILIENCE PURPOSES AND EMERGENCY RESPONDERS' NEEDS

Considering the new list of solutions, we reassigned the solutions to the different needs and purposes (as explained in section 3.1.1).

By examining Table 3, we see that the "Before" and "During" phases are covered by more solutions (almost 2.5 times) than the "After" phase. This aligns with the needs of the first responders, as they mentioned in the interviews (D2.1), they want the community members to have coping abilities. Because emergency responders have limited resources, they emphasize that community members play the most important role in this stage of the crisis management cycle. This lack of resources during the recovery phase is understandable because the role of emergency responders is limited to dealing with the emergency (e.g., wildfires); they are not responsible for housing people who lost their homes as a result of the disaster or rebuilding bridges that collapsed.

Table 3 Number of solutions per solution type per disaster phase

Solution type	Before	During	After
Alert system	0	3	0
Apps	12	22	4
Awareness and training campaigns	12	2	0
Call centre	1	5	1
Collaborative methods and technologies	6	5	4
Community of practice	1	2	1
Framework	3	0	1
Guidelines	4	3	2
Incentives	2	0	0
Media	3	4	1
Services to reach society	5	2	4
Web platform	5	10	2
Total[1]	54	58	20

[1] The total values here does not represent the total number of solution, as each solution could cover more than one disaster phase

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Figure 10 shows the distribution of solutions across different purposes. We can see that "Enhance preparedness" is the purpose covered by the highest number of solutions, while "Empower citizens in governance and leadership" ranks last. Comparing the ranking in the new list to the old list of solutions (see Figure 11), we can find that there are minor changes; three purposes stay in the same rank, while the other six change to one rank higher ("Facilitate quick recovery", "Promote efficient response" and "Enhance preparedness") or one rank lower ("Empower citizens in governance and leadership", "Enhance risk awareness", and "Improve communication"). Please note that in the graph a smaller number means a higher rank.

We can see that there is a lack of solutions covering the "Empower citizens in governance and leadership" purpose, this could be due to the idea that emergency responders sometimes see citizens as an obstacle in the disaster response efforts, they would like the community members to join organized volunteering groups and follow their instructions (see the results of the interviews in D2.1). Moreover, ordinary people's efforts to help others and themselves are hardly taken into account during emergency planning although they are always first at the disaster scene [10]. One of the KI-CoP members of the project mentioned that this could be due to a myth that citizens will panic and have irrational behaviour when a disaster happens and that there is a mentality of command and control in emergency organisations that don't allow for citizens to be part of the process, emergency responders do not recognize that citizens have different needs, priorities, and perspectives (they think that their point of view is inclusive and covers everything). The lack of solutions related to citizen empowerment also aligns with the findings of deliverable (D1.4) after analysing the different case studies.

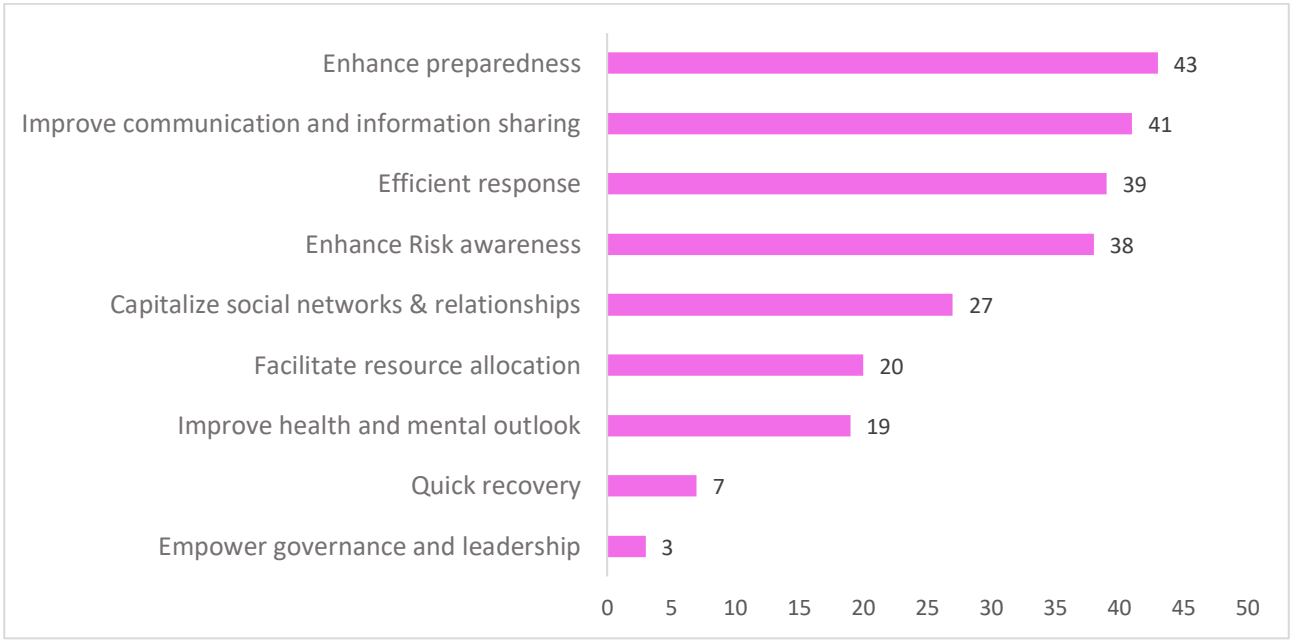

Figure 10 Number of solutions per purpose (new list)

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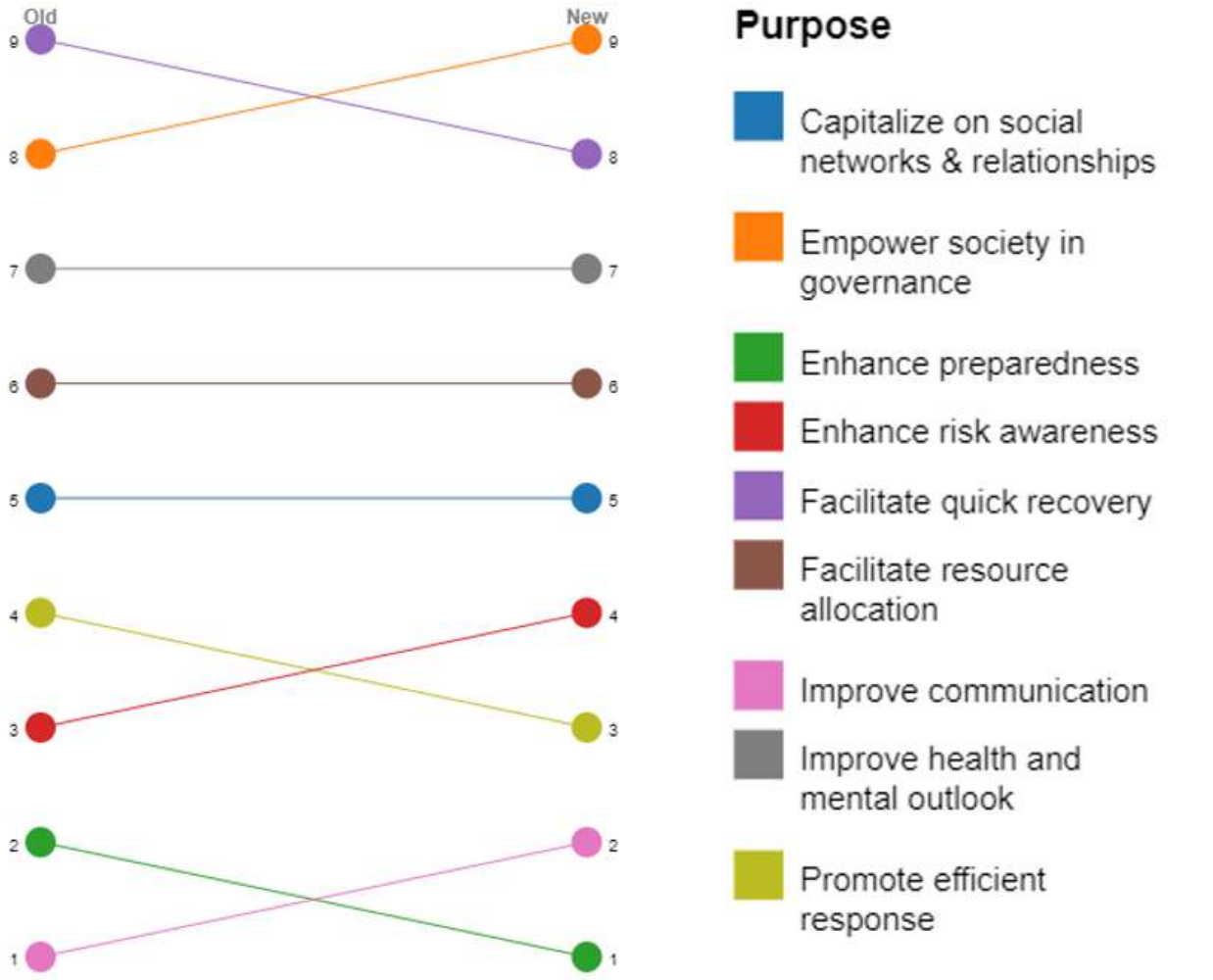

Figure 11 Change of purposes ranks between the old and new list of solutions. For example: Improving communications (pink line) was ranked number 1 in the old list, which means it was the purpose covered by the highest number of solutions, however, in the new list it ranks the second

Figure 12 gives more details about how the solution types address the different purposes; it shows the percentage of solutions in each type that addresses this specific need. For example, the 67% in the cell (Alert system, Enhance risk awareness) is calculated by dividing 2 (the number of solutions within the "Alert system" type) by 3 (the total number of solutions in the "Alert system" type). By examining the figure, we can see that research output, presented by frameworks, are highly focused on enhancing risk awareness and preparedness.

The solutions that cover the "Facilitate resource allocation" purpose are of different natures, not only depending on the solution type, but also the type of resources the solutions facilitate for their assignment, and the time frame. For example, 80% of the solutions under the call centre category cover this purpose; the type of resources allocated by call centres are mainly emergency responders (manpower), for example, firefighters, police, or paramedics; and the time scale is during the emergency and it should be very quick. On the contrary, the "Incentives" solutions are more into the long term and appear in the preparedness and planning phases, and they are associated with financial resources like the Community Rating System (CRS) program in the USA; the program incentivizes citizens with points and money when they follow some activities related to preventing floods. Web platforms, on the other hand, cover both emergent moments and the preparedness phase, for example, Crisis Information Management (CIM) solution in Norway, enables resource mobilization during a crisis, while a solution such as "Freiwilligenweb" is used for volunteers' recruitment before and during a crisis. Other platforms such as "Dopomoha" and "Hackney Wick

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Scrubs Hub" are used to collect physical resources such as food and housing in the first case, and scrubs and masks in the latter case.

Web platforms also facilitate "Efficient response" as they play a role in mobilizing volunteers and providing citizens with the needed information during a crisis. The same applies to "Apps", for mobilizing people, alerting them, and providing them with the needed information. Despite the benefits of using such technology-based solutions – we can see in Figure 8, that the majority of solutions come from these two categories- there is a question about the inclusivity of such solutions. Are they elderly or disability friendly? What about people who cannot afford to buy smartphones to access these applications and websites?

Furthermore, "Apps" and "Alert systems" are used to cover many purposes such as "Efficient response", "Improving health and mental outlook" and "Improving communication". Although both types of solutions could be used to achieve the same goals, for example, alerting the population about a specific thread using SMS in the case of "Alert systems" or notification in the case of "Apps", they convey a different behaviour of the population. In the case of "Alert systems" people are playing a passive role, they just receive the alert from emergency services without doing any action, on the contrary, in the case of "Apps" people need to go to the app store, download the app to get these types of notifications, in this case, members of the community are more active, and more willing to collaborate, even if it is just by trying to follow the official sources of information.

	Purpose								
Solution type	Quick recovery	Efficient response	Improve communication and information sharing	Empower citizens' governance and leadership	Improve health and mental outlook	Capitalize social networks & relationships	Enhance preparedness	Facilitate resource allocation	Enhance Risk awareness
Alert system	0%	67%	67%	0%	33%	0%	33%	0%	67%
Apps	4%	54%	58%	0%	35%	19%	50%	12%	46%
Awareness and training campaigns	0%	8%	17%	0%	8%	50%	100%	25%	75%
Call centre	0%	100%	100%	0%	20%	0%	0%	80%	0%
Collaborative methods and	0%	57%	29%	14%	29%	43%	43%	14%	57%
Community of practice	50%	50%	0%	0%	0%	100%	0%	0%	50%
Framework	0%	0%	33%	33%	0%	0%	100%	0%	100%
Guidelines	50%	50%	25%	0%	25%	25%	75%	25%	50%
Incentives	0%	50%	0%	0%	0%	0%	100%	100%	0%
Media	0%	25%	100%	0%	25%	25%	25%	0%	75%
Services to reach society	38%	13%	50%	13%	38%	63%	25%	13%	0%
Web platform	0%	70%	50%	0%	0%	40%	30%	50%	20%

Figure 12 Percentage of solutions vs purposes

Aside from the purposes, Figure 13 shows the distribution of solutions versus the needs of the members of emergency organizations. The figure is ranked from the need covered by the highest number of solutions to the one covered by the least number. Both the highest rank and the lowest ones are coloured red. "Having risk culture" is the need that is associated with the highest number of solutions (47 solutions) this is followed by the "Following authorities and emergency responders' recommendations" need (32 solutions). None of the solutions cover the need of "Showing appreciation to emergency responders" and only two are assigned to "Understanding the nature of first responders' job". These two particular needs were only mentioned in a couple of the interviews conducted as part of T2.1. Moreover, these two needs have indirect relationship to emergency management, they are more related to community members supporting and connecting with the human side of the emergency responders.

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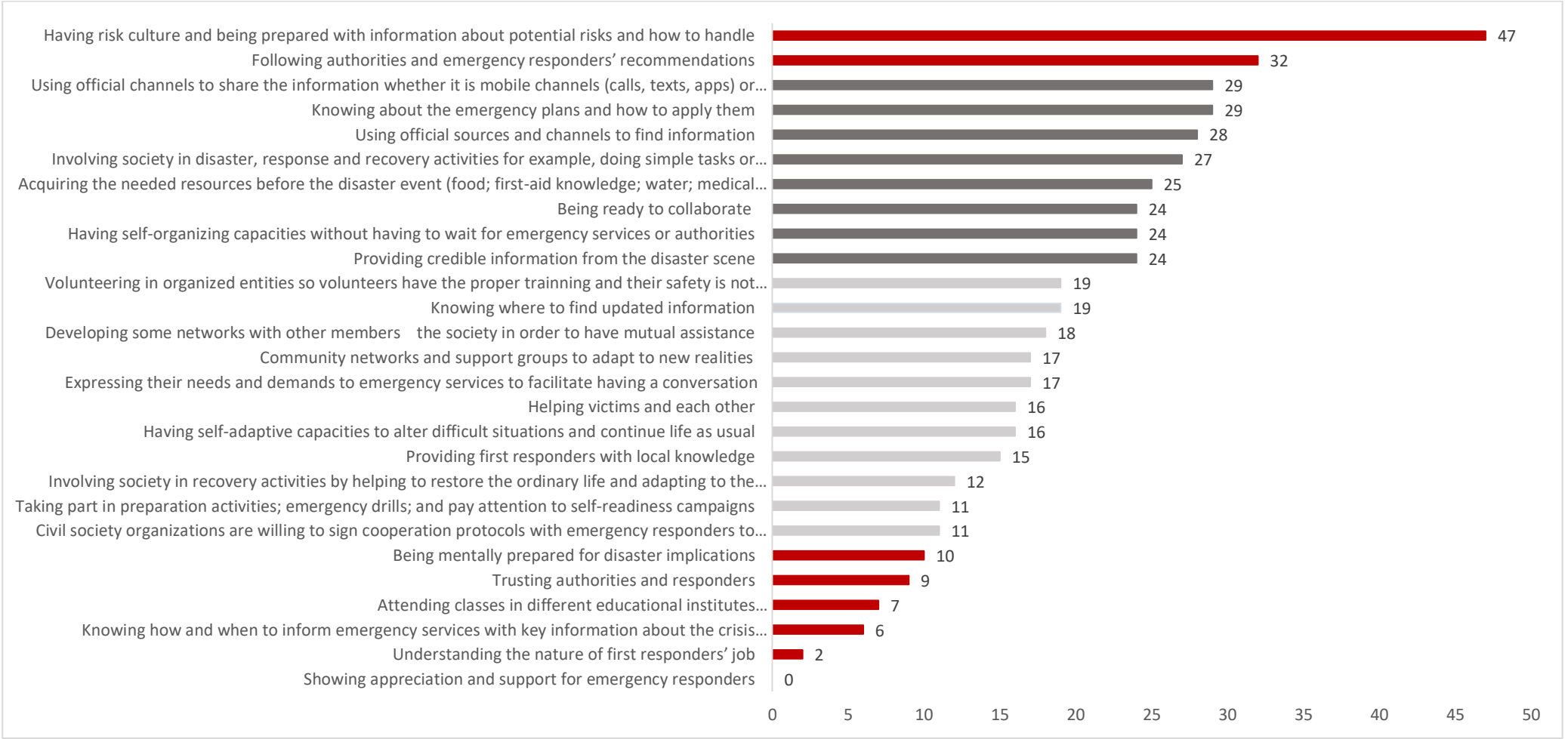

Figure 13 Number of solutions per need (the complete description of the needs can be found in Table 7)

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For further analysis, we conducted a correlation analysis between the different needs and purposes. Figure 21 (in the Appendix) shows the correlation matrix. The darker the cell, the higher the correlation between the two aspects. Considering a strong correlation exists when the correlation coefficient is greater than 0.6, we found the following strong correlations:

- **(N2)** Using official sources and channels to find information and **(N12)** Using official channels to share information whether it is mobile channels or social media.
- **(N2)** Using official sources and channels to find information and **(N4)** Knowing where to find updated information.
- **(N10)** Developing some networks with other members of society to have mutual assistance and **(N22)** Community networks and support groups to adapt to new realities.
- **(N10)** Developing some networks with other members of the society to have mutual assistance and **(P4)** Capitalize on social networks and relationships.
- **(N11)** Involving society in recovery activities by helping to restore ordinary life and **(P9)** Quick recovery.
- **(N12)** Using official channels to share information whether it is mobile channels or social media and **(P7)** Improve communication and information sharing.
- **(N22)** Community networks and support groups to adapt to new realities and **(P4)** Capitalize on social networks and relationships.
- **(N26)** Having risk culture and being prepared with information about potential risks **and (P1)** Enhance risk awareness.

Table 7 and Table 8 (in the Appendix) show the numbers and descriptions of the needs and purposes respectively.

4.1.3 THE FINAL LIST OF SOLUTIONS

Considering the results of the gap analysis, focusing on the resilience purposes, we did another round of search for solutions addressing the two purposes with the least number of assigned solutions; "Quick recovery" and "Empower citizens in governance and leadership activities". How we obtained the new solutions is described in the methodology section (3.1.2). We found 13 solutions covering the "Quick recovery" purpose, and 4 solutions covering the "Empower citizens in governance and leadership activities". Some other solutions were found during this search that does not cover any of the two purposes (Quick recovery or Empower citizens in governance), we included these solutions also, as they could be added to the Catalogue of Solutions and the Knowledge Platform.

After this second round of search, we can see that still we are lacking solutions covering "Empower citizens in governance and leadership activities" which align with the results of the first search and the findings of D1.4. This could be due to the top-down approach that the development of the solution follows, and that the solutions related to empowerment are grassroots-led movements that do not fit into the definition of formal solutions.

The new solutions cover almost all the solution types (Apps, guidelines…etc). Of the 13 "quick recovery" solutions, four are technology-related solutions (Apps and Web platforms). Three of these solutions were developed in Japan in 2014 and 2017 for use before and during a disaster. One of them called "goo Disaster" reliably searches for safety information and provides a map to locate evacuation centres and shelters, offering accurate information for timely recovery in the event of a tragedy. International travellers can also find accurate information through the "Safety tips" app that explains evacuation behaviour during a disaster, a communication card that can be used to receive information from Japanese people and emergency shelter information for quick attention. Also, the Japanese government has taken it upon itself to create its own "Japan official" app that has instructions on how to find emergency shelters, where to receive medical care and embassy

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information, and traditional communication cards with keywords for communicating with Japanese native speakers. Although not developed by government agencies but developed by students for an NGO in the USA, the "Shelter finder" website launched in 2018 aims to help civil society find shelter information such as capacity, occupancy, and location in the aftermath of a disaster. As can be seen in all four technology-related solutions, the aim is to provide citizens with timely information to respond quickly to an emergency without having to wait for emergency services.

Two of the solutions related to quick recovery are categorized as "Collaborative methods and technologies": "Software factory" and "Community lifelines implementation toolkit". Although the "Software factory" has not been deployed for general public use, a solution created in collaboration with academic institutions, start-ups, and NGOs can generate a set of computer-aided planning, engineering, and management tools. The solution comes from a paper that presents the initial results of a cloud-based solution called "Software factory" that produces software according to end-user requirements through an assembly process for communities that need specific locations and elements such as administrative portals, training application materials, and policy considerations for pandemics, disasters, and other emergencies. The second solution is developed by FEMA (Federal Emergency Management Agency) which aims to coordinate community partners with lifelines to ensure the uninterrupted functioning of important government and commercial operations and becomes a source of collaboration between the community and government agencies.

Three other solutions are guidelines: "Community Recovery Management Toolkit", "Roadmap to Federal Resources for Disaster Recovery" and "Pre-Disaster Recovery Planning". The "Community Recovery Management Toolkit" is also developed by FEMA. It is a guideline for recovery planning and preparedness principles. The materials in this toolkit have been developed with community leaders in mind and can be applied at any stage of the long-term recovery process following a disaster. They enable community leaders to rebuild quickly, build relationships with stakeholders, resolve disputes, and raise funds from various agencies to rebuild in a thoughtful, fair, and resilient manner. The "Roadmap of Federal Resources for Disaster Recovery", also produced by FEMA, focuses primarily on financial programmes as it includes a list of federal resources that are frequently used to improve recovery outcomes and can be used as a starting point to investigate other resources to accelerate recovery. Regarding "Pre-disaster Recovery Planning" was developed to assist local governments in creating a recovery plan that outlines recovery responsibilities and capabilities, organizational frameworks, and detailed policies and programmes. This solution was also allocated to the "empower governance and leadership" purpose since it advises the involvement of the entire community as preparedness is a shared responsibility. The guidelines encourage broad participation in an inclusive process to strengthen community buy-in and organizational support. Moreover, the solution fosters the involvement of stakeholders and divisions of local government that are not typically involved in emergency planning, such as those involved in organizations that support homelessness and housing, insurance companies, stakeholders in the environment and historic preservation, and many more. As can be seen in these three guideline-type solutions, all are government-derived and targeted at local communities affected by a disaster so that they can more easily navigate recovery either before, during, or after the disaster.

Another two solutions that cover the "Quick Recovery" purpose are categorized as a "Community of practice": "Community Recovery Committees" and "Building capabilities". The "Community Recovery Committees" is developed through a consortium led by universities and emergency response centres. The solution presents a deliberative democratic method of community engagement. It provides a clear summary of important ideas and supporting data, references to additional resources, and a 'tip sheet' that recovery workers can consult in the field. The "Building capabilities" solution was developed by the Australian government for accessing state government recovery professionals in advisory roles to local governments that do not have recovery management expertise. With the aid of knowledgeable individuals who can offer information on how to conduct and manage recovery, such as setting up arrangements (emergency management), this consultative method empowers communities to make their own decisions, thus, making it a solution suitable also for the "Empower governance and leadership" purpose.

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The last two solutions that cover the "Quick Recovery" purpose are "Layout of shelters and ways to use space" and "Insuring Against Disaster" which are assigned to the "Service to reach the society" and "Awareness and training campaigns" categories respectively. "Layout of shelters and ways to use space" is developed by the Japanese government and it includes services for society such as infographics about the locations of the shelters. The "Insuring Against Disaster" solution was developed in Australia to give financial help through a collaboration with insurance firms to provide inexpensive catastrophe insurance. The toolkit solution developed by Good Shepherd Microfinance was launched in 2019 and aimed to raise awareness so households may follow the procedures outlined in the toolkit to be financially prepared and recover faster from the effects in the aftermath of a disaster.

On the other hand, the "empower governance and leadership" purpose has only four solutions, two of which were already addressed previously in this section ("Building capabilities" and "Pre-Disaster Recovery Planning") since they are also covering the "quick recovery" purpose. The other two solutions were located in Afghanistan and Bangladesh to develop community resilience within the local communities.

The solution in Bangladesh called "Resilient agents" seeks to engage the community in disaster preparedness and resilience-building through a group of volunteers consisting of ward-level elected officials, Union Disaster Management Committee (UDMC) members, vulnerable women, social workers, and students based within their communities. They receive floods information on their mobile devices, including early-warning audio messages, which they use to create accessible warning and action messages for the local population. By establishing positive relationships and contact with local stakeholders, resilience agents supplement the shortcomings of the national early warning dissemination system by ensuring that the communities' needs are reported and appropriate support is supplied during a flood event.

Finally, in the mountains of Afghanistan, a new framework of early warning solutions for flash floods, debris flows, and landslides has been developed from an existing framework of early warning systems (EWS) for landslides, mudslides, and floods. The new framework aims to increase the coping capacity of the community and the resilience culture among communities due to limited ability for adaptation, deterioration of indigenous knowledge on hazards, gendered livelihood transition, and lack of public access to science-based information. The new framework has wider implications for effective governance and institutional arrangements for disaster management and emergency preparedness in particular hazards such as flash floods; heavy rain, debris flow, and drought.

4.2 List of Solutions

Table 9 in Appendix 9.6 shows the final list of solutions (112 solutions: the old 86 plus the new 26). The final list of the solutions with all the basic information (ex. date of launch, location, users, needs) could be accessed through the Knowledge Platform (https://engageknowledgeplatform.eu/#/)

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4.3 SELECTION OF THE SOLUTIONS BASED ON THE CONTEXT

This subsection presents the results of the last part of the interviews. We interviewed nine experts who work in emergency related organizations such as private sector, emergency organizations and humanitarian organizations. Six of the interviewees are experts in preparedness and the other three are communication experts. Only one participant is a woman.

4.3.1 RESULTS FROM THE DECISION-MAKING PROCESS IN THE INTERVIEWS

In this section, we present the results we got from the interviews about the selection process of new solutions to address a specific need. In this part of the interview, we were interested in investigating the criteria decision-makers use to select new solutions; whether these criteria are imposed by a specific government direction/orientation, by the population characteristics, or by the organization's resources.

4.3.1.1 Communication experts

Some of the factors influencing their decision-making process overlap, while others do not. Some of the overlapping factors are: 1) if the solution is broadly used by other units in the region, this makes it easier to apply the solution as it proves to be successful in other places and easier to use as most probably the person applying the solution would be familiar with them. 2) cost-effectiveness and resource availability. In the same direction, one participant mentioned that if their network of partners could use the same solution and hence share the expenses then the solution would be recommended for selection.

One of the factors that were mentioned only by one participant is the legality of the solution. Another participant who works in an NGO mentioned that the endorsement of an official to use a solution provided by them could help the solution to be implemented. Members of this NGO could develop solutions for their use as well as for use by official emergency organizations. Another participant who is an executive director in a humanitarian organization mentioned that they follow a different approach. First, there is a general assembly of all the executives from the local branches to put national plans; these plans are generic and include the overall goal of the plans of the local branches, for example, raising the competence of emergency personnel (preparedness guards). Second, the local branches start setting plans that align with the national goal(s). After setting the goal and sub-goal(s), to achieve these goal(s), the organization starts doing a context analysis of the population, for example, collecting some statistics about the demographics and the health status of the population in the city, and based on this, they start selecting and implementing solutions that cover these needs. To implement the solution, it should pass through one final step, which is board approval.

4.3.1.2 Preparedness experts

Based on the interviews with preparedness experts who work in emergency organizations, the private sector, and authorities; we identified three main themes from the interviews. First, is the theme related to the factors the decision-makers consider when choosing a solution to implement. The second one is how the decision is made, in other words, who decides on a specific solution. The third theme is related to the types of analysis the decision-makers do when selecting a solution.

The factors the participants mentioned that they considered in their organizations are:

- Budget availability (most of the interviewees agreed on this),
- Manpower availability,
- The legality of the solution and how it fits into the legal framework,

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- Scalability of the solution, for example, the solution could be applied to handle different types of disasters,
- The simplicity of the solution. This appears in two directions, building and applying the solution,
- The easiness of integrating the solution within the already existing system.

Concerning who decides on the solution, participants from the private sector and emergency organizations stated that the decision is made collectively through a working group. Another participant who works in an emergency organization mentioned that the emergency organization could ask the private sector to build solutions for them, or that the private sector could propose a solution, and the emergency organization could approve or reject it.

Finally, different types of analysis were mentioned during the interviews. A SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis of the proposed solution for example was mentioned by a member of the emergency organization. Moreover, Risk Analysis was stated by a member of the authorities in Norway. The same member of the authorities mentioned that they rarely do a population analysis, however, this is not the case for the other participants. One participant, who works in a private consultancy, mentioned that they do social research that guides the development of new solutions. Another member of a private company mentioned that they conduct a contextual analysis to analyse the situation in the country where they are proposing their solution; they investigate the legal situation and the characteristics of the population and their behaviour, for example, if people usually tend to be altruistic and trusting of other members of their community. A third member who works in a private company, that they consider the age of the individuals in the community while developing their solutions. Also, considering different characteristics of the population was mentioned by a member of an emergency organization, they take into account the minority groups and if the solution is oriented toward people who live in rural or urban areas.

4.3.2 Scenario and solutions ranking gathered from the interview

In each of the following subsections, we present the results of the formal solutions' ranking part of the interviews.

4.3.2.1 Improving Communication Scenarios

In the scenarios related to "improving communication" purpose, there were 9 solutions to be ranked based on their suitability to handle the fake news situation explained in 3.2.2. Table 4 shows the Borda scores and ranks associated with each of the solutions in the two scenarios. Some of the solutions share the same rank, for example in the first scenario, solution number 1 and solution number 7 share the same rank (rank 5); while in scenario 2, both solutions number 3 and number 5 share the fifth rank. Figure 14 visualizes the change in the ranking according to the scenario. From the figure we can see that two solutions (3 and 7) are context independent; their ranking did not change from one scenario to the other. Solution number 3 is a technology-based solution, while solution number 7 utilizes traditional media.

Please note that in both the table and the figure, we follow the standard competition ranking (1224), which means if there is a tie between two items, both are assigned the same rank. And then, the item that follows (in the score) is assigned a rank that is two values lower.

All the interviewees highlighted that social media acts as a source of fake news which is why they ranked it last as a solution to face fake news about the vaccine. Moreover, they emphasized that the level of trust in the government highly affects the choice of the solution, in scenario 1 the level of trust in the government was low but in scenario 2 the government was transparent, so the citizens trust the official information more. The change of the ranking was reflected in a decrease in the importance of depending on volunteers (VOST and Corona Loyals) to mediate the information and an increase in the importance of using solutions that are based on governmental data such as Corona

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dashboard, brochures, and covid call centre. On the other hand, the higher digital literacy level of the population in scenario 2, did not enhance the ranking of the solutions, for instance, solution 3 (mobile application) remained in the same rank, while solution 9 (software for information verification) dropped two ranks. However, the corona dashboard which is a technology-based solution also moved to a higher rank. The changes in the ranks of the corona dashboard and the verification software are due to trust in the government, not digital literacy.

Table 4 Borda rank of each of the solutions in the "Improving communication" set of scenarios

		Scenario 1		**Scenario 2**	
#	Solution	Borda score	Borda rank	Borda score	Borda rank
1	VOST: A team of trusted virtual volunteers that share useful information with citizens, amplify dissemination of key messages and verify fake news.	10	5	9	6
2	Corona dashboard: Online platform that provides information and statistics about the number of COVID-19 cases, bed availability, number of vaccines…	11	4	13	2
3	Mobile application for sharing COVID-19 vaccine related information, news and statistics that are verified by authorities.	12	3	12	3
4	COVID-19 Call centre	14	2	14	1
5	Corona loyals: Group of volunteers that mediate the corona and vaccine related information to other members of the society.	16	1	12	3
6	Brochures for encouraging the population to verify the information and for sharing information	6	7	9	6
7	Debriefing sessions in the TV: a representative of the ministry of health provides updated information and fact sheets about the vaccination status in the country.	10	5	10	5
8	Social media accounts that verify fake news.	2	8	3	9
9	Software that helps people verify the information such as Verifybly App (to get texts on your phone of verified information about COVID-19 as well as tips on how to spot false information in different languages and CVIX (site that includes a collection of videos, tutorials and resources that teaches you quick strategies to investigate information).	9	6	8	8

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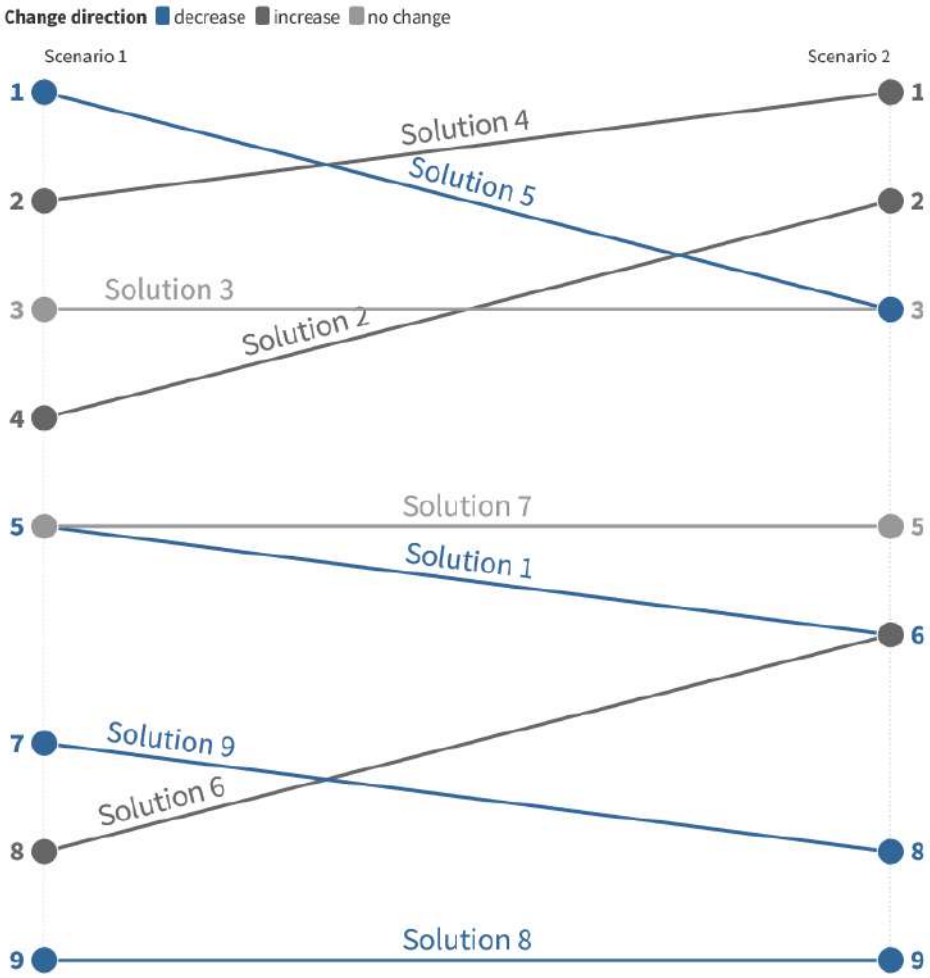

Figure 14 The change of solutions ranking from one version to another in the communication scenario

4.3.2.2 Enhancing Preparedness Scenario

In the scenarios related to "enhancing preparedness" purpose, there were 8 solutions to be ranked based on their suitability to handle the heat wave situation explained in 3.2.2. Two of these solutions are technology-based (mobile app for mobilizing volunteers, and information web pages), and one solution is a financial incentive. Three of the solutions are campaigns; two of them are interactive campaigns such as campaigns in senior citizens centres and schools, the third is less interactive, it is self-readiness campaigns brochures. The other two solutions are media related; one is campaigns on social media, and the other is campaigns on tv, radio, and in newspapers. Table 5, shows the collective Borda ranking of the solutions based on the two versions of the scenario related to heat waves. Two solutions maintained the same rank across the two scenarios: solution 1 (financial incentives) in rank 7, and solution 7 (awareness campaigns at senior citizens centres) at rank 1. One of the comments we got through the interviews is that the list of the solutions proposed in the exercise, vary among the time scale. For example, "financial incentives to adopt energy efficiency measures" is a long-term solution, if the heat wave is coming in two weeks that won't work. Also, "school training campaigns" solution does not have an immediate impact, compared to a solution such as social media campaigns for example.

Although there is a huge difference in the percentage of the elderly in the two scenarios, in the first it is 25% and in the second 60%; the "campaigns at senior citizens centres" solution ranks first in both scenarios; the interviewees consider that this is a high percentage of elderly in both cases. For the same reason, solution 3 (campaigns on the radio and tv) has a high rank in both scenarios, as traditional media is easily accessible by elderly people, however, it dropped one rank in the second

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scenario due to the lack of trust. "Social media campaigns" dropped three ranks between the two scenarios also due to the lack of trust in the government in the second scenario. Moreover, the lack of trust, also resulted in the "school training campaigns" solution to jump two ranks in the second scenario, since working with the children provides a good base to build trust in the long term, and they are good mediator of the information the learn in schools to their family members.

Table 5 Borda rank of each of the solutions in the "Enhancing preparedness" set of scenarios

		Scenario 1		**Scenario 2**	
#	Solution	Borda score	Borda rank	Borda score	Borda rank
1	Financial incentives to the citizens to adopt energy efficiency measures and green infrastructures such as green roofs and green walls.	20	7	19	7
2	Social media campaigns about the risks of heat waves and how to mitigate them.	30	3	20	6
3	Campaigns on the radio, tv, and in newspapers about the risks of heat waves and how to mitigate them.	36	2	30	3
4	Mobile application for managing and mobilizing the volunteers in case of a heat wave.	24	5	27	4
5	Web pages include information on how to prepare for a heat wave.	23	6	19	7
6	School training campaigns about best practices to face the heat wave.	25	4	34	2
7	Awareness campaigns at senior citizens' centre.	39	1	40	1
8	Self-readiness campaigns brochures.	19	8	27	4

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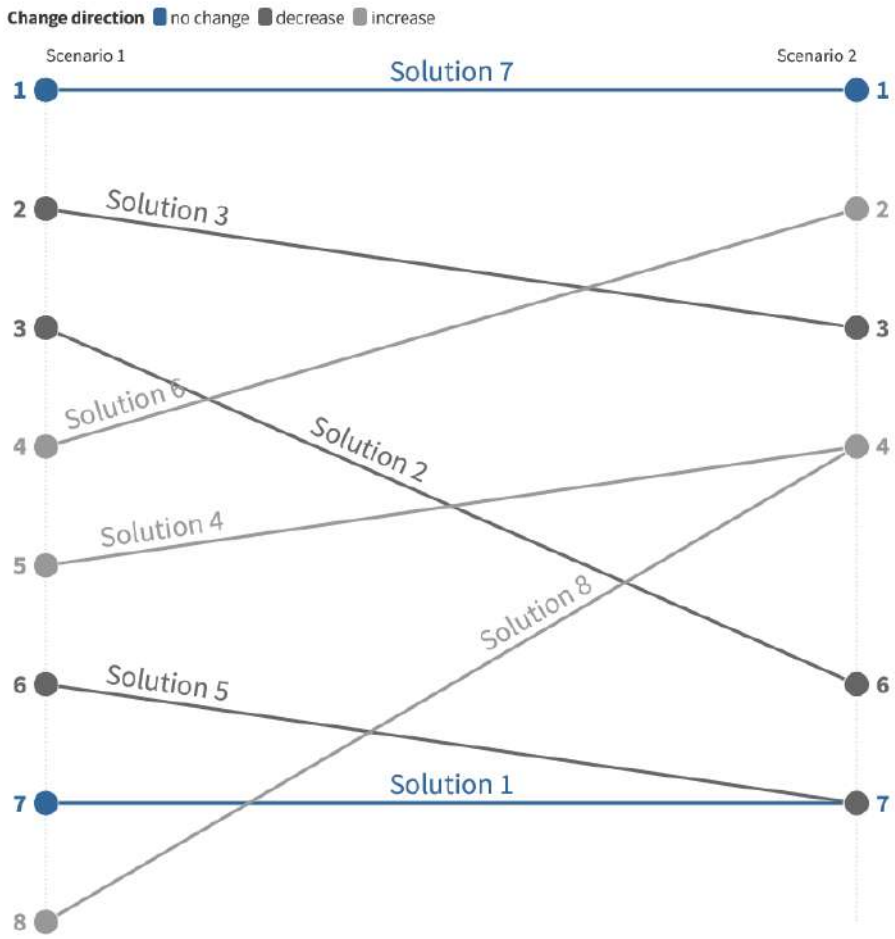

Figure 15 The change of solutions ranking from one version to another in the preparedness scenario

4.4 FORMAL VS INFORMAL SOLUTIONS BASED ON THE CONTEXT

Disasters are becoming more and more complex and uncertain and therefore many times the already established plans and procedures are not suitable or enough to handle the situation. The already established formal solutions might not be sufficient and therefore, new solutions might be created on the fly. In these situations, improvisation is required. In turn, improvisation has become an inherent feature of today's disaster management [11], [12]. Improvisation can be defined as the spontaneous and creative process of trying to achieve a target in a new way because the already established ones are not suitable or not enough to obtain the target [13].The improvisation in emergency response activities can range from a slight deviation from an already established approach (adapting to the new situation) to a complete change needing to develop new approaches from scratch [14], [15].

Although improvisation will be necessary to deal with disasters, being well prepared and having good preparation beforehand will reduce the need for improvisation [16]. In addition, having a well-nurtured and integrated response network before the disaster occurrence will increase the capacity to improvise [16]. Good planning and preparation enable flexibility, a shared vision among the stakeholders, awareness of potentials and weaknesses, and fluid communication that eases the improvisation during a disaster response.

Therefore, societal resilience is conceptualized as the potential of all social actors, formal and informal, to cope with an adverse situation taking into account the social context influencing this potential. This adaptive capacity that characterizes resilience should integrate both formal and informal disaster response mechanisms that go beyond the established plans and procedures and integrates formal and informal actors.

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Formal disaster response is composed of formal structures that involve formal disaster response agencies such as governmental-level emergency management agencies and departments, first responders (firefighters, police, medical services, coastguards, etc.), institutionalized non-profit organizations (Red-cross), and private corporations. These formal actors are coordinated through already established procedures, standards, and rules, and roles and responsibilities are already clearly defined. To provide support to these activities, they create and develop a wide range of products and services that in the context of this project is labelled "formal solutions". Examples of these formal solutions are early warning systems, apps, and web platforms to share information with the citizens, social media channels to communicate with the citizens, emergency awareness and preparedness campaigns, emergency drills, etc.

However, disasters evolve unpredictably, and formal disaster response is often not enough to cope with the situation since they lack flexibility and effectiveness. Formal disaster response functions very well when the emergency is well-defined and can be dealt with the already established formal plans and procedures [17], [18]. However, its effectiveness decreases for large disasters when multiple hazards occur in a short period, the resources are not enough to deal with the situation, the involvement of several agents is required for the response, and the information is lacking to properly make decisions.

The hierarchical and centralized structures in formal response decrease the flexibility in actions, and the vertical coordination and communication may hamper the horizontal coordination and communication and consequently delay the decision-making. Furthermore, formal procedures used to provide aid to the citizens may not reach the most needed people since they might not be "legible" to take this aid, or in case of disability, they cannot reach the point of assistance. In response to this, informal disaster response might present an opportunity to overcome these challenges and improve the response in case of large and unpredictable disaster situations.

Informal disaster response is constituted of groups of citizens that are not previously organized that come together because of the disaster to cope with it. They are characterized by their fast organization through both local and digital networks and include current citizens from the local population and community leaders often supported by grassroots and non-profit networks already established and operating in the area. These groups have decentralized and horizontal structures that facilitate the flexibility and rapidness for adapting to the new situation. They are open groups that share a sense of belonging to a community. These groups are close to the local community which facilitates the identification and assessment of the needs of the local population and neighbourhoods and the dissemination of this information to the authorities and formal emergency responders. These groups are self-organized and often develop products and services to cover the needs of the public that formal response agencies cannot address such as online disaster maps of the affected areas, timely and accurate disaster-related information, and the allocation of relief resources. However, many times, they do not have enough capacity to cover all the needs of the local population. Informal groups have a comprehensive mapping of the needs of the population but they lack the professional capacities to deal with the situation [19], [20]. Therefore, the integration of both formal disaster response and informal disaster response is of utmost importance to deal with current disasters.

In practice, the response operations might not be totally formal or informal, but they might be along a continuum line between formal and informal responses. For example, an emergency manager might follow an already established procedure for communicating with another emergency service, however, use different communication channels from the ones identified in the formal procedure.

Based on this understanding, we define the following conceptual framework that characterizes the formality level of the response based on two dimensions: the actors involved in the actions and the level of formality of the implemented procedures, actions, or solutions. Some of the examples of how the solutions are characterized based on the framework are shown in Figure 16.

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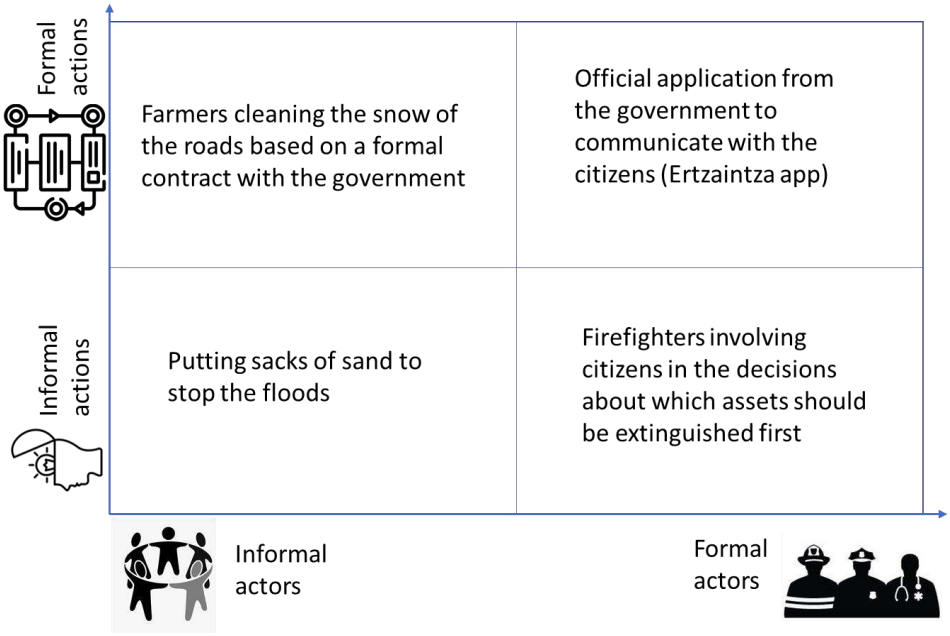

Figure 16 Formality-Informality Framework

Literature defines the following aspects to determine whether a solution is formal or informal [21]–[28]. These aspects are also thoroughly explained in *D2.2: Formal solutions to improve societal resilience.* These aspects are the efficacy of the solution, the efficiency of the solution, the uncertainty of the situation, the legal framework supporting the solution, bureaucratic delay to include in the plan or procedure, coordinated action required for the implementation of the solution, predicting the overriding of the actions, supporting tools needed to carry out the solution, and to what extent the stakeholders are part of the official team.

In addition to the perspective from the literature, we wanted to explore and better understand from the point of view of the practitioners the difference between formal and informal solutions and the aspects that are considered for their differentiation. In the interviews conducted with the emergency managers, we presented several examples of solutions and we asked them to define on a scale from 1 to 5 the formality level of the solution being 1 extremely informal and 5 extremely formal.

Figure 17 represents the results obtained from the semi-structured interviews.

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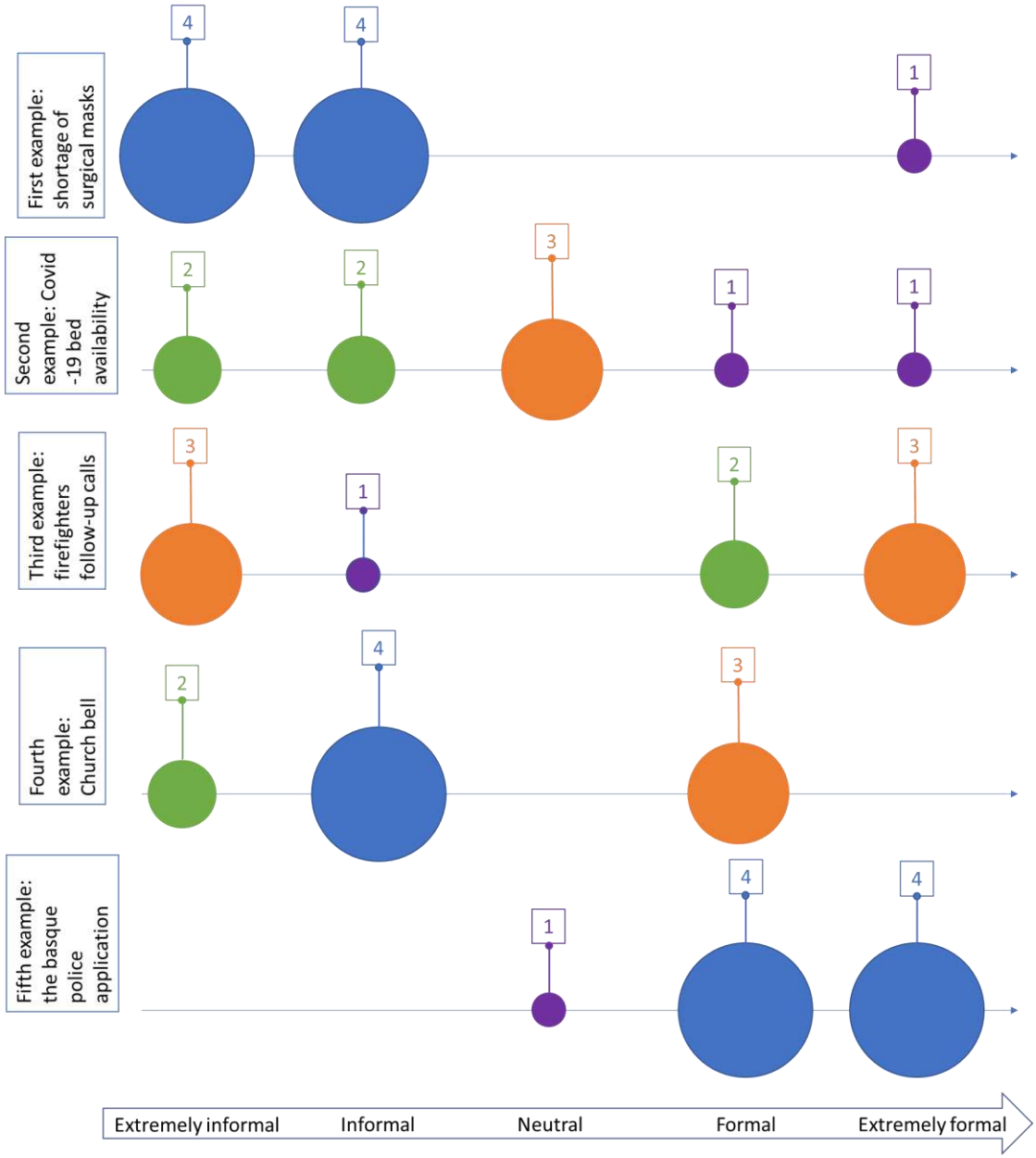

Figure 17 Results of the extent of formality of a solution exercise in the semi-structured interviews

As can be seen in the graph, in most cases there is a diversity of opinions about the formality level of the solution. The interviewees had a different understanding of the meaning of when a solution is formal or informal. In the first example, the one regarding the shortage of surgical masks, most of the participants agreed it is an informal solution except for an interviewee who argues that this solution had the approval of the WHO, a reference institution in the health issues, and this approval makes the solution to be formal. During the interviews, the participants emphasize the importance of the time frame for this solution, since in the short term it was an informal solution put in place to handle the situation but in the long term it became part of a formal procedure getting the approval of governmental bodies.

In the second, third, and fourth examples, there were a variety of opinions with a low level of consensus among the participants. In the example related to the problem with bed availability in the COVID-19 case, four participants thought the solution was informal, two said the solution was formal and three participants thought it was in the middle. The ones who thought it was informal gave the following justifications. One of them considered it as informal because the solution was opportunistic, innovative, and not part of the current emergency activities. Another one justified by saying that the solution was not legally backed and therefore it could not be considered formal and another one

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justified from the perspective of the patients, arguing that they would see it as an informal procedure since when they go to the hospital, they expect them to be treated there. The last one looked at the solution as a bottom-up approach with a high degree of flexibility, initiated by a single doctor from personal initiative.

In the third case, the one related to firefighters' follow-up calls, the opinions were almost equally distributed between formal and informal. The ones who defined the solution as informal justified by saying that this procedure was established in the protocol. Another one thought this is a way of proceeding from "an angry professional" who is annoyed by the bureaucracy of formal procedure. The interviewees who located the solution on the formal side argued that the firefighters already use the formal procedure to notify of the incident, and that sending the emails and the calls were extra steps to facilitate the work. The interviewee also emphasized that the action was formal because it was replicable and transferable enhancing the response process and, at the same time, easing tracking the calls and identifying the responsible person.

In the case of the church bell example, most of the participants argue that the solution was informal. However, the participants thought that this solution could be considered a formal solution if it was well-defined and considered in the way of proceeding in the protocols, it is replicable and repeatable, and it is effective in alerting the population when a disaster occurs.

Finally, concerning the last example related to the Basque police application, all the interviewees placed it on the formal side. One participant commented that he/she placed the solution as formal and not as extremely formal because no law obliges the citizens to use the application. So it is a solution developed by a formal entity and there are some formal procedures on how to use it to share and disseminate information but there is no obligation for the citizens to use the app.

Based on these examples and the arguments gathered from the interviewees, we found that the criteria used by the participants to define if a solution is formal or informal are closely related to the ones in the literature (see D2.2). However, the participants did not mention all the criteria defined in the literature.

Uncertainty of the situation, the legal framework that supports the solution, the stakeholders that create and use the solution, and the bureaucratic delay when establishing formal procedures are the criteria that the interviewees mentioned during the interviews. Concerning uncertainty, when the situation is vague or new and hence, there is no plan or formal solution at hand to cope with the situation, then solutions are informal. Many times, in unpredictable situations, the pre-planned solutions fail which requires the emergency managers to improvise new solutions following the instinct of the people. Furthermore, informal solutions are used in particular situations or special cases where emergencies do not follow generalized situations.

Regarding the criteria of a legal framework, the participants highlighted that solutions are informal when they are not backed by a legal framework or a governing structure. In addition, solutions are considered informal when the stakeholder who is implementing had no legal responsibility, such as in the case of the church bells with the priest; if the priest does not ring the bell to alert the people, he is not going to be held accountable for anything that would happen. Therefore, the less accountability the stakeholder has the more informal the solution will be. Finally, they mentioned the aspect of bureaucratic delay. Informal solutions are faster and more flexible compared to formal ones since they do not require formal approval from bureaucratic institutions for their implementation. Table 6 summarizes the criteria and the related aspects mentioned by the interviewees although, as mentioned earlier, we consider that solutions are not completely formal or informal but they should be placed along a continuum line between formal and informal.

Table 6 Informality criteria based on the interviews

Criteria for informality	Related aspects

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Uncertainty of the situation	No formal solution is in place Pre-planned solutions fail New situations Improvisation Special cases where generalized procedures are not working
Legal Framework	No governing structure assigned No legal responsibility
Stakeholders	Individuals with fewer managerial roles in disaster management
Bureaucratic delay	Informal solutions provide more flexibility Informal solutions are implemented faster

4.5 CITIZEN-DRIVEN EFFORTS

To investigate the role citizens can play in disaster management and in resilience in general we conducted interviews with both members of emergency organizations (section 3.2) and interviews with citizens (section 3.3) to capture the two perspectives. Moreover, a workshop with citizens in Rome, Italy was conducted as part of the efforts for T5.6, the main outcome of this workshop would be included in the results sub-section related to citizens. T5.6 covers the methods for engaging citizens, first responders and authorities in a cocreation process for building resilience. We will start by summarizing the findings of the emergency responders' interviews, followed by the ones from the citizens.

4.5.1 EMERGENCY RESPONDERS' PERSPECTIVE

From the emergency personnel interviews, we identified three main themes. First, how emergency organizations incorporate citizens and their efforts to build a resilient society. Second, what the pros and cons of including citizens are. Third, some examples of solutions driven by community members.

Emergency organizations incorporate citizens in two ways. The first is through adopting some of the initiatives or solutions they propose. For example, in one of the interviews with a member of a humanitarian organization, the interviewee mentioned that they had a process to incorporate citizens' initiatives. Individuals identify their needs and sometimes a solution and explain these needs to the people in the organization. Then the organization has an internal validation process, this validation is done using a group of employees in the organization (2-3 people); the validation process includes studying the formality of the proposal and if it is a general need that touches the lives of many people, also, if they have enough resources to carry out the initiative/solution. Then, the solution is approved or not. Moreover, a member of emergency services, mentioned that sometimes the private sector proposes a solution to the government and then the government assesses its validity and effectiveness and adopts it. For example, an NGO proposed a package of applications to the Romanian government, these applications addressed issues related to the Coronavirus such as fake news detection, resource pooling for humanitarian aid, and another application to show the statistics about the COVID cases and so on.

The second way to engage community members, is by including them in community council meetings for example, in this manner people are part of the planning process and their ideas are appreciated and sometimes implemented. For instance, one interviewee mentioned that in one neighbourhood there were many bike thefts, some people suggested deploying a security camera system, and they specified the locations where these cameras should be put. The municipality installed two cameras in the specified locations, and this resulted in fewer bike theft incidents.

Involving citizens in resilience-building efforts could be a double-edged sword. First and foremost, they should be included because they are typically the victims of any event. By involving them in the process, citizens gain a better understanding of the situation and are less likely to criticize

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emergency responders. Moreover, it enhances social capital, as people meet more and discuss more about what is happening in their community, so they build trust and work together. Also, citizens' involvement provides emergency responders with local knowledge during the event. Furthermore, citizens could always help in things that emergency responders do not set as a priority, for example, saving animals.

But, on the other side, involving citizens could be dangerous and harmful to them, especially if they are not organized. Furthermore, the lack of organization could lead to unpleasant results. For instance, in Norway, and during the Ukrainian-Russian war many people wanted to help by donating clothes and food, however, these things were not suitable for the refugees, for example, the clothes are too big or too small. Also, some of the refugees' shelters were drowning and there was no place for all these clothes and food. Most of the interviewees highlight that citizens' efforts need to be organized to get the most out of it.

One example of a solution provided by community members is the earlier-mentioned bike theft. Another issue was that people did not want to quarantine in hotels during covid, preferring to stay at home. As a result, some police officers formed a task force (retired cops) to visit people at their homes and ensure that they did not need anything and were quarantined. This occurred as a result of a shortage of doctors. Another example is when emergency responders ask random people on the street to translate because they do not speak the language of the person involved in an accident.

4.5.2 Citizens' Perspective

Regarding the citizens' perspective, we had five interviews; three of them were with people who worked in emergencies as volunteers or activists, and two of them were with "normal" citizens who do not work in an organized entity. Three of the participants were female and the other two were male.

In the workshop, there were around 60 participants. 40% of them were part of volunteering organizations, 20% are spontaneous volunteers, and the other 40% has no experience as volunteers.

Asking the participants about what made them willing to respond to a disaster, we got different responses according to the responder profile. Volunteers or activists were driven by the common good and the well-being of society. For example, one participant said that she grew up in a family of volunteers and activists which made it normal for her to help others and made her more empathetic toward those who are suffering. On the other hand, normal citizens are more driven by their survival instinct and their sense of responsibility toward others when there is a dangerous situation. Another factor that appeared as a driver to participate is related to the direct involvement of a disaster, when people face disasters and are impacted by them, they tend to help more in disaster response. The same conclusions are derived from the workshop.

In the same vein, when we asked the interviewees if they participate in emergencies that have a closer impact on their belongings or loved ones, three of them mentioned that this is not relevant and does not impact their participation. Another interviewee mentioned that yes, she is more involved when there is a direct impact on her and her family. The last participant mentioned that somehow everyone is impacted by disasters, and if they can help, they should actively participate.

Moreover, we asked the participants how their intervention in disasters is concerning the government's role. We got two different directions of responses. The first one is related to more participation in case of the governmental absence. In this case, citizens try to fill the gap that exists because of the delay or the lack of intervention from the government side. The second direction is related to the tendency of citizens to collaborate more in case the government is playing an active role in managing the situation at hand. For example, one participant mentioned, "Where there is a lack of local government, volunteerism also suffers from this absence and struggles to recognize the supportive activities to which they can contribute."

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Then, regarding the barriers that stop citizens from participating in disaster response activities, all the participants mentioned the lack of training as the main obstacle that stops them from participating. This lack of training makes individuals susceptible to harming themselves and others. This aligns with emergency responders' point of view of why not to include citizens in disaster-related activities. The lack of knowledge is another barrier, whether this knowledge is about what to do in the case of a disaster, how to act, where to go, who to contact; or knowledge of the organizations that could support in these moments. Furthermore, the participants mentioned that sometimes it is difficult to know how to contribute, as they should be included in an organized volunteering entity and sometimes it is difficult to join one of these entities especially if they are not trained and there are few training initiatives, and they are not accessible. In the same vein, there is an absence of a public point of reference that can channel the availability of "latent" and/or potential human resources (even at later stages). One last barrier is related to the emergency organizations' attitude toward citizens, authorities do not listen to citizens and there is no venue to facilitate this even before the emergencies, there is a lack of discussion and upstream moments of sharing the citizens' concerns and problems. Also, when the authorities do not pay enough attention to people's problems, citizens start to distrust them, and they surrender and stop trying when faced with something out of their reach.

The participants in the workshop mentioned similar things related to training, information, and organized volunteering. They mentioned that they would like to be prepared with all the information and skills that would allow them to better handle disasters. However, most of the trainings they attended are not localized nor contextualized, they are more theoretical or done just to satisfy the requirements of the law, but they are not useful for them. Moreover, they confirmed the point of the interviewee that there is no venue for discussions especially with the authorities, they can sometimes, exchange opinions and experiences with other volunteers but not with official organizations.

Furthermore, when we asked the participants if their gender impacts their role in disaster management all of them said that they had not thought about it before. Then they followed up by saying that the ability to respond to emergencies depends more on other individual factors, such as health conditions, and physical fitness.

Regarding if the help of citizens is being appreciated by the emergency responders, two of the participants who were engaged in organized volunteering organizations mentioned that their help was appreciated and welcomed when their engagement was structured and well-coordinated with the emergency responders. One of the non-volunteer participants, on the other hand, mentioned that she tried to alert the fire department about a fire that happened while she was on vacation in an isolated area on the outskirts of the city, but they were not responsive and considered her as *"a troublemaker, telling them how to do their job"*. The participants in the workshop also mentioned that their efforts are appreciated if they are part of an organized entity, otherwise, the authorities ignore their role, especially after the first phase of an emergency.

The interviewees mentioned that emergency services utilized their help in the areas or activities that were not covered by dedicated emergency personnel. They usually ask them to help in simple tasks that do not require specialized skills, such as disseminating information on the ground and giving non-medical assistance to vulnerable people such as the elderly, children, the disabled, etc.

The final part of the interview covers the citizens' perceptions about their role in disaster management. 60% of the participants emphasized that the most important phase of a disaster for citizens to participate in is the prevention phase. This should be accompanied by providing citizens with disaster-related information and training sessions. The need for training and information was emphasized by all the participants, including the 40% who see that citizens should participate more in the response phase, not prevention, as prevention is more related to strategic planning for risk reduction.

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Figure 18 shows a summary of both perspectives of the emergency responders and citizens regarding three common points; training, organized volunteering, and community meetings. The emergency responders' point of view comes from the interviews conducted in this task T2.5 and the ones in T2.1. Emergency responders want citizens to attend training sessions, citizens would like to attend these sessions, and they believe in their usefulness, however, they see that there is a lack of training initiatives, and the available sessions are not practical enough and not customized to the needs of their communities. Concerning the organized volunteers, emergency responders prefer to work with organized volunteers and appreciate their assistance and efforts. On the other hand, citizens claim that it is difficult to join volunteering entities. They also emphasize that when they join such entities they have a higher sense of responsibility towards their communities. Lastly, some emergency experts state that community meetings are a great opportunity to include citizens in the decision-making process about their community, however, citizens complain about the lack of these types of meetings and say that there is no opportunity for upstream discussions.

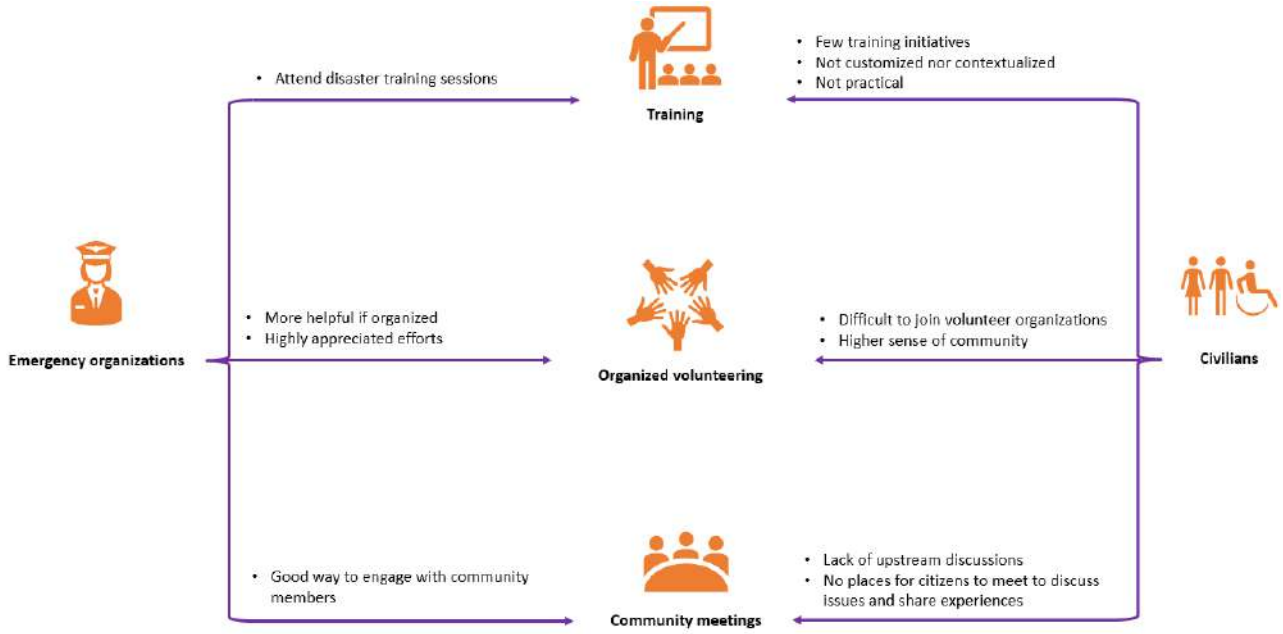

Figure 18 Emergency responders VS citizens' perspectives

4.6 INFORMAL SOLUTIONS

This research defines societal resilience as the potential for all types of social actors, formal and informal, to cope with adverse situations and the social context influencing this potential. This definition presents many challenges but at the same time exhibits the main potential to impact societal resilience.

Social actors are complex systems acting unpredictably in a non-linear fashion and are self-organized. Disaster professionals, on the other hand, act guided by planned norms, a division of labour, and predefined tasks. Therefore, how the link between these two groups might be possible needs to be understood. And this challenge, in turn, exhibits the main goal or ambition of the ENGAGE project: improve the interactions between formalized and non-formalized actors coping with disaster needs. We need to explore how the informal groups could be involved in formal disaster response and interact with formal disaster actors considering that citizens will continue behaving based on social scripts and improvised actions.

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4.6.1 DEFINITION OF INFORMAL SOLUTIONS

In this section we revisit the definition of informal solutions we had in D2.3 based on the findings of the interviews conducted with emergency experts. Example number 3 and number 4 in section 3.2.2 were mentioned in D2.3, and examples 1 and 2 are new examples that we thought could be helpful in redefining informality. Based on the discussions in the interviews, the classification of example number 3 changed, for example in D2.3 it was defined as informal, but here, it is on the line between formality and informality. Based on such a change of perspective we are redefining the informal solutions.

We describe informal solutions based on two dimensions: the stakeholder who implements the solution, and the planning level of the action or procedure (see Figure 16). If the solution is created and managed by informal groups, regardless of the planning level of the action or procedure, we consider it an informal solution. In case the solution is developed or managed by a formal group, the action or procedure should deviate from the already planned and established actions to consider it informal. Below we describe more in detail when we consider solutions as informal.

Who applies informal solutions?

Informal solutions might be created and adopted by either informal groups or formal disaster response teams. In case the solution is created, managed, or implemented by citizens, then the solution is considered informal since the citizens do not have any accountability nor legal responsibility if the solution is not working properly. However, in case the solution is created, managed, or implemented by formal response groups, to consider the solution as informal, the solution should be different from the already established and planned solutions (as have been explained in section 4.4).

Why and when are informal solutions applied?

Citizens are often the first on-site during a disaster and they are forced to cope with the situation during the unfolding of the event and until the formal response teams arrive. In these situations, they rely on their social and professional skills and the roles they occupy in their daily lives to provide support. In these situations, they put into practice coping actions to deal with the situation that is represented as informal solutions.

In the case of formal actors, informal solutions are adopted in the following situations (See D2.3):

- Bad planning and preparedness: knowledge about the situation exists but there are no formal solutions already incorporated in the response plan, forcing the adoption of solutions that have not been tested or validated beforehand.
- Lack of appropriate resources: lack of resources needed to implement the formal solution could force to improvise new solutions or new ways of implementing the formal solutions to deal with the situation.
- Uncertain situations: despite the efforts to cover all the possible contexts in disaster planning, it is impossible to consider all of them. Lack of information or incomplete and unreliable information about the disaster could also create unforeseen situations. In the case of these situations, informal solutions need to be created and implemented without the guarantee of their success.

How informal solutions are applied?

Considering the citizens, informal solutions are the representation of the coping actions that have been defined in WP1. When responding to disasters, informal actors will take decisions and conduct actions that will affect and restructure the disaster management process, reorganizing the effects. These coping actions can be performed both individually or collectively and make the society actively transform a disaster situation. These coping actions are materialized through informal solutions that are created and developed to cope with disaster situations.

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In the case of formal actors, when already established and planned solutions are not enough to deal with situations due to previously mentioned circumstances, alternative solutions should be implemented, what we call informal solutions. Sometimes, informal solutions represent a minor deviation from a formal solution, other times, solutions need to be created from scratch. However, in general, formal response groups are careful when implementing informal solutions, since, in case the solution fails, they are accountable and have a legal responsibility for possible damage. This was the case for example of the coast guards in Gulfport, Mississippi when Hurricane Katrina hit the region. They can act relatively autonomously in the field and therefore, looking at the inactiveness of official emergency services in the response to the catastrophe, they started operating outside of their regular functions, and involving in the rescuing missions in flooded areas. They were able to rescue families trapped in attics by axing through rooftops. On the other hand, due to unawareness and passiveness of the government, citizens start rescuing and providing shelters to their neighbours using their own resources. Similarly, in the 9/11 terrorist attack, the harbour community did not have any plans for mass evacuation of the city but with their own initiative they could improvise a successful evacuation of hundreds of thousands of people. In collaboration with private ferries, tugs, dinner cruise boats, and other private vessels they could performed this mass evacuation. In this case, also the operators in the harbour were able to make sense of the situation and the criticality of the situation makes them take action in an unplanned way.

What is the level of informality of the solutions?

The level of informality of the solutions might be very different. The informal solutions may range from slight deviation from a formal solution to totally new solutions created from scratch. In fact, we consider that there is a continuum line between formal solutions and informal solutions.

Normally, the more extreme the situation is, the more informal the solution needs to be since the already defined formal solutions might not be enough to deal with the situation and solutions need to be developed pragmatically.

Furthermore, due to legal responsibility and accountability issues, formal responders usually tend not to diverge too much from the already defined formal solutions while citizens have more freedom in this regard and tend to be more creative and come up with totally new and innovative solutions.

How does the context affect the implementation of informal solutions?

The context can favour the initiative of informal actors to take action and develop informal solutions. For example, in case of society does not trust the government and its response capacity, society tends to be more proactive and put more informal solutions in place. This was the case of the example mentioned previously regarding the Hurricane Katrina. The inactiveness of the government and their lack of trust in authorities make the citizens to put in place actions to cope with the situation.

Furthermore, in case the legal framework allows the formal response agents to have some flexibility in their actions, they can be more active in creating and implementing informal solutions when a situation is getting complicated, and they need to cope with it.

4.6.2 FROM INFORMAL TO FORMAL SOLUTIONS

When informal solutions demonstrate their usefulness and efficacy to deal with the problem, sometimes, they are formalized and included as part of the formal response. However, not always the solutions are completely formalized. There are some solutions that are always implemented during a crisis event but they are not formally included in the disaster response plans neither managed by formal actors. Furthermore, there are some barriers that hamper a solution to be formalized so many of them remain as informal. Below, based on the results of the interviews with

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emergency experts, we present a framework that explains this formalization process of the informal solutions. The formalization framework is composed of three elements that describe the process:

- **informality drivers:** describe the situations or factors that force the adoption or development of informal solutions.
- **formalization enablers:** identify the aspects that facilitate the conversion from informal solutions into formal solutions.
- **formalization barriers:** define the opposing forces that impede the informal solutions to become formal.

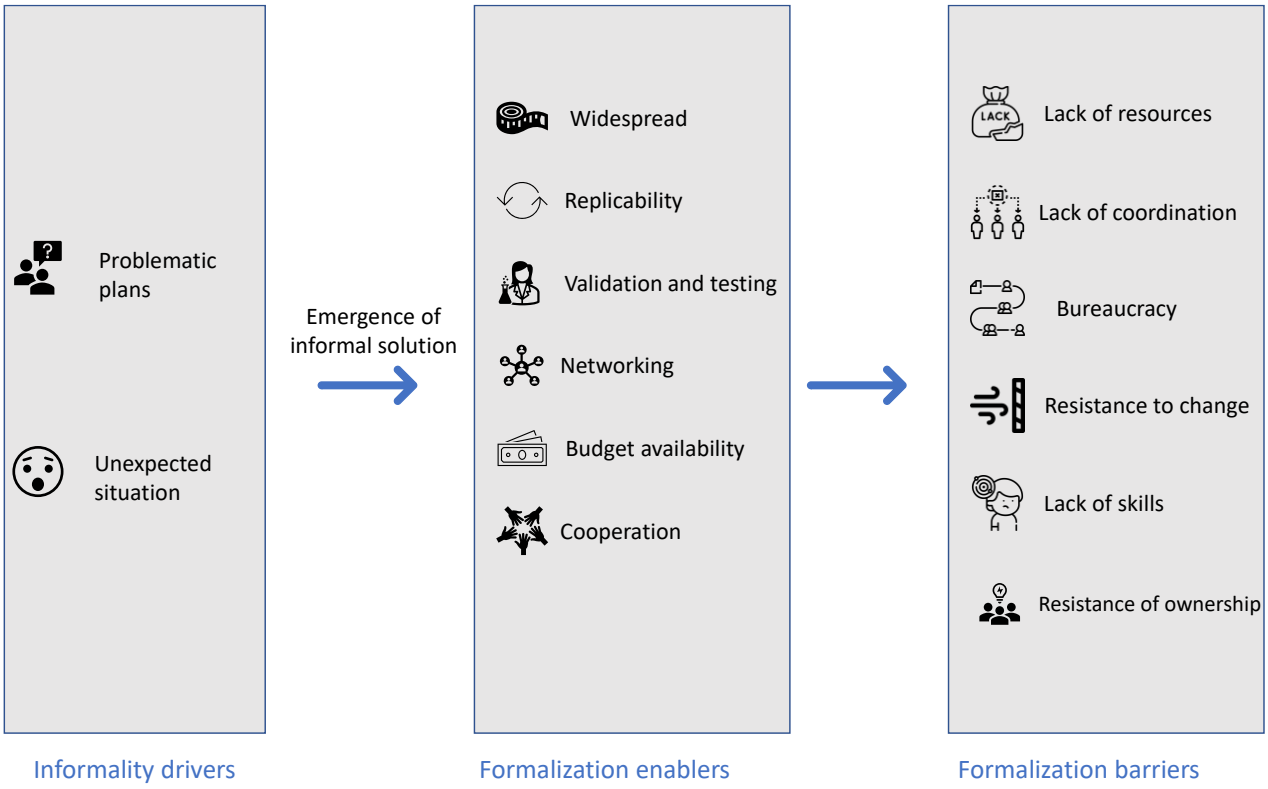

Figure 19 Formalization process

Two types of informality drivers push toward the adoption of informal solutions: problematic plans and uncertain situations. Problematic plans include:

1) bad planning and preparedness where the plans and procedures for usual situations are lacking,
2) the plan is not working because the needed resources are lacking or unexpected outcomes of the plan occur,
3) the situation does not match with the plan prediction, and 4) lack of training that enables the responders to properly cope with the situation.

On the other hand, uncertain situations cover:

1) overwhelming emergencies,
2) unprecedented situations,
3) lack of unpredictable resources (not as a result of bad planning).

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The formalization enablers included two groups of aspects: the first group includes aspects related to the solution such as if the solution has been tested and validated, the replicability level of the solution, how many times the solution has been used, and the extent the solution is spread throughout the community. The second group of enablers, they are related to the implementation aspects of the solution, such as the available budget to implement the solution and the cooperation and networking efforts needed from the different stakeholders for its proper implementation.

The last element of the framework presents the barriers that hamper the formalization process of informal solutions. These barriers include the lack of proper skills to implement the solution. Another barrier is the lack of resources which could be financial, human, equipment, etc. Lack of coordination among the different stakeholders and resistance to change are other barriers that could impede the formalization process. Finally, the cumbersome bureaucratic process might be a significant barrier since it often requires the approval of many governmental levels, much paperwork, inflexibility, and red tape for the solution to become formal.

Furthermore, it is worth saying that not all successful informal solutions should become formal. Sometimes, when these solutions become formal, they lose their effectiveness. When the solutions are formalized, citizens might be more reluctant to use them because they might not feel as if they are something close to them. Still, informal solutions can still develop into institutionalized practice in the sense that they remain informal but become recognized as solutions by both emergency preparedness professionals and citizens.

4.6.3 CHARACTERIZATION OF INFORMAL SOLUTIONS

As a result of the conducted analysis about informality, we developed a template to characterise informal solutions. This template would act as the base for the description of the informal solutions in the Knowledge Platform. Informal solutions will be included in the Knowledge Platform as part of the overall description of solutions and associated content. We will use the list of informal solutions defined in D2.3 to select those for which we can gather enough information to be characterized using the template proposed in this document. Moreover, we will create a form (based on this template) to collect additional informal solutions from the other project partners and members of the KI-CoP

We will explain the template in this section and provide an example of informal solutions following the identified scheme.

The scheme includes the following attributes:

- **Name**: the title of the solution,
- **Who** developed the solution,
- **Who** is using the solution,
- **Description:** the description of the solution and how it works, giving an idea about the context,
- **Why/When:** The drivers to create the solution,
- The placement of the solution considering the framework in Figure 16. This is driven by the idea that the solutions always fall on a spectrum from completely informal to completely formal.
- **The extent of formalisation**: information about if the solution has been formalised or widely adopted and a description of which factors could impact the formalization process.

Example: John Hopkins Covid-19 Dashboard

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.

Developer: Researchers at the Johns Hopkins University, USA.

This is an informal actor, it is not an emergency organization, nor an NGO, it is a university. Still, it is a formal entity but not related to emergencies and does not hold any legal accountability in disasters, also, it is not spontaneous volunteers that appear at the emergency scene.

User: Governments, the general public, journalists, researchers.

Description: During the Covid-19 outbreak, a researcher at the University of Johns Hopkins, USA developed an online dashboard[2] to track statistics about the coronavirus worldwide. These statistics cover the number of cases, deaths, vaccine doses, etc. The dashboard uses hundreds of data sources and news outlets from around the world such as 1point3acres. The researchers even received emails from people all over the world reporting new cases that were not accounted for in the dashboard. The dashboard was started as an initiative by a post graduate student, Ensheng Dong, at the Center for Systems Science and Engineering, Johns Hopkins University. The student discussed the idea with his supervisor Dr. Lauren Gardner and the project started. Soon, the group of Dr. Gardner was working on data collection and curing. Then, due to the high demand and the high amounts of data, the Applied Physics Lab at the university started supporting the group with all the back-end technology. After that, Esri the GIS company, started helping with managing the platform [29]–[31].

Why/When: Once Ensheng Dong heard the news about the virus spreading in China, his home country, he was concerned about the safety of his family and friends; especially, since he studied epidemics and knew how dangerous viruses could be. Then, the first case of Covid-19 in the USA was confirmed on January 20. The next day, Dong was discussing the idea with his advisor Dr. Gardner and they agreed to develop a dashboard to track the virus building on a GIS.

The dashboard appeared at first as a personal initiative, that was driven by personal interest and the absence of an alternative. The COVID situation was unexpected, the governments were not prepared to face it, and when it happened, they were busy trying to stop the spread of the disease, solve the bed availability issues, and search for a treatment and a vaccine. They did not allocate the resources to accurately track all the statistics about the COVID situation. Moreover, the different cities and states did not have a clear procedure for data reporting. Hence, the solution appeared to cover a gap in government efforts.

Figure 20 shows where the solution falls on the informality quadrants (the lower left quadrant).

The dashboard was developed by informal actors which places it into the left part of the graph, and it does not follow a pre-established plan, so it is placed into the informal actions.

The extent of formalization: The dashboard was widely used across the globe, it has been accessed around 2.5 billion times since its beginning till now [32]. It started growing to the extent that the platform was supported by a private company such as Esri. The data produced by the dashboard was consumed by media outlets, decision-makers, researchers, and reports worldwide. Despite its wide use, the solution was not formalised in the sense that the owner of the solution did not change, it was owned by the government or any other official organization. Meanwhile, the World Health Organization (WHO) already built another dashboard to track COVID statistics.

The solution is repeated, tested, and validated, widespread, replicable, and it has a lot of collaboration behind it; all of these make it a very good candidate for formalisation.

[2] https://coronavirus.jhu.edu/map.html

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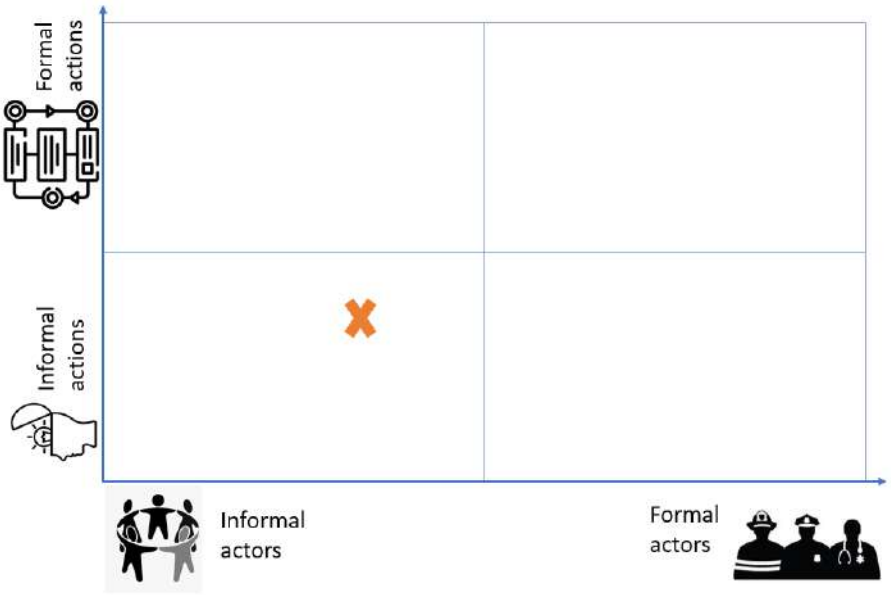

Figure 20 Johns Hopkins Covid-19 dashboard on the informality-formality quadrants

Some of the solutions that could be characterized using the template mentioned in this document - after collecting more information- could come from:

- D2.3 such as: the French association of radio amateurs (page 38),
- Examples such as the ones mentioned in section 3.2.2,
- Solutions collected through the informal solutions form that would be shared with members of the KI-CoP and the project consortium.

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5 FINAL REMARKS

Going back to the comments/feedback gathered from the KI-CoP members in the validation activities and bearing in mind the challenges and opportunities mentioned in the literature, the approach/focus of the knowledge platform has been adjusted. The solutions are context dependent and the coping actions and the response teams' preferences might vary from place to place. Therefore, the aim of the catalogue has been changed and instead of providing an inclusive list of solutions, it has been established to be used as a source of inspiration for the end-users to develop their solutions to address the needs of their community. In this line, the description and characterization of the solutions are oriented towards explaining the implementation and functionality of the solution in a given place for a given situation, but the user should be able to adjust it to their context and need.

Based on the change, the motivation of this deliverable D2.5 has been adapted, focusing on identifying the gaps regarding the existing solutions to cover the needs and purposes, understanding how the context influences the decision-making process when selecting a solution, the role of informal solutions and their characterization with a special emphasis in citizens driven solutions and their involvement in disaster management, and finally, the definition of what formal and informal solutions are and how the formalization process works. Due to this change in motivation, we found it better to utilize interviews instead of the focus groups initially envisaged; such methods allowed for a deeper understanding of the concepts we were studying.

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6 STRENGTHS & LIMITATIONS

6.1 STUDY LIMITATIONS

This study is limited by the small number of interviews with citizens, as only five interviews were conducted, all of which were with participants from Italy. This impacts the generalizability of the results and may introduce biases associated with the Italian context. This also applies to the workshop in Rome with the citizens, although the number of participants is sufficient, all of them live in Italy.

Moreover, regarding the interviews with emergency experts, women are underrepresented, we had only one woman out of nine interviewees.

Another limitation is related to the methodology used to re-assign solutions to needs and purposes, which was conducted by a small team of only three researchers at TECNUN. This narrow sample size could influence the results due to the background of the researchers.

Moreover, we could not build an assessment tool to assess the effectiveness of the solutions. This is due to many reasons; first, the change of the Catalogue of Solutions focuses from a comprehensive database to an inspirational platform, they could provide ideas to emergency responders for building solutions to enhance community resilience. This change was a result of the multiple workshops that were conducted with the members of the KI-CoP to evaluate and validate the Knowledge Platform and many discussions among the consortium members. Second, some of the factors that play a key role in selecting the solutions are the budget and the fitness of the solution into the legal framework in the country where the solution is applied. These factors cannot be evaluated easily, as the cost of building a solution varies from one place to another, depending on many types of costs such as labour, technology, and infrastructure. Moreover, the legality of a specific procedure differs from one place to another, what could be legal in Spain, could be illegal in Norway.

6.2 STUDY STRENGTHS

The strength of this deliverable lies in its thorough methodology, which includes a diverse range of data sources and expert insights, ensuring the validity and reliability of the findings. First, to include new solutions we used two different sources of information, grey literature, and academic publications. Second, to better understand the solutions and their relationship to community resilience we interviewed emergency experts from different backgrounds to get comprehensive results. We also asked emergency responders how they see the solutions provided by citizens. Third, we also incorporated citizens' perspectives about their role in building a resilient society; which is one of the main objectives of ENGAGE, to include citizens. This inclusion of multiple perspectives provides several benefits such as increasing comprehensiveness since including a variety of perspectives leads to a more complete understanding of the topic being studied. Additionally, it enhances objectivity and decreases the bias of the results. Moreover, including the citizens' perceptions allow us to transfer their point of view to the project end-users and KI-CoP members, hence, it provides a learning opportunity for emergency personnel.

Furthermore, we explored the concept of informality from the practitioners' point of view, complementing the results with a review of the scientific literature. Based, on this information we developed a formalization process to fully utilize the informal solutions. Moreover, all the results are aligned with the finding of other deliverables to enhance the coherence of the project.

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.

7 CONCLUSIONS

The objective of this deliverable is to gain a deeper understanding of the relationship between solutions and resilience. To reach this objective we analysed the solutions we have in the Catalogue of Solutions and their connections to the different community resilience purposes. Additionally, we conducted interviews with emergency managers in order to explore how the selection process of a solution is done. Furthermore, we delved into the concept of informality from both perspectives of the emergency managers and the citizens.

Through the analysis of the current list of solutions and the search for new ones, we found a lack of solutions covering the "empower citizens in governance and leadership activities" purpose. This could be due to the perception among emergency responders sometimes that citizens can hinder the disaster response efforts, they would like the community members to join organized volunteering groups and follow their instructions. The command-and-control mentality prevalent in emergency organisations also contributes to citizens' exclusion from the process. Additionally, the lack of solutions in this area could be due to the nature of the solutions that allow for self-governance, that they are citizen-driven and follow a bottom-up approach, and hence, do not fit into the definition of formal solutions.

The purpose that is covered the most by solutions is "enhance preparedness" followed by "improve communication and information sharing"; this aligns with the needs of first responders (D2.1) that they need people to be prepared and follow the instructions and information from reliable sources.

From the interviews with emergency experts, we identified these guidelines for selecting a solution to address a specific need related to community resilience:

1) The availability of funds.
2) The degree of simplicity of the solution and the familiarity of the people with it.
3) How the solution fits into the legal framework.
4) The decision to select a specific solution is made by a working group.

Regarding the contextual factors that could affect the choice of a solution, the level of trust in the government plays a major role in the selection process. This information not only enhances our knowledge about the decision-making process in emergency organizations -regarding the solutions- but also could guide our efforts in characterizing the solutions and building the Knowledge Platform.

Both emergency experts and community members mentioned that the lack of disaster training would hinder the inclusion of citizens in disaster response activities. This absence of training makes individuals more vulnerable to causing harm to themselves and others. Moreover, experiencing disasters or having a volunteering experience significantly increases the awareness of citizens and their motivation to participate in disaster management activities.

Furthermore, community members disregard gender as a factor that affects their role in disaster management. They mentioned that factors such as health conditions and physical fitness are more significant in determining their ability to respond to emergencies.

Finally, this deliverable delved into the understanding of informal solutions and their usefulness in disaster management. Informal solutions are the representation of coping actions developed by the citizens when dealing with disasters. They could be defined as a first draft of future formal solutions and it could be a way to test their usefulness before being formalized. Also, it is a way for involving citizens in disaster management activities making the most of their potential and creativeness, which are the required properties for improvisation.

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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9 APPENDICES

9.1 ANALYSIS OF THE LIST OF SOLUTIONS

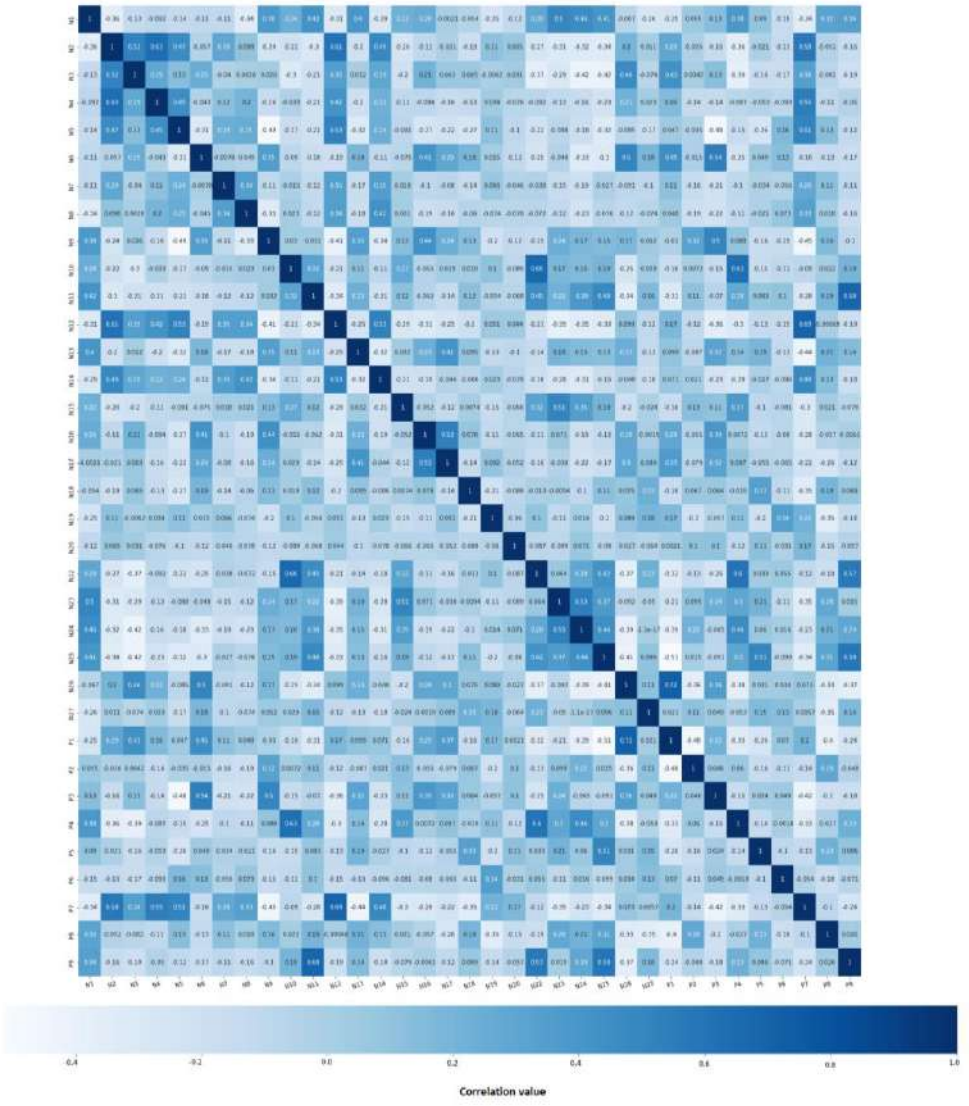

Figure 21 Correlation analysis among the needs and purposes

Table 7 Description of needs

Need number	Need description
N1	Involving society in disaster, response and recovery activities for example, doing simple tasks or providing resources
N2	Using official sources and channels to find information
N3	Following authorities and emergency responders' recommendations
N4	Knowing where to find updated information
N5	Providing credible information from the disaster scene
N6	Knowing about the emergency plans and how to apply them

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N7	Knowing how and when to inform emergency services with key information about the crisis situation (videos; photos; and messages)
N8	Providing first responders with local knowledge
N9	Acquiring the needed resources before the disaster event (food; first-aid knowledge; water; medical supplies etc.)
N10	Developing some networks with other members of the society to have mutual assistance
N11	Involving society in recovery activities by helping to restore the ordinary life and adapting to the new conditions
N12	Using official channels to share the information whether it is mobile channels (calls, SMS, apps) or social media
N13	Having self-organizing capacities without having to wait for emergency services or authorities
N14	Expressing their needs and demands to emergency services to facilitate having a conversation
N15	Civil society organizations are willing to sign cooperation protocols with emergency responders to share their resources and their know-how
N16	Taking part in preparation activities; emergency drills; and pay attention to self-readiness campaigns
N17	Attending classes in different educational institutes about potential risks and how to prepare for them
N18	Having self-adaptive capacities to alter difficult situations and continue life as usual
N19	Trusting authorities and responders
N20	Understanding the nature of first responders' job
N21	Showing appreciation and support for emergency responders
N22	Community networks and support groups to adapt to new realities
N23	Volunteering in organized entities so volunteers have the proper training, and their safety is not compromised
N24	Being ready to collaborate
N25	Helping victims and each other
N26	Having risk culture and being prepared with information about potential risks and how to handle
N27	Being mentally prepared for disaster implications

Table 8 Description of purposes

Purpose number	Purpose description
P1	Enhance risk awareness
P2	Facilitate resource allocation
P3	Enhance preparedness
P4	Capitalize on social networks and relationships
P5	Improve health and mental outlook
P6	Empower citizens in governance and leadership
P7	Improve communication and information sharing
P8	Efficient response
P9	Quick recovery

9.2 INTERVIEWS TEMPLATE [EMERGENCY PERSONNEL]

Interviewee Code:

(Please use the first letter of the resilience need you are investigating (P or C) + your organization initials + interview number. E.g., PTECNUN1 for the first interviewee conducting by TECNUN addressing the preparedness need)

Summary of semi-structured interview

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Country: **Gender:**
Date:
Type of organization (do not include identifiable information):
Type of role (do not include identifiable information):

9.2.1 INTRODUCTION

Interview length: 60 – 90 minutes

Purposes: identifying when a solution is formal or informal; and how emergency organizations make decisions about the selection and implementation of new solutions to enhance the interactions among members of the community and emergency organizations.

Background Information

Please tell us more about your professional experience. What is your current job and how long have you been working in this job?

What is your relationship with emergencies? Reflect on the other positions the interviewee had and the other countries or communities they worked in and also the contextual aspects and political social situation. Please focus the interview on the most relevant experiences.

9.2.2 INFORMAL SOLUTIONS

Definition

First, introduce the interviewee to what we mean by a solution in general, and what aspects we use to differentiate between what is a formal solution and what is informal solution.

We consider any tool, approach, guidelines …etc. as a solution to enhance the interaction between emergency organizations and citizens.

To differentiate between solutions being formal or informal, we consider some criteria such as:

- Solution owner (stakeholder)
- Legalization
- Repetition
- Replicability
- Improvisation
- The availability of supporting tools

Show the examples in SurveyMonkey and ask the interviewee to identify if they consider the solution formal or informal. Summarize the criteria they are using to consider a solution to be formal or informal in the space below. The survey link: https://www.surveymonkey.com/r/5YTPDY6 Please use the same interviewee code in this file in the survey.

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The interviewee experience:

Considering the examples we discussed before, have you ever applied/created something like that before? How did you apply/create it?

Why did you apply such a solution? And did it work?

Timing and situation:

In which situations do you think that informal solutions may be adopted?

Limitations:

What are the barriers that prevent you from adopting informal solutions? (You or other emergency responders)

Citizens' driven solutions:

So far, we were speaking about solutions driven by emergency official, but what about citizen-driven solutions (mention an example or two) …..should they be considered formal or informal? Here we are expecting that they will mention that the citizen's solutions are informal; we are using this as an introduction to this part of the discussion. *One example:* When there is a snowstorm, in Spain, in some areas, people expect that the official cleaning services are going to take many days to clean and remove the snow blocking the roads near them, so they remove the snows themselves. In Norway, people do the same, but they have a legal agreement with the government to do this, and they get some incentives in return.

Do you incorporate the citizens-driven solutions into your work? How do you do that? (Examples: contract the citizens; legalize the best practices; ...etc.)

Why do you adopt citizens' driven solutions? Or in other words, what makes citizens' driven solutions appealing/ interesting for you to adopt into your work?

Formalization of informal solutions:

We use this section to wrap up the informal solutions part and move to the formal solutions part.

Are you aware of any informal solutions that become formal? How and why?

Are there some contextual factors that favour the formalization of the solutions? What we mean by context here, is the population demographics, the level of education, the governmental support, the available budget…. etc.

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9.2.3 FORMAL SOLUTIONS:

Decision making process:

Here, we need to know how the selection of a new solution to address a specific need happen. What kind of factors do they take into account? Both types of factors: things imposed by the government such as the budget, digitalization strategy and so on; and things related to the population characteristics (age, level of education, gender…).

If you would like to improve X (preparedness against heat waves for example), how the selection of the solutions that will be applied is made? By how we mean: • Who is in charge of selecting? • Which criteria do you use for making the selection? (Budget, population characteristics, organization resources, external conditions (forced by the government) • Do you make a contextual analysis of the population? Which factors do you consider? [ex. Population demographics (age, gender), level of education, previous disaster experience, spirituality (relation to a higher being), digital literacy]

Solution ranking:

Using the survey link, you will find two different scenarios associated to the "need" addressed by the interview (either "preparedness" or "communication"), please ask the interviewee to read the scenario and rank the solutions accordingly. Then asking the interviewee the below question.

How did you come up with this ranking? Which factors did you consider?

9.3 INTERVIEWS SCRIPT [CITIZENS]

City: **Gender:**
Age: **Job:**

First, the aspects that push to (force) or prevent citizens from participating in disaster management activities:

- What makes you willing to respond to a disaster?
- Which type of emergencies do you (as a citizen) participate in handling? The types of emergencies could differ based on:
  - The scale of the emergency (small scale such as snow blocking the road in front of the houses; or big scale, such as the L'Aquila earthquake)
  - The level of government control: (Everything is under control, such as a train accident; or things are out of hand such as a big earthquake or a tsunami or a terrorist attack)
  - The frequency of the emergency (high-frequency emergencies where citizens follow a specific procedure every time to handle the situation; or things that are rare such as pandemics)
- Do you participate more in handling the emergencies that have a closer impact on you (your belongings (house, car, etc); your close family members, and your safety)?

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- Do you act in response to a disaster if you know that the government plays a major role in responding to the situation or do you respond better in situations where the government is absent or plays a minor role?
- What are the barriers that stop you from participating in disaster response activities? Or in other words, what are the factors that discourage you from participating?
- Do you think that your gender affects your reaction to disasters?

Second, emergency personnel reactions to citizens' efforts/help:

- Do you feel that your help is appreciated by emergency responders? If yes, how?
- How do emergency responders utilize your help?

Third, citizens' perceptions of their role in disaster management:

- How do you think you should be involved in disaster management activities[1]? Or when do you think you have the most relevant role in disaster management? Or what is the key timing of your intervention as a citizen in disaster management activities?

[1] We are more focused on the response activities from the informality point of view, but you can also addressed the activities in other phases.

9.4 CITIZENS WORKSHOP [ROME], QUESTIONNAIRE

Questions for those having experience as volunteer:

1. When you have been involved in disaster management did you get an adequate support from the authority (e.g. information and resources shared timely, clear definition of roles and responsibilities)?
2. Did you experience any situations or problems in which you had to adopt "creative" solutions"?
3. Do you think your contribution has been adequate and useful to manage the emergency?
4. Did you collaborate with other volunteers or with the authority in the different phases of the emergency?
5. At the end of the emergency did you have the opportunity to talk with others and share your experience?
6. Do you think your participation to the emergency management changed your awareness about risk?

Questions for those not having experience as volunteer:

1. Have you ever been involved in a preparedness action, for example an evacuation training, or a seminar to know the risks of your area?
2. If you answered no to the previous question, go to no. 5 otherwise please proceed. Who organized the preparedness action of point 1?
3. How have you been informed/involved?
4. Do you think it was worthwhile and that you are better prepared to afford an emergency?
5. Have you ever done something that could be considered as a preparedness action by yourself, please consider also simple actions such as reading a book on risks, buying something to be used in case of an emergency? Please describe it.

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6. Did you collaborate with somebody to organize such an action like friends, neighbors, relatives? or have you ever proposed something of the kind to local authorities or organizations such as your municipality, local civil society organizations, local committee?
7. Do you know which the major risks for disasters for the area in which you live and would you able to estimate the probability that these disasters will happen?

9.5 INTERVIEWS CONSENT FORM

Consent Form

Principal Investigators:

- Leire Labaka, TECNUN school of engineering, University of Navarra llabaka@tecnun.es
- Sahar Elkady, TECNUN school of engineering, University of Navarra selkady@tecnun.es

Statement of Consent:

I have read and understood the details of this research as explained in the information letter.
I have been informed that:

- The data collected will be treated in full confidentiality and will be registered and stored in a secure manner
- Only authorized personnel involved in the project will have access to the collected data
- No personally identifiable information will be published in any way
- The results of this study may be used for publication purposes
- I can withdraw from the study at any time without any obligation to explain my reasons for doing so and without being disadvantaged in any way
- *If I withdraw from the study then I will be offered the choice between having any data that is identifiable as belonging to me removed or allowing it to continue to be used. However, once the findings have been produced, removal of my data may not be possible.*

I hereby fully and freely consent to participate in this study knowing that my data is going to be processed solely for research purposes.

Participant's name: _____

Participant's signature: _____ Date: _____

If you would like to receive a summary of the research finding, please check the box ☐

If you would like to participate in further research following up on this one, please check the box ☐

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9.6 List of Solutions

Table 9 List of Solutions (Purpose: P: enhance preparedness, R: enhance risk awareness, RA: facilitate resource allocation, SN: capitalize on social networks, H: Improve health, G: Empower in governance, C: Improve communication, ER: efficient response, QR: quick recovery), (Phase: B: before, D: during, A: after)

#	Solution name	Short description of solution	Solution type	Purpose(s)	Phase
1	HeartbeatNow	HeartbeatNow (HartslagNu) is a Text Message (TM) alert system used in the Netherlands as a solution to notify citizen volunteers trained in resuscitation to help in cardiac arrest cases near their location. The aim is to reduce the delay in response time to start basic life support in the event of a sudden out-of-hospital circulatory arrest (OHCA). The TM alert system is based on a network consisting of TM volunteers and automatic external defibrillators placed in residential areas. In the case of a cardiac arrest, TM volunteers can be notified by the dispatch centre, using the zip code derived location of the victim and the closest volunteers. In a suspected out-of-hospital circulatory arrest, the dispatch centralist activates the system simultaneously with two ambulances. Zip code identified TM volunteers within a radius of 1 kilometer of the victim receive a text message, directing them to the scene either to start basic life support or to get the nearest network automatic external defibrillator. The alert system has been found to be effective in increasing the survival of OHCA victims and a low degree of disability after survival.	Alert system	P,H,ER	D
2	Ro-Alert System	The Ro-Alert system is used to send Cell Broadcast messages to warn and alert citizens in case of emergency. The system is used in severe situations, in which citizens' lives and health conditions are endangered. Specific examples are extreme weather conditions, threatening floods, terrorist attacks and other situations that severely threaten communities. It was used during the Covid-19 pandemic, in order to remind the population to respect the protection measures and to announce restrictions. The Ro-Alert messages can be received on Romanian territory, where the recipient connects to either 1G, 3G, 4G and GSM. No special application is necessary to install, and it makes no difference whether the recipient has prepaid or subscriber services. There are no additional costs or taxes involved in receiving Ro-Alert messages. One limitation is that if the phone is turned off or has no service, alerts will not be received.	Alert system	R,C	D
3	Everbridge Public Warning Centre	Everbridge Public Warning Centre is a hybrid Public Warning solution which combines Cell Broadcast and Location-based SMS as well as other channels such as SMS, email, social media and CAP. Based on data from mobile network operators, authorities, emergency response teams and public safety officials can have an overview of population counts that will be alerted.	Alert system	R,C,ER	D
4	"City Connect" (in Hebrew)	Municipalities use these apps to distribute information for the public according to the specific area in which they reside and they allow them to distribute information also bottom-up.	Apps	R,C	B, D
5	Corona Dashboard	The Corona dashboard was developed during the Covid-19 pandemic to communicate about the development of the Covid-19 virus in the Netherlands. The information provided include for example how many people with Covid-19 are in hospital and how many ICU beds are occupied by Covid-19 patients, as well as whether and where the virus is reviving and an indication of the pressure on healthcare. The public can access different geographical areas and monitor trends they are interested in, at the district level or the whole country. The information is available in both Dutch and English, and comply with privacy guidelines.	Apps	R,P,C	D

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6	NewsBrief	Newsbriefs was created to help expats/immigrants, who feel that the Media Industry is underserving them. Newsbriefs provides a curation of relevant news in 70-word-summaries. Scroll through the app and stay updated on current events in less than 10 mins.	Apps	SN,C	B, D, A
7	DSU Mobile App	The DSU Mobile Application reports useful information for emergency management. The application informs and prepares the population to deal with daily emergencies, and provides access to real-time information and alerts in case of disaster. The app may be used in multiple situations such as official communications and press releases addressed to the population, but also to allow scene witnesses to report accidents and send pictures from the field. Emergency services can see the amplitude of the incident and scale the number of emergency forces that will take part in the operation.The app is used at the national and local level, and Inspectorate for Emergency Situations in all counties has dedicated personnel in charge of the application. A function in the app makes it possible for citizens to select the cities and/or counties to receive news, updates and alerts. The main outcome of the DSU app in terms of societal resilience is behavioural change in the population in relation to disaster management. Here, three aspects are particularly important; (i) knowing how to behave and react in particular emergency situations, (ii) making people understand that they have to be self-sufficient within the first 71 hours, (iii) respecting the official recommendations coming from national authorities in charge of disaster management. It is therefore an important tool in terms of learning, exercising and testing the knowledge about disaster prevention in the population.A limitation of the app is that the server may go down on various occasions for a limited period of time due to maintenance services, information updates, or overloaded web servers.	Apps	R,P,C	B, D
8	Ertzaintza App	The main objective of the app is to create a communication channel between citizens and the Ertzaintza, the Basque police. 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 14 hours, that is, users can communicate with the police whenever they need it.The solution enables the citizen to have direct contact with the police agency and offers various options:- a list of all the police headquarters to physically visit if necessary- the direct 111 number connection- different communication channels (mobile, email, SMS, WhatsApp)- means for anonymous communication- news-advice- other social media channels (Twitter)- Other apps (traffic app and weather app)	Apps	R,P,C	B, D
9	EUSKALMET App	The EUSKALMET App aims to increase citizen awareness about weather conditions in the Basque Country. It uses Progressive Web Application as a one-way communication and information channel from the Basque meteorology centre to the population. The app is used to share warnings and information about extreme weather conditions about to occur in the region. This is used as a measure to spread information and rise awareness among citizens located in the Basque country.	Apps	R,P,C	D
10	EVapp	The EVapp is a smartphone application in the Netherlands which can be used to mobilize medically trained volunteers in case of emergency. Examples of such volunteers are nurses, paramedics, Red Cross volunteers and others. The app is used as a tool to overlap the time between the occurrence of an emergency and the arrival of the emergency services, and focuses mainly on cardiac arrest. If a volunteer accepts the emergency call, they will be navigated to the right location through the app. It also shows the closest AED.One limitation with the app is that people still have to call emergency services.	Apps	P,H,ER	D
11	LazioAdvice	The Lazio Advice is a heat warning mobile app designed to improve the population's awareness, preparedness and response to health risks associated with heat waves. The app is used to mitigate the consequences of heat waves. It targets a reduction in mortality rates of vulnerable people associated with temperature rises by monitoring people with risk factors (e.g., cardiological risks). Through the app these people are recorded and	Apps	R,P,H,ER	B, D, A

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		surveyed. The app is used by the people at risks themselves, doctors, or healthcare operators. Medical doctors use the app to carry out active surveillance (home visits, phone calls) over vulnerable patients during heat waves. The app is free to download. For each city users can consult levels of heat severity (Level 1- Level 3), access phone numbers for medical help and social services, learn about heat related health risks and download brochures/information leaflets that describe how to act and protect themselves during a heat wave.			
12	Crisis Information	Crisis Information (krisinformation.se) is a web page providing information from the Swedish authorities to the citizens during a crisis and severe situations. On this web page, important phone numbers, warnings, and other instructions and verified information are provided. The aim of this s to provide reliable information for the Swedish population, minimize the risk of the spread of false information and help citizens to know where to seek information when a crisis occur. The web page is also available through social media, such as Twitter, Facebook and Instagram, as well as in application format.	Web platform	R,C	D
13	My EMS/MDA	An app by the Israeli EMS, Magen David Adom, allowing to contact the emergency services and to broadcast location - even when there is not service. The app also allows to store critical health information for situations in which the individual is not responsive and needs immediate care.	Apps	H,C,ER	D
14	My112	My112 is an app developed to keep citizens updated of nearby events. My112 allows civilians in distress to communicate with the 112 Emergency Centre, sending their current position to the operator who is assisting them. In addition, My112 receives real-time notifications of emergencies when they occur. Users can subscribe to the integrated centres to receive emergency notifications. They can also send photographs of the incident, and additional information. The app also makes it easy for the users to send SMS notifications to a list of selected contacts after the call to the Emergency Centre.	Apps	R,C,ER	D
15	AlertCops	AlertCops is an app for people at risk or in an emergency situation, and can be used to easily contact emergency services. The app has an SOS button, which directly sends a person's location and an audio message of 10 seconds to the closest police force. It is possible to share location with people of choice to make the rescue faster. The service is developed to be discreet so that people in dangerous situations can seek help, and provides features of chats, to send messages, videos or pictures. The app may be used as a warning system as well, warning people if they are close to dangerous areas. One can also report criminal occurrences in the app after it has occurred.	Apps	R,C,ER	D
16	Resource Volunteer Management (RVM App)	The RVM-app consists of two modules. One is a website with a management system that allows Chief Security Officers (CSOs) to add the resources they have and can deploy at the time of a crisis. Authorities can check the stock to know which response capacity can be relied upon by civil society and in which cities. It has an alert system that allows broadcasting an SMS message to all volunteers who have specific qualifications or who are registered in a specific city. The second module is a mobile app that may be used also if there is no data connectivity. The information will be stored locally and the database will be updated as soon as the officer reaches a place where there is connectivity available.	Apps	RA,P,ER	B, D
17	Covid-19 Self Report (Everbridge)	The Covid-19 self-report is an app which is helping people to return safely to university campuses during and after the pandemic. The app is to be used by students, staff and visitors, before entering the university area. The main goal of this service is for people to assess their health status through symptom checks in surveys, which will provide evidence of verification. People using this app will get insight into risk factors on campus, and get notifications if they have been exposed to the virus. The app also provides information for students and staff that has already been contaminated.	Apps	SN,H,ER	D
18	Stroke 119	The Stroke 119 app is aiding patients with self-screening and information when in suspicion of stroke. The app includes a stroke screening tool and presents information on symptoms and the prescribed actions when	Apps	P,H,ER	B, D

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		it is occurring. It shows cartoons of how facial palsy and arm weaknesses would look like and provides reading exercises for the patient to test. The app is also presenting information about hospitals nearby that is providing thrombolytic treatment. The app may contribute to decrease the hospital arrival time. The thrombolytic treatment are time-dependent, and early arrival to hospitals are positive.			
19	Staying Alive	Staying Alive is an app that provides defibrillator mapping and management of citizen responders. The app is available in 18 languages and maps over 110.000 defibrillators worldwide. It is a solution to improve the critical emergencies handling by locating and alerting citizen. The solution is used by French Emergency services to handle Out of Hospital Cardiac Arrest by alerting trained citizen responders. It can also be used as a Public Warning System to alert or notify responders within a specific perimeter.The main contribution is an improvement of cardiac arrest survival rate. In Paris region the survival has been multiplied by 1 reaching 35 percent when responders are dispatched on site.	Apps	P,H,ER	D
20	TrygFonden Heart Resuscitation App	TrygFonden is an app where volunteers are notified if there is a case of cardiac arrest near them, so they can start immediate heart resuscitation. The help of volunteers is mainly used before the arrival of the ambulance and paramedics. This app is built upon Heartrunner, which is a service provided by a Swedish company and handles the logic behind the application and how the allocation of volunteers' work. The Heartrunner app is an app that can be implemented by any emergency service across the world.	Apps	P,H,ER	D
21	KATWARN	The KATWARN system sends public warnings and behavioural advice in case of crisis through app and SMS. All warnings originate from government agencies responsible for safety, security organisations and control centres. These actors decide on the content, timing and the extent of issued warnings. Examples of senders are the police, fire department control centres, the German Weather Service, as well as flood and earthquake centres and external warning systems. Examples of when such warning systems may be used is under large scale fires, floods or others. The KATWARN system was developed by Fraunhofer FOKUS on behalf of public insurance companies in Germany.	Apps	R,C,ER	D
22	VOST (Virtual Operations Support Teams)	Virtual Operations Support Teams (VOST) applied to emergency management and disaster recovery is an effort to make use of new communication technologies and social media tools. The aim is 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. VOST can also be used to share useful information with citizens and amplify dissemination of key messages. VOST is implemented in several European countries. The French-speaking VOST (called VISOV) provides advice to the population through Twitter and cooperates with French authorities by creating collaborative maps in the case of crises.	Media	SN,C,ER	D, A
23	The regional school tsunami project	The regional school tsunami project was initiated in 1017 by the Japanese government in collaboration with the UN to prepare the Japanese society for future tsunami's. After suffering a great tsunami in 1011, Japan wished to increase the general tsunami preparedness. Teachers and school administrators from over 300 schools have been trained in tsunami preparedness. Key parts of the program was to implement emergency drills in order to enhance evacuation behaviour during disaster. The emergency drills contributed for schools to draft evacuation plans, made evacuation routes safer and contributed to the procurement of essential items. It also may facilitate sharing the consensus and confidence on evacuation policy among community members as well as reduce delays, risk of drowning and casualties in the next catastrophe.	Awareness and training campaigns	R,RA,P	B
24	Fire Risk Awareness Campaigns	The awareness campaigns is about making citizens aware of the risks they face at their homes, mainly concerning fires, explosions and improvisations that can cause victims and damages.These campaigns aim at reducing the number of home fires, but also the number of victims and material damage. They also aim to reduce the number of fires and explosions caused by improvisations in electrical and natural gas installations	Awareness and training campaigns	R,P,ER	B

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		in citizens' homes. Examples:- FIRE Campaign - Flames kill children (1011)- Risk Campaign - Give Up! House improvisation are dangerous (Part I - 1013)- Risk Campaign - Safety is not a gambling (Part 1 - 1014)- Risk Campaign - Safety is not a gambling (Part 3 - 1015)- Risk Campaign - You're better prepared than died (Part 4 -1016)- Risk Campaign - You're better prepared than died (Part 5 -1018)Limitations are directly linked to statistics (impact) and national coverage of these campaigns, mainly if the population becomes more aware regarding the risks they face within their homes.			
25	Awareness interviews	The purpose of the solution is to educate and increase the awareness of problems faced by certain groups in society. The main contribution has to do with building a strong base of communication and awareness than can minimize future problems. The experience is that many volunteers from different units in an organization meet with different groups in order to share experience of confronting problems in different areas. Such as:- Raise awareness in youth about traffic issues- Rise awareness about equality gender- Rise awareness within certain groups in high risk of radicalization- Raise awareness of certain risks with the use of social media- Integration of different ethnics and religious groups The Law enforcement agency (LEA) will many times use intermediaries that link the police with these various groups. This intermediaries will typically be respected persons from that collective. The LEA will try to find the least invasive, and most respectful way to approach a certain group based on its characteristics.Limitation: This is a long-term task. It requires constant attention to increase strong ties with the collectives we work with.	Awareness and training campaigns	R,P,SN	B
26	Be Ready Caravan	The Be Ready caravan is designed as a mobile training centre, built on the structure of a truck. The purpose of the caravan is to raise awareness in the population about what to do in case of an emergency, and particularly an earthquake. This is done by arranging events throughout Romania where the caravan is used for giving information and teaching basic first aid skills. It has an extendable part, which is used as a classroom with a capacity of 40 people. In addition, the caravan is equipped with medical and first aid equipment and portable devices, including simulators. In addition to visiting cities and different parts of the country as part of its yearly calendar, the caravan is also sent to mass events such as concerts, festivals, or at sea during the summer season.	Awareness and training campaigns	R,P,SN	B
27	INR-T (information campaign)	The INR-T is an information campaign launched by multiple Italian governmental and non-governmental actors working on natural hazards. The campaign was used as a measure to inform the population about how to prevent risk in relation to natural hazards, and how to act when disasters occur. The information campaign aimed to engage with the local populations and to train them with information on scientific basis of the risk, how to prevent risks, what to do in case of emergency, warnings and who to contact. It should lead to increased awareness, more knowledge and promote best practice guide on response measures among the population. Governmental and non-governmental organisations trained volunteers with information about different natural hazards such as flooding, earthquakes, volcanic eruptions, tsunami and others. These volunteers were part of the information campaigns in disseminating information further to population through meeting in public spaces.	Awareness and training campaigns	R,P,SN	B
28	The Kubik educational program	The Kubik educational program is developed to inform the population regarding risks related to food allergies (mainly for children), but also how and when to used an Epipen adrenaline auto-injector. The program includes a special guide regarding food allergies for children, as well as a set of rules and possible strategies in order to protect children, to anticipate and solve the problems. The extent of this campaign is limited, therefore it is expected to involve more resources in order to raise the level of awareness among citizens about food allergies risks.	Awareness and training campaigns	R,P,H	B

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29	EU Modex	EU Modex is a simulation exercise promoting a well-coordinated joint response to disasters. A joint approach further helps to pool expertise and capacities of first responders, avoids duplication of relief efforts, and ensures that assistance meets the needs of those affected. By pooling together civil protection capacities and capabilities, it allows for a stronger and more coherent collective response. The exercise was implemented in many EU countries, but here we are focusing on the one that was carried out in Romania in 1018. It was a huge scale exercise, simulating the event of an Earthquake and all the mass casualties that could result from such an event.	Awareness and training campaigns	RA,P,SN	B
30	Don't Shake At Earthquake	The "Don't Shake At Earthquake" is an awareness campaign focusing on preparedness in case of an earthquake. The main objective of the campaign is raising awareness, informing, and preparing the population to react correctly in the occurrence of an earthquake.The campaign consists of 6 videos, and each video lasts for 30 seconds. The videos show what to do if an earthquake happens and how to act in different environments, for example at work and in school.	Awareness and training campaigns	R,P,SN	B
31	Firefighters recruitment	When fire department want to recruit new staff members they go to high school and present the educational offer for a military career as a firefighter. Students show their interest in pursuing this career path.	Awareness and training campaigns	RA,P,C	B
32	School training campaigns (Focused on threats on the internet)	These campaigns aim at teaching the children and young people about different safety measures in order to prevent an accident and know how to deal with a crisis when it occurs. Depending on the institution that provides this training and awareness the content changes. For example, the police are focused on training in road safety measures. However, the NGOs teach students how to perform CPR and what to do in a terrorist attack. An example of this type of solution is the school training campaigns carried out by the Ertzaintza in the Basque country. The awareness campaigns are carried out with talks in different centres, from schools to universities and organisations. There are a total of 9 different talks, including threats on the internet. The objective of these talks is to promote the values of responsibility, privacy, empathy and dignity. The presentations are given in a time slot of 1.30-1 hours. The presentations (PowerPoint) are the same for all Euskadi. The talk is supported with real examples of dangerous situations such as grooming, cyberbullying and so on. The presentations also include videos. During the presentation, the ERTZ also explains the main laws and responsibilities associated with all these dangers on the Internet.	Awareness and training campaigns	R,P	B, D
33	Covid Call centre	For information and questions regarding the Coronavirus situation. They gave information and instructions to people, such as when to quarantine themselves, what to do if they have symptoms. It is important to note that the call centre operated under the same regular information call centre of the Israeli ministry of health ("Call Habriut"). Similar call centres were also operated by the HMOs.	Call centre	H,C,ER	B, D, A
34	Emergency call centre	It is a communication center responsible for receiving and processing emergency calls from the public. These calls are typically related to urgent situations that require immediate response from emergency services, such as police, fire, or medical services.	Call centre	RA,C,ER	D
35	Norwegian index for emergency medical care	The Norwegian index for emergency medical care is an index for people answering emergency calls. It is a compilation of questions that is asked while people on the accident site are waiting for the emergency response teams to show up. The questions are related to location, the scope of the accident, the status of the patient and other things relevant. It also contains more specific questions based on the disease or accident that has occurred. It determines how the emergency services should coordinate and mobilize the right resources. Important information is collected through these questions and helps the emergency services to	Call centre	RA,C,ER	D

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		get an overview of the accident site. The calls are recorded, and the questions asked may be verified in some cases, and in other cases not.			
36	Single Emergency Number	In Europe, the emergency service hotline is a Pan-European emergency number for all EU member countries. The solution has been launched by the European Union, and by dialing 112, emergency services such as ambulance, fire and rescue, and police can be reached. The number is free of charge and can be accessed 24/7. The main aim with this solution is to develop easy access to emergency services across European countries, both for inhabitants in the countries as well as visitors. In addition to EU member states, the number is possible to use for emergency purposes in Albania, Georgia, North Macedonia, Montenegro, Liechtenstein, Norway, Serbia, Switzerland, Turkey, the UK, and many other countries.	Call centre	RA,C,ER	D
37	Police hotline (100)	The police emergency call center in Israel.	Call centre	RA,C,ER	D
38	Community opinion leaders	Whether it is on the national level or on the community level, the use of opinion leaders aims at spreading information and influencing people through the people they trust the most and following their opinion. Opinion leaders are individuals who are highly connected and have an effect on other individuals in the community. Such as religious leaders.	Collaborative methods and technologies	R,G,C	B, D, A
39	The vigías volunteer network	The vigías volunteer network is engaged in volcano monitoring of the volcano Tungurahua in Ecuador, and has existed since the year 1000. The group of volunteers are monitoring the volcano and are collecting scientific data. The observational data is applied by scientists in different kinds of research, and are used in many ways to reduce volcanic risk. The vigías network is used as a communication channel increasing awareness for the general population, and for civilians to understand the different hazard's. This may be used as an early warning system to protect civilians, and contribute to enhanced preparedness in case of volcanic eruption.	Collaborative methods and technologies	R	B, D
40	The Civil Guard (community patrols)	Voluntary groups that help Police to make the local community safer for everyone. They are volunteering for the police, and making policing activities, but they are not considered policemen. They just facilitate the work of police and allow the organisation to fulfil more tasks.	Collaborative methods and technologies	RA,SN,ER	B, D, A
41	Corona Guardian	EMS trained what they defined as "corona loyalists", who were in charge of mediating the information for community members. Corona loyals also received training to facilitate the COVID-19 regulations in organisations, such as enforcement.	Collaborative methods and technologies	R,H,C,ER	D, A
42	The community emergency and resilience team	"Community emergency & resilience teams" (CERT) are groups of volunteers that receive basic training to intervene and aid during varied emergencies. They offer help to individuals, groups, and other community members in different areas, from medicine, mental help, search & rescue, social help and more. For example, both urban and rural municipalities in Israel have arranged such teams. In large cities they operate on a community (specific geographic boundaries) level, while in rural areas they operate as a regional (more expansive) level. In an interview with an ex-security officer, he expressed his view that it can work better in rural municipalities than in big cities due to the size of the area and the sense of community. Nonetheless, several cities in Israel (for example, Acre which has a population of approximately 60,000 residents) have successfully integrated such CERT teams in their plans for emergency response.	Collaborative methods and technologies	P,SN,ER	B, D, A
43	Volunteers from passion	A program that aims to increase resilience at the community level by training paramedics. In this way, the volunteers involved can become small ambassadors of their community. It started as a pilot project and evolved on a very large scale (allowing to periodically enrol people, from youth to people coming from different socio-professional categories).	Collaborative methods and technologies	P,SN,H	B

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44	TimeBank	The TimeBank solution is used as a tool to establish a network for civilian participation in the response and recovery from crisis. It was first used after an earthquake in New Zealand in 1011. The solution helps by detecting already active civilian networks, as well as establishing the available time of each participant. The foundation of the solutions is based on trading skills, and is measured by the time it takes to complete a task. The task is paid in credit, and 1 hour or work equals 1 credit. The credit can then again be exchanged for new services. After the earthquake in New Zealand, the TimeBank solution was used to assist emergency services, and played a large role in the recovery process.	Community of practice	SN,ER,QR	D, A
45	RiskMap	VGI is the harnessing of tools to create, assemble, and disseminate geographic data provided voluntarily by individuals. VGI aids in building community resilience very focused on communication.VGI initiatives with recognized benefits can also provide mechanisms for precipitating other events with potentially negative consequences.This solution has some limitations regarding the quality of the data and the participant inequality since it doesn't provide adequate opportunity for inclusive community participation.	Community of practice	R,SN	B, D
46	Second Life	Second Life provides a virtual space where users can access a range of tools as a means of informing, educating, empowering and warning participants in emergency scenarios, both real and simulated. The solution is posited as a media tool with clear advantages for the training of emergency services professionals and citizens in the community as well as for critical thinking and decision-making. Second Life provide an online forum in which participants can interact, communicate and simulate action in a complex 3D graphic environment. A platform like Second Life may provide a virtual solution for such communication challenges especially where communities are too remote, too dispersed or even too many in number to be easily accessible in the field.	Framework	R,P,C	B
47	The Communities Advancing Resilience Toolkit (CART)	The Communities Advancing Resilience Toolkit (CART) is theory-based and evidence-informed community intervention designed to enhance community resilience by bringing stakeholders together to address community issues in a process that includes assessment, feedback, planning, and action. Tools include a field-tested community resilience survey and other assessment and analytical instruments. The CART process encourages public engagement in problem solving and the development and use of local assets to address community needs. CART uses four interrelated domains that contribute to community resilience: connection and caring, resources, transformative potential, and disaster management. The primary value of CART is its contribution to community participation, communication, self-awareness, cooperation, and critical reflection and its ability to stimulate analysis, collaboration, skill building, resource sharing, and purposeful action.	Awareness and training campaigns	P,SN	B, D
48	Hyogo Framework for Action	The Hyogo Framework for Action 1005-1015 aims to build the resilience of nations and communities to natural hazards and disasters. The prioritized actions are related to several measures. Making disaster risk prevention a national and local commitment and a priority is an important step for building resilient societies. It is also important to detect the risks and hazards that may occur in the chosen area, to enhance early warning to the population. An important measures is to spread knowledge about hazards to the civil societies, and locating and detecting vulnerable areas to reduce risks. A last step is to prepare the societies for possible actions when crisis occur. All these steps is important to build resilient societies. This program was the predecessor of the Making Cities Resilient 1030 program which is reference framework in the field of city resilience.	Framework	R,P	B
49	Making Cities Resilient 1030 (MCR1030)	Making Cities Resilient 1030 (MCR1030) is a campaign launched by the United Nations Office for Disaster Risk Reduction. The main aim is to rise awareness of risk reduction and resilience in cities. The campaign is primary aimed at local governments and politicians to help them achieve the Sendai Framework for Disaster Risk Reduction, the Paris Agreement and other important agreements. The program offered several meeting	Framework	R,P,G	B, A

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		points, and participants shared knowledge and previous experiences from different cities. An important aim of this campaign was also to attempt to connect different layers of city governance closer, including the citizens.			
50	IBERO Protocol	The IBERO Protocol aims to be a guide for the standardization of procedures and resources, to improve coordination between the different respondents involved in responding to Multiple Casualty Incidents conducted intentionally (LVMI), reducing pre-hospital care times and transfer to definitive treatment centres for victims, thus improving your chances of survival. This protocol promotes the integration of the different members in responding to emergencies and disasters. The acronym IBERO corresponds to Information, blocking the threat, escalation, response and rescue, order and evacuation which define the sequence of the activities to be followed when dealing with emergencies and disasters.	Guidelines	RA,P,H,ER	B, D
51	Information brochures	Information brochures are a solution used by multiple country authorities, and are developed to provide important information about actions before and during a crisis. In Sweden these are sent out to all households, with the purpose to help its citizens to become better prepared for crisis or war. The types of crisis this solution is pointing to are accidents, extreme weather, IT attacks, military attacks or other types of conflicts. It states what you should do if crisis occurs, lists for home preparedness, and information on different warning systems. They also include how citizens should deal with information or disinformation after an incident, and what to do after terror attacks. The Swedish authorities also include information about defence capabilities and their expectations of citizen contribution to the total defence. The Norwegian brochure has a narrow focus and has a purpose of giving advice on simple measure each household can do to improve home preparedness for crisis or war situations. The Norwegian brochure provides lists and information of food, equipment, medicines or other supplies to procure for home preparedness. The list is providing items for people to survive within their homes for 72 hours.	Guidelines	R,P,C	B, D
52	Guidelines for handling floods	The solution provides guidelines to citizens regarding what to do when flooding and extreme weather phenomenon occurs. This solution provides only one direction of communication, which is from the UK government to the citizens. The guide addresses several points on what to do, and the first section, what regular citizens should do when living through a flood. This section covers how to recover and clean up from a flood, together with information on health perspectives. The second section covers similar things as the first section, but are specifically targeting frontline responders. The last part of the guide covers surveillance reports of floods from the year of 2014.	Guidelines	R,P,QR	B, A
53	ECHO and DIPECHO Program	ECHO and DIPECHO are a programs launched by the European Commission, to improve preparedness and reduce effects of natural disasters with preventive measures. The program provides funding for projects and pilot activities on simple preparatory measures that can enhance resilience, strengthening local physical and human resources in areas with high risk. Examples of projects which have been funded is for example early warning systems, local capacity building, education, linkage between public organisations and others. These project are located in many different countries across the world, and the project emphasize that the risk reduction measures and preparedness should be applied before incidents occurs as preventive measures.	Incentives	RA,P	B
54	Community Rating System	The Community Rating System (CRS) is a voluntary incentive program introduced by the National Flood Insurance Program in the USA. The CRS is a federal initiative, aiming to strengthen resilience towards floods in local governments and communities, through financial, human, natural, physical political, and social capital already in the community. The National Flood Insurance Program has set some minimum requirements, but the activities in the CRS are more comprehensive. Communities earn points based on 19 creditable activities related to flood preventing topics. These topics are public information, mapping and regulations, flood damage reduction, warning and responses. One of the limitations related to this initiative is the need to	Incentives	RA,P,ER	B

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		determine if the benefits of implementing these resilience-enhancing activities over time exceed the costs incurred. USA joined the CRS system in 1010 following a severe flood in 2008.			
55	Covid-19 webinars	Webinars held by the EMS. Many people watched them and participated by asking questions in Q&A sessions. This helped the organisers to know what kind of information the public are interested in, and how they can adapt solutions to these questions. Involves bilateral communication.	Media	R,P,C	B, D
56	West Midlands Ambulance Service on Twitter	West Midlands Ambulance Service (WMAS) on Twitter communicates with the population through twitter posts. They provide information on regular work days, the types of calls they receive, smaller or larger events, and other information on what has happened during the day. They also provide health information such as how to reduce the risk of heart disease, and on what to do during emergencies. In times of crisis when high call volumes occur, pandemics, or other major incidents, they also communicate advice to the public on Twitter. The main contribution of this solution is information on how to prepare in order to reduce the impact, and action to take in order to reduce harm. The posts the WMAS publish during regular work days will build a larger audience. To have a large audience helps during crisis times, when critical messages need get out to the public. A limitation with the solution is that it only reaches Twitter users, although many posts are picked up by news outlets.	Media	R,H,C	B, D
57	Action plan against radicalisation and violent extremism	This solution provides a governmental level plan to prevent radicalisation and violent extremism. It was developed and implemented after the 11 July terror attack in Norway. The action plan promotes anti-radicalisation work in each police district in the country, as well as providing courses for among others non-governmental organisations, religious organisations, and sports teams. The action plan aims to foster health and social networks for potential persons at risk of radicalisation, to enhance informal anti-radicalisation efforts, and to improve emergency organisations and non-governmental organisations' ability to identify individuals with potential for radicalisation and violent extremism. The action plan was revised in 2019.	Apps	R,SN	B
58	Heat Health Action Plan	The Heath Health Action Plan was developed to improve awareness of and reduce heat related health impacts. The main purpose of this solution is to raise awareness and to provide coordinated response between different policy makers and stakeholders in the community.The interaction of the plan is bilateral between institutions, emergency services, non-governmental organisations, and the health system specifically in that they manage the plan and ensure prevention, preparedness and response. Citizens are the target group of the action and is involved in all activities.	Apps	R,P	B
59	Snow Emergency Plan	To be prepared to handle snow events in the centre and south of Italy (where snow events are rare). The population has a dedicated website and leaflet to improve proper risk avoidance behaviours (proper clothes, avoid water pipes freezing, car maintenance tips in winter weather, avoid accidents in slipping grounds, etc).	Apps	RA,P	B
60	The regional plan on prevention and active fight to forest fires in Lazio region	To coordinate the prevention of forest fires through surveillance of wild and green areas. The plan gives the general structure of the prevention and fighting activities, in particular in case of a fire the responsibilities of each stakeholder involved, with the aim to clarify the role of each and improve coordination of specialised persons and technical extinguishing means. The plan foresees a surveillance activity nearby green spaces during the entire fire season and this is in charge of civil protection volunteers organisations. On the basis of the plan, every year, at the beginning of fires season, the Mayor of each municipality in Lazio region issues a regulation in which citizens are involved to avoid risky behaviours: proper grassland management of private fields, day-trippers not using fires or disposable barbecue, especially near green spaces and trees, proper pruning the trees, etc. The volunteers of the civil protection are also engaged into an information and education campaign to schoolchildren including forest fires ("Io non rischio" campaign, with a video animation from DPC).	Apps	R,P,ER	B

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61	Safecast	Safecast is a collaborative citizen science platform for measuring radiation. It was implemented after the Fukushima earthquake in 2011, and provides tools and a database for measuring radiation after nuclear disasters in order to allow citizens to make their own informed decisions. This solution was developed through a process of collaborative open innovation by an international, volunteer-based organisation. The information Safecast provided has proven useful to experts, policy makers, and the public.The usage of the tools provided by Safecast is extended to monitor Air Quality besides the radiation levels. Safecast is a volunteer-dependent platform, as the majority of the collected data is provided by volunteers who use Safecast hardware to share some readings from the areas they choose.	Apps	SN,C,QR	D, A
62	Gatherings for bereaved family	Gatherings for bereaved family was a program launched by the Norwegian Directorate of Health (NDH) for family suffering losses after the Norwegian terror attacks in 2011. The program's main aim was to provide psychological help for people that lost family members in the terror and to help them recover from trauma. The gatherings occurred for four weekends after the terror attacks. During the process people learnt about grief, and attended lectures, workshops and social activities, either in smaller groups or in plenary sessions, covering a wide range of relevant themes The themes changed throughout the period, and let people reflect on different upcoming events such as the trial, verdict and so on, or other themes related to the process of grief.	Services to reach society	H,QR	A
63	Memorial ceremony after terror events	The memorial ceremony after the Norwegian terror attacks in 2011 was hosted to rebuild national community and tolerance. To mark the 10 year anniversary after the attack, a ceremony was hosted for two days, with important speeches and songs. The event was hosted by several organisations such as The 11 July Centre, Utøya AS and the Norwegian authorities. It was hosted in several places, in which the service in Oslo Cathedral Church was open to the public. The main contribution with the solution is to strengthen social support, remembrance of the victims and to prevent future marginalisation. One of the limitation might be that parts of the ceremony are held in churches, which might lead to some kind of polarisation towards certain groups.	Services to reach society	H,QR	A
64	Public access to audit reports	Public access to audit reports was provided by the Norwegian government after the terror attacks in 2011. This provided public insight into governmental audit reports and their work on societal security. The ministry of Justice launched an audit report on the work with societal safety and preparedness in different ministries in Norway. This solution aims at improving the openness and trust towards formal authorities and their handling of societal safety related issues. It also enables the public to participate in the discourse on important aspects related to societal resilience. One of the limitation with this solution is that the report could reveal potential vulnerabilities that could be exploited by persons and actors with bad intentions.	Services to reach society	P,SN,G	B, A
65	Online memories after disasters	To provide diverse narratives of a disaster event and help in coping with the disaster through social platforms. It was implemented after the L'aquila earthquake to promote the communication and information sharing from the society to the institutional agencies as well as among the members of the society to recover from the suffered impact. It can also be used among citizens to share experiences and provide mutual assistance	Services to reach society	SN,H,C	A
66	BILTZEN	The integration and enjoyment of the rights of citizenship by all persons resident in the Basque Country, regardless of for example their racial and/or ethnic origin, language, religious affiliation. Being a Publicly owned service, attached to the Department of Employment and Social Policies of the Basque Government, BILTZEN can contribute to the adaptation of regulations, and professional practices to the diversity that exists in Basque society.The main contribution to community resilience is the permanent advance in the capacity of the Basque society to manage positively and in inclusive key the cultural diversity and the coexistence between the different cultural groups that form it. It aims to incorporate the following perspectives for the	Services to reach society	SN,C	B

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		promoting the integration and inclusiveness: interculturality, diversity, lack of discrimination, equal treatment etc.			
67	EKINBIDE	Service responsible for receiving, studying, and responding to complaints, comments and suggestions for improving the public security system and the services provided to citizens. Thus, it is a complaining service, where if at some point in time a citizen considers that any given problem that he has faced has not been adequately managed by the Law Enforcement Agency, he can proceed to file a complaint through this service to improve future actions and resolving the problem at stake. This solution helps to improve the quality of the law enforcement services and the trust that citizens have in these services. Limitation: Since the service is designed to capture each individual's experience, this sole point of view must be further analysed before arriving at conclusions.	Services to reach society	SN,C	B
68	Nixle	To keep citizens updated with relevant information from local public safety departments & schools. Nixle Alerts is an SMS OPT-IN service where people text a zip code to a freephone number, they can signup for all categories of alerts (Criminal Activities/Severe Weather/Missing Persons/Local Events/Traffic).	Services to reach society	C	B, D
69	Red Cross Preparedness Guard	The preparedness guard system is a method and process for a non-governmental organisation (the Red Cross) to organise volunteer efforts in local communities during emergency situations. The main aim of the Preparedness Guard 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 the Red Cross. 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.Citizens are alarmed and mobilised for providing relevant resources in a given situation. Tasks can be transport, manning information posts at an evacuated area, traffic control, and administrative work like registering persons.	Services to reach society	RA,P,SN,ER, QR	B, D
70	The Enabling Social Action programme	This programme presents guidance and recommendations for the public sector to enable and foster social action. Social actions refer to people investing their time and other resources to help the community and provide to the common good. This can range from volunteering and community-owned services to community organising or simple neighbourly acts. Therefore, social action is about people coming together to solve problems in their communities and help improve lives. Whilst many of these social activities occur without the support of the public sector (in which case the role of public servants is to ensure that the right conditions are in place for social action to thrive), some require more specific support from the public sector. The Enabling Social Action Programme defines guidance and a framework of tools to engage with society to help deliver public services more efficiently. Therefore, the aim of this programme is to provide learning and resources for commissioners and other public sector leaders to enable social action. The Enabling Social Action programme describes three approaches to increasing the impact and scale of social action: 1. Joining up local activities and action in a coherent strategy 1. Replicating and tailoring good ideas 3. Supporting a movement	Guidelines	SN,ER,QR	B, D, A
71	Preparedness for Effective Response (PER)	Preparedness for Effective Response (PER) is a program launched by the International Fund for Red Cross and Red Cresent (IFRC). The main aim of the program is to reduce crises impacts on society, and help in preventing human suffering and loss. The crises in aim are floods, epidemics, storms, drought and wildfires. The IFRC decide which hazards they want to prioritise in their preparedness plans, based on country risk assessments, as well as their mandate, services, ongoing projects and overall capacity. The preparedness	Collaborative methods and technologies	R,P,ER	B

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		measures are coordinated with national authorities, and the focus is on training first responders to be prepared for different types of hazards. They are also researching new technologies and contribute to set up early warning systems. The IFRC serves the community with personal capacity, equipment and tools for the ongoing crises management.			
72	30days30waysUK	30days30ways is a national campaign of preparedness activities for citizens via social media. It takes place every year on September. It is an evidence-based, structured social media emergency risk communication, education and engagement initiative. The aim is to increase household and community preparedness and resilience in a world increasingly impacted by climate change and a wide range of risks. Over 30 days every September, all-hazard themed messages and resources are shared by a wide range of partners over social media, e.g. Twitter, Facebook, Instagram and YouTube, using memes and narrative to - connect and facilitate the understanding of risks - empower personal preparedness through easy steps - inform recovery and resilience	Awareness and training campaigns	R,P,C	B
73	Crisis Information Management	Crisis Information Management (CIM) is a standard tool for emergency preparedness and crisis management in Norwegian municipalities. It enables information logging, information sharing, notification and mobilisation of citizens and other preparedness organisations.The main contribution is that most emergency organisations, municipalities and county governors use the same tool to manage crises, which enables for example good collaboration and familiarity across users. It further enables mobilising resources and effective crisis communication. For example, in the case of a water contamination in a municipality, the system is used for notifying citizens by text messages (SMS) to boil the water.Since it is a crisis management tool, it needs to be paid attention to maintaining skills and competence in using the tool during normal operation.	Web platform	RA,P,C	B, D
74	National Emergency Preparedness Platform	The National Emergency Preparedness Platform is an official source of information in Romania to help citizens better understand the risks, and to inform people about prevention measures and behaviour in various emergencies or disasters. The platform uses a webpage called Fiipregatit.ro to convey the information to its citizens. The aim of this platform is to provide extensive information to the population regarding various types of risks. The information is provided based on multiple guidelines with the same structure. The platform is based on a series of guides related to various types of risks and the action to be undertaken before, during and after the crisis. During the COVID-19 pandemic, a series of guides, such as state of emergency, state of alert, symptoms, isolation, vaccination, travel, shopping, general recommendation and others were uploaded on the webpage. This solution was also used as a tool to counter disinformation campaigns about COVID-19. One example was as lack of trust in the population of the protective measures. To counter this, Romanian authorities uploaded a guide with myths, questions and answers that was highly accessed by the population, and contributed to less confusion. One limitation with this solutions is that the server that hosts this platform may go down on various occasions for a limited period of time, due to maintenance services, information update, overloaded web servers and other things.	Web platform	R,P,C	B, D
75	RoHelp	RoHelp is a fully-featured digital platform which lends itself to be used by all organisations that actively are involved in halting the spread of Covid-19. The platform was developed during the Covid-19 pandemic, and its main purpose is to help organisations collect the resources they need. On the RoHelp platform various civil society organisations that are interested in helping during emergency situations can register themselves. They identify the needs adapted to local context and circumstances and they collect donations via the platform in order to solve the problem. The solution allows non-governmental organisations with various fields of expertise to build bridges within their local community and increase the societal resilience. Limitation: Donors	Web platform	RA,SN,ER	B, D, A

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		might lose their interest after the pandemic and this might affect NGOs in their way of collecting donations and solving problems at the community level.			
76	DRIVER+	The DRIVER+ (Driving Innovation in Crisis Management for European Resilience) is an initiative for accelerating crisis innovation in Europe and is launched by the EU. The project aim to encourage crisis innovation and seek to develop a common understanding of crisis management in Europe. The initiative offers a repository of best solutions to improve crisis management, support the development of trials and sharing of user experiences. DRIVER+ provides a portfolio of solutions for the emergency responders. Depending on the need, they can choose among a set of solutions, making it easy to find a solution for each needs. Each solution reaches the society in different ways, and many of the proposed solutions are being tested and implemented.	Web platform	P,ER	B, D, A
77	PublicSonar	PublicSonar (previously known as Twitcident) is a system for real-time social media monitoring for safety and security. The system works by first monitoring local emergency broadcasts for an incident. Once an incident is reported, PublicSonar begins to aggregate relevant social media updates. The service then analyses and filters what it has uncovered. First responders can then use PublicSonar's filters to parse the information that interests them. The system could be used by both first responders and regular citizens to make informed decisions on how to proceed during an emergency. For example, firefighters could be alerted when a second blaze has broken off from the main fire, and direct a team to tackle the new challenge. The service could also be used by people who want to steer clear of trouble in a local area. PublicSonar heavily depends on Artificial Intelligence (AI) techniques, especially Natural Language Processing (NLP).	Web platform	C,ER	D
78	TweetTracker	TweetTracker is a web application developed by Arizona State University that is used as a tool to track, analyse and understand activity on twitter. This enables emergency responders to geographically search and track the population's tweets about specific disasters or events. This contributes to the emergency responders insight into the situation, and may be used as information for necessary actions. The system analyses Twitter feeds to extract and rank popular hashtags, mentions and URLs. It can also provide time filters, geographical maps for tagged tweets and word clouds for popular terms. The TweetTracker is similar to the web application Ushahidi applies the same techniques but instead of focusing only on disasters, they focus on a wider scale of events.	Web platform	C,ER	D
79	A volunteer recruiting platform "Freiwilligenweb"	It is a volunteer recruitment website in Austria. The website aims to connect volunteers with non-profit organizations and social projects that need assistance. On the website, volunteers can search for volunteer opportunities based on their interests, skills, and availability. Organizations can also post their volunteer opportunities and connect with potential volunteers through the website. Freiwilligenweb is part of the Austrian Volunteer Network (Österreichisches Freiwilligenzentrum), which is a platform that promotes volunteering and supports the development of the voluntary sector in Austria.	Web platform	RA,SN,ER	B, D
80	Hackney Wick Scrubs Hub	The Hackney Wick Scrubs Hub are sowing scrubs for health care workers in the British National Health Services (NHS). During the COVID-19 pandemic in 1010, the NHS experienced shortages in scrub supplies. A local doctor contacted the Hackney Wick group, and asked for support. The Hackney Wick voluntary network consisted of people with interest and skills in sowing established the Hackney Wick Scrub Hub. The network was sowing scrubs for health workers located in North-East London. The initiative was started by four women with experience from the fashion industry, but it eventually grew to consist of over 50 volunteers. The initiative also spread to other places, and over 110 sewing hubs were created across England.	Web platform	RA,SN,ER	D
81	Social media strategy for	The social media strategy was developed by the Norwegian Institute of Public Health (NIPH) to streamline the activity and appearance of the institute on social media. The aim is to communicate the NIPH's messages and	Media	R,C	B, D

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	scientific communication	advice to the public especially, and to disseminate information based on their basis of knowledge in general. Moreover, social media function as a listening post, in which one can get insight into the opinions of target groups, as well as get input and feedback on own work. The NIPH has an active presence on different social media accounts (Facebook and Instagram in particular) and seeks to reply to questions and comments from social media users. The strategy provides broader guidelines that employees working with the institute's social media accounts must abide to, which ensures that the institute work in the same direction. Based on the strategy, there are more detailed guidelines on for example which language to use, how to report to the next person on duty, how to use the social media management tool (Retriever RelationDesk), and when to close comments sections.			
82	Dopomoha	Dopomoha.ro is an information and support platform for refugees who request help in Romania. The web platform named Dopomoha, which means "Care for Romania", was developed as a response to the refugee crisis during the war in Ukraine. It allows NGOs, (unorganised) volunteers, and private companies to register their available resources, such as transport, food and housing. Moreover, national and UN agencies located in Romania can access and make use of the resources to help the refugees, for example with finding safe housing. The NGO Code4Romania has developed the platform in open source-code.	Web platform	RA,SN,ER	D
83	Covid-19 chatbots	During Covid-19 pandemic, several health authorities worldwide used chatbots to provide information about the pandemic, vaccines, symptoms, and other questions to the public. The most dominant chatbots were created by WHO and CDC, but there is still a wide use of similar chatbots worldwide. In most cases, the chatbots are used to answer simple questions, such as to help the individual to decide what to do with his/her symptoms, or to find information about COVID-19 regulations. The chatbots were implemented either on independent websites or in messaging apps and social networks (e.g., WhatsApp, Viber, Facebook).	Web platform	H,C,ER	D
84	Humanitarian aid chatbot, #vBezpetsi ("Safe Space")	The world food program-led Emergency Telecommunications Cluster (ETC) launched a mobile chatbot to aid people living in Ukraine, in the humanitarian crisis during the war with Russia. The chatbot is part of a set of solutions for communication services in humanitarian emergencies. The chatbot lets people find information where, when and how to get the support they need. The chatbot allows individuals to apply for assistance directly from different humanitarian organizations in their own language. It also allows the humanitarian organisations to take a scalable, electronic, hands-off approach to fielding queries and delivering information to the people in Ukraine.	Apps	C,ER	D
85	Clara, the disaster response chatbot (Red Cross)	Clara is a chatbot aimed at disaster survivors, to assist them to get the aid and resources they need, and also to provide information about the red cross. It is part of the Red Cross website. The chatbot can answer questions about several topics: (1) disaster response – looking up for local shelters or getting financial assistance; (1) financial donations – where to donate to how to get help with a donation; (3) volunteering – how to apply or volunteer remotely; (4) training service – how to register for courses; (5) service to the armed forces – resources for veterans or members of the military; (6) international services – information about the American red cross' relief efforts.	Web platform	RA,H,C	B, D, A
86	PetaBencana, Indonesian chatbot for disasters	PetaBencana is an Indonesian chatbot that crowdsources social media data to map disaster events in real-time, enabling residents and government agencies to spread information to the public. The conversation abilities of the chatbot are basic. Addressing the chatbot or tagging it in Twitter results a link to the website in which the individual can provide data and then get the relevant information to him/her about disasters close by. In addition, individuals can send picture from the affected area to facilitate alerts.	Web platform	SN,C	D

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87	Emergency management zones	South Australia has created eleven urban and regional Zone Emergency Management Committees responsible for strategic emergency management planning within each Zone, in response to the requirement for planning to improve local capacity and competence.	Collaborative methods and technologies	R, P	B
88	Building capabilities	Access to state government recovery professionals in a consultative role for local governments who are overburdened or have minimal expertise in recovery. This consultative method encourages locals to make their own decisions while receiving guidance from knowledgeable individuals on how to conduct and manage recovery.	Community of Practice	ER, G, QR	A
89	Insuring Against Disaster	Good Shepherd Microfinance created a Toolkit to help households enhance their financial resilience and increase their adoption of adequate insurance. The Toolkit outlines the procedures to follow in order to be financially prepared and recover faster from the effects of a disaster.	Awareness and training campaigns	R, P, QR	B
90	Resilience agents	The resilience agents are a community-based group responsible for sending early warnings, reaching, and strengthening relationships with the government, advising communities, preparing databases, and identifying those most vulnerable. The resilience agents learn about their needs and interests, such as early response, flood management, first aid, Community Risk Assessment (CRA) preparedness, gender, leadership, and COVID-19 prevention.	Collaborative methods and technologies	P, ER, G	B, D, A
91	Heatwave warning system	The alert system is based on the Australian Warning System and includes three phases: 'advice', 'watch and act' and 'emergency'. The notifications would be sent via the WA Emergency website, ABC Radio, and other broadcasters.	Services to reach society	P, C, ER	B
92	Community Recovery Committees	Community Recovery Committees (CRCs) are volunteer-led organisations that help communities recover from catastrophes. Collecting information, establishing community goals, advocating for community needs, and organising or supporting activities are all examples of this.	Community of Practice	SN, ER, QR	B, D
93	Workbook to reduce disaster risks	Workbook-style reading materials for learning how to lower catastrophe risks at the national and neighbourhood levels.	Community of Practice	R, P, C	B
94	The Safety tips app	Its goal is to create an atmosphere in which overseas visitors may travel about Japan with more confidence. In addition, there includes an evacuation flowchart that explains what evacuation behaviours are necessary for the given situations, a communication card that can be used to receive information from Japanese people, and valuable links that provide information in times of catastrophes such as emergency shelters.	Apps	C, QR	B, D
95	Japan Official Travel App	Natural catastrophes, harsh weather, and other crises are all warned of via alert alerts. There is also information on what to do in an emergency, such as instructions to emergency shelters, where to receive medical aid, contact information for embassies, and a communication card with important words for individuals who do not speak Japanese.	Apps	C, QR	B, D
96	goo Disaster Prevention App	It is an all-in-one disaster information application. It has the ability to register and search for safety information. The disaster prevention map tool allows you to locate evacuation centres.	Apps	P, C, QR	B, D
97	FEMA App	FEMA (the Federal Emergency Management Agency) provides information on over 20 different types of crises, ranging from avalanches to cold weather. The app also connects to important numbers like 911 and FEMA, so one can receive help all in one location. Guidelines for filing flood insurance claim are also accessible.	Apps	C, ER	B, D
98	Layout of Shelters and Ways to Use Space	The government assisted the field response by developing reference examples such as shelter layouts for COVID-19, space layouts for healthy people to stay in shelters using partitions and tents, and private room layouts for those with symptoms such as fever and coughing and others in close contact, and disseminating these references to local governments.	Services to reach society	ER, QR	D

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99	Japan Meteorological Agency (JMA)	The online portal provides alerts for volcanic eruptions as well as countrywide seismic warnings via the Earthquake Early Warning (EEW) system. JMA is also one of the World Meteorological Organization's Regional Specialized Meteorological Centres (WMO).	Media	P, C	B, D, A
100	Shelter finder	This webpage presents the most recent shelter information from the National Shelter System, which is refreshed every 30 minutes. The website maps sites around the United States and contains information such as the agency overseeing the shelter, the shelter's capacity and present population, the linked catastrophe event, and the precise shelter address and location.	Web platform	C, QR	D
101	Disaster alert	Disaster Alert is a free smartphone app that gives people, families, and loved ones the information they need to be safe anywhere in the world. Disaster Alert provides real-time alerts on 18 distinct categories of hazardous dangers as they occur throughout the world.	App	R, P, C	B, D, A
102	Get Ready	The Get Ready website provides information on risks in New Zealand as well as advice on how to prepare for an emergency.	Web platform	R, P	B, D, A
103	Disaster multimedia toolkit	Downloadable multimedia materials in several languages, such as social graphics, posters, announcer scripts, accessible movies, and animations, to assist individuals in sharing critical catastrophe information with others before, during, and after a disaster.	Web platform	R, P, C	B, D, A
104	Integrated Public Alert & Warning System	The Integrated Public Alert and Warning System is a local alerting system that sends out authenticated emergency and life-saving information to the public via mobile phones via Wireless Emergency Alerts, radio and television via the Emergency Alert System, and the National Oceanic and Atmospheric Administration's Weather Radio.	Alert system	C, ER	B, D, A
105	Resilience Analysis and Planning Tool (RAPT)	RAPT has over 100 preloaded layers, including peer-reviewed community resilience indicators, census demographic data, infrastructure data, and weather, hazards, and risk data.	Collaborative methods and technologies	R, P, ER	B, D, A
106	Community Lifelines Implementation Toolkit	The Community Lifelines Implementation Toolkit gives information and tools to whole community partners in order for them to comprehend lifelines, coordinate with entities that use lifelines, and provide basic direction on how to execute the lifeline construct during crisis response.	Collaborative methods and technologies	P, ER, QR	B, D, A
107	Pre-Disaster Recovery Planning Guide for Local Governments	The planning guide is intended to assist local governments in preparing for recovery by developing pre-disaster recovery plans that follow a process that engages members of the entire community, develops recovery capabilities across governmental and nongovernmental partners, and eventually creates an organisational framework for comprehensive local recovery efforts.	Guidelines	P, G, QR	B
108	Community Recovery Management Toolkit	The toolkit walks communities through a three-step process of recovery organisation, planning, and management, while also providing resources from other recovery support roles.	Guidelines	RA, ER, QR	B, D, A
109	Roadmap to Federal Resources	The Roadmap to Federal Resources for Disaster Recovery assists state, municipal, tribal, and territorial authorities, as well as other interested parties, in navigating some of the frequent obstacles that follow a disaster. The Roadmap explains how existing government funding programmes might be coordinated to support viable solutions to the highlighted concerns.	Guidelines	RA, ER, QR	A

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	for Disaster Recovery				
110	The Climate-related Disaster Community Resilience Framework	A framework for early warning solutions for flash floods, debris flows, and landslides, with broader implications for disaster management and emergency preparedness in Afghanistan's conflict-prone highlands. The framework recommends measures to improve community resilience.	Framework	P, G	B, D, A
111	Hospital Emergency and Disaster Management (HEDM) index	A tool for developing hospitals that are resilient and prepared in the event of an emergency or disaster. The HEDM score may also be used to benchmark hospitals in terms of the critical aspects for establishing disaster-prepared hospitals. A quantitative technique that assists decision makers in setting long-term improvement targets.	Collaborative methods and technologies	RA, P	B
112	Software Factory	The cloud software factory creates Smart Collaborating Hubs, which are hubs of activity that comprise highly specialised and intelligent artefacts such as an Administrative Portal, a Citizen App, Training Materials, and appropriate Policies on a certain issue. Most significantly, all SCHs are pre-configured to collaborate with one another.	Collaborative methods and technologies	C, ER, QR	A, D

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