

LINKS

Strengthening links between technologies and society
for European disaster resilience

D2.7 SECOND KNOWLEDGE BASE METHODOLOGY FOR THE LINKS FRAMEWORK AND CASE ASSESSMENTS

Research Report

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EXECUTIVE SUMMARY

About the project

LINKS “Strengthening links between technologies and society for European disaster resilience” is a comprehensive study on disaster governance in Europe. In recent years, social media and crowdsourcing (SMCS) have been integrated into crisis management for improved information gathering and collaboration across European communities. The effectiveness of SMCS on European disaster resilience, however, remains unclear, the use of SMCS in disasters in different ways and under diverse conditions. In this context, the overall objective of LINKS is to strengthen links between technologies and society for improved European disaster resilience, by producing sustainable advanced learning on the use of SMCS in disasters. This is done across three complementary knowledge domains:

- Disaster Risk Perception and Vulnerability (DRPV)
- Disaster Management Processes (DMP)
- Disaster Community Technologies (DCT)

Bringing together 15 partners and 2 associated partners across Europe (Belgium, Denmark, Germany, Italy, Luxembourg, the Netherlands) and beyond (Bosnia & Herzegovina, Japan), the project will develop a Framework to understand, measure and govern SMCS for disasters. The LINKS Framework consolidates knowledge and experiences on the uses of SMCS into useful products for relevant stakeholders. It will be developed and evaluated through five practitioner-driven European cases, representing different disaster scenarios (earthquakes, flooding, industrial hazards, terrorism, drought), cutting across disaster management phases and diverse socioeconomic and cultural settings in four countries (Denmark, Germany, Italy, the Netherlands). Furthermore, LINKS sets out to create the LINKS Community, which brings together a wide variety of stakeholders, including first-responders, public authorities, civil society organisations, business communities, citizens, and researchers across Europe, dedicated to improving European disaster resilience through the use of SMCS.

About this deliverable

This deliverable (2.7) provides the second version of the methodology of the LINKS project after the first case assessments. It is a follow-up of the first methodologies developed in the first phases of the project in D2.3, D3.2 and D4.2. This deliverable presents a description of how the first set of methodologies were applied in the cross-case assessments and evaluates this process (Section 2). Moreover, it provides an overview of how the methodologies contributed to the development of the products and the LINKS Framework that are being developed in the project (Section 3). The main section of the document is related to the research design for the second methodology. It offers a holistic approach starting from the first methodologies insights, combined with a set of researcher and practitioner driven activities (Section 4). As in D2.3, D3.2 and D4.2, this second methodology is also based on the three LINKS knowledge bases (KBs), Disaster Risk Perception and Vulnerability

(DRPV), Disaster Management Processes (DMP) and Disaster Community Technologies (DCT), allowing to apply the methods across the five different cases.

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LIST OF ACRONYMS

Acronym / Abbreviation	Description
CAT	Case Assessment Team
DCT	Disaster Community Technologies
DMO	Disaster Management Organisation
DMP	Disaster Management Processes
DRM	Disaster Risk Management
DRPV	Disaster Risk Perception Vulnerability
KB	Knowledge base
LAC	LINKS Advisory Committee
LCC	LINKS Community Center
LCW	LINKS Community Workshop
NGO	Non-governmental organisation
SMCS	Social Media and Crowdsourcing
WP	Work Package

DEFINITION OF KEY TERMS¹

Term	Definition
Case assessment	The cross-case assessments (or case assessments) are joint efforts between WP2-4 and investigate the specific knowledge domains across different contexts while exploring interacting themes. The cross-case assessments are thus both an attempt to explore domain-specific questions through a comparative lens and an attempt to explore the interdependent questions cutting across knowledge domains.
Disaster Community Technology (DCT)	A DCT is a software(-function) for interaction with, within or among groups of people who have similar interests or have common attributes (communities) in case of a disaster as well as performing analysis of these interactions
Disaster Management Processes (DMP)	A collective term encompassing a systematic series of actions or steps taken to reduce and manage disaster risk. Disaster management processes are often associated directly with the phases of the Disaster Management Cycle. In the context of LINKS, DMP are specifically referred to as the policy frameworks, tools and guidelines developed to govern disasters across all phases of the Disaster Management Cycle
Disaster Risk Management	Disaster risk management is the application of disaster risk reduction policies and strategies to prevent new disaster risk, reduce existing disaster risk and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses.
LINKS Advisory Committee (LAC)	Invited professionals and experts from relevant organizations (representing practitioners, researchers, and citizens) that advise, inform and validate developments and results in the project.
LINKS Community Center (LCC)	The LCC brings together different stakeholders (LINKS Community) in one user-friendly and flexible web-based platform and enables them to exchange knowledge and experiences and to access, discuss and assess learning materials on the usage of SMCS in disasters.
LINKS Framework	A set of best-practices consisting of methods, tools and guidelines for enhancing the governance of diversity among the understandings and applications of SMCS in disasters for relevant stakeholders.

¹ Definitions are retrieved from the LINKS Glossary (forthcoming).

	<p>Methods in LINKS refer to approaches that will enable researchers and practitioners to assess the effects of SMCS for disaster resilience under diverse conditions. Tools are practical instruments supporting first-responders, public authorities and citizens with the implementation of SMCS in disaster and security contexts. Guidelines are recommendations for improving national and regional governance strategies on SMCS as well as introductions and explanations of how to apply the methods and tools under diverse conditions.</p>
LINKS Knowledge Bases	<p>The outputs and knowledge obtained from the assessment of the three knowledge domains. The knowledge is used to develop the LINKS Framework.</p>
(Disaster) Risk perception	<p>Risk perception is the way individuals and groups appropriate, subjectivise and perceive risks that might or might not be calculated in an objective manner during risk assessment. The importance of studying risk perception more seriously is obvious: risk perception directly influences people's ability and level of preparedness. Risk perception covers what is also referred to as "risk awareness".</p>
Vulnerability	<p>The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or system to the impacts of hazards. The LINKS project focuses on social vulnerability, which is interpreted as a function of exposure, susceptibility and resilience. It is a pre-existing and dynamic condition, result of processes built over time (e.g., social power relations at national and international levels) and all the environmental and social circumstances that allow or limit community's capacity to deal with risks.</p>

1. INTRODUCTION

1.1 Purpose of the Second Methodology

This deliverable is a follow-up to D2.3 (Bonati et al. 2021), D3.2 (Nielsen et al. 2021) and D4.2 (Gelhar et al. 2021), which represent the first versions of the methodologies for the three knowledge bases (KBs) defined in the first phases of the project: Disaster Risk Perception and Vulnerability (DRPV), Disaster Management Process (DMP) and Disaster Community Technologies (DCT). This deliverable is part of the tasks T2.4, T3.3 and T4.3 from the Grant Agreement with the purpose to inform and refine the three knowledge bases and the methodologies through the first case assessments carried out from November 2021 - April 2022 by the Case Assessment Teams (CATs). Part of the results from the case assessments have been already presented in Deliverable 6.4 (Clark et al., 2022) and a systematized and in-depth analysis is planned to be presented in a future project publications. Hence, this deliverable does not aim to present the results in detail but, starting from the first assessment phase, to outline the development, purpose and the main methods to be used in the second case assessments. The new version of the methodology will be used to assess the products of the LINKS Framework to better inform and guide their/its development. The LINKS Framework and the products have been first described in the deliverable D5.3 (Fonio et al. 2022) and the next update on the Framework and products will be in D5.4 in November of 2023.

This methodology is an ensemble of the three LINKS knowledge base methodologies (D2.4, D3.3 and D4.3). The decision to have a joint methodology is due to the recognition that at this point of the project the focus of the actions is not exclusively on the individual knowledge bases but mainly on their interaction and how this interaction could be at the basis of the production of new knowledge. Based on this conviction, the products in the LINKS Framework are the result of this interaction and collaboration among WP2, WP3 and WP4. However, this does not exclude that the results of the second methodology will be used to update the individual KBs.

1.2 Reading Guide

This deliverable has two main purposes. First, it evaluates the first case assessments and presents how the outcome has informed the current status of the LINKS project. This is done in Section 2 where we summarise how the first methodologies were applied and reflect on the validity and usability of the methods. In Section 3, we present how the results generated by the first methodologies have informed the LINKS Framework with an emphasis on the LINKS products.

Second, the second version of the methodology serves the members of WP5 and WP6 who will apply the new methodology in the second case assessments. This new methodology is described in Section 4.

2. APPLICATION AND ASSESSMENT OF THE FIRST METHODOLOGIES

The aims of the first Knowledge Base (KB) methodologies were to guide and support the development and the assessment of the LINKS Framework that has been applied in the five cases. Each methodology provided information on the research methods applied in the case assessments.

From the three methodologies a set of research questions were elaborated (D2.3, D3.2, D4.2), related to the three KBs for the first case assessments. The questions were mainly focused on understanding connections between the knowledge bases and investigating how social media and crowdsourcing (SMCS) are used in disaster risk management, what are their limits and potentialities, and how their use can be implemented.

Some considerations on the contribution of the methods applied are described at following.

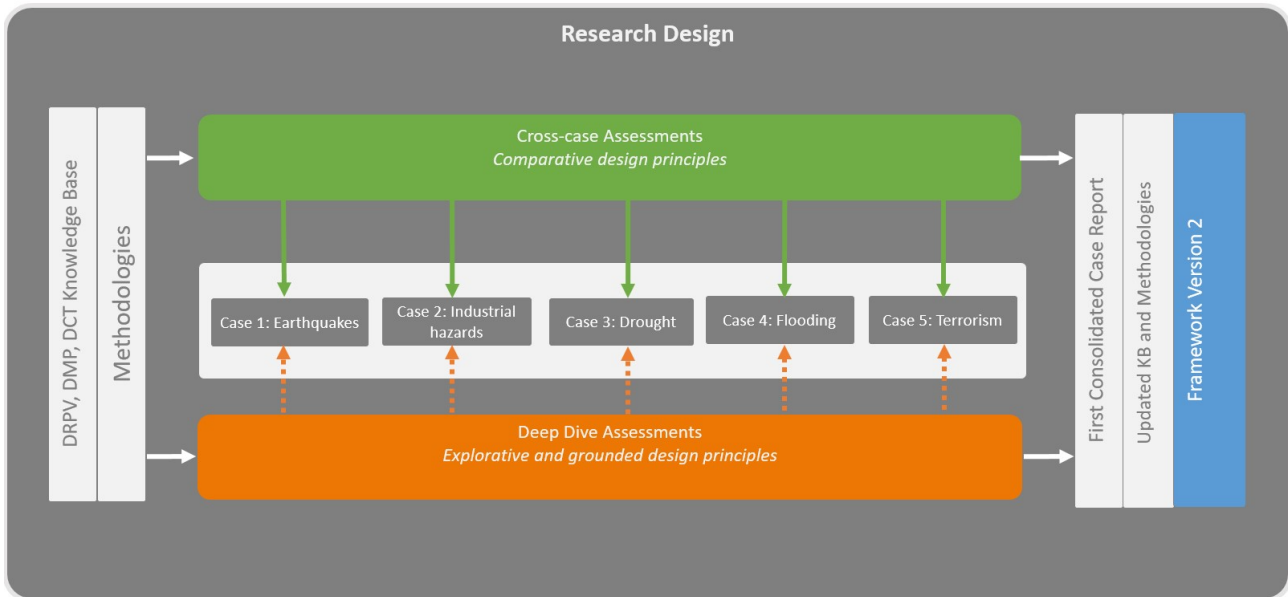
2.1 How the Research Methods were applied

As previously noted, the development and evaluation of the Framework is carried out through research activities in five case scenarios in Europe:

- Case 1: Earthquakes in Italy
- Case 2: Industrial hazards in the Netherlands
- Case 3: Drought in Germany
- Case 4: Flooding in Denmark
- Case 5: Terrorism in Germany

There are two rounds of case assessments during the project. The first round of assessments ran from November 2021 – April 2022. The research design was based on two levels: cross-case assessments and deep dives assessments (Figure 1).

Figure 1: Research Design for the first Case Assessments



Source: WP2-4 contribution and adapted by WP6

For the cross-case assessments, a set of methods were established for exploring interrelated themes and questions across DRPV, DMP and DCT knowledge domains in all cases (D2.3, D3.2 and D4.2). The methods aimed at gathering information on experiences, good practices, needs and challenges of disaster management organizations (DMOs) in the application of SMCS in disaster management processes. To ensure this, the case assessment teams were equipped with guidance and protocols for applying different research methods in the cases (guidelines and protocols are provided in D6.4).

For the deep dives, the case assessment teams also had the freedom to explore topics related to the uses of SMCS, within the specific contexts of the local case scenarios (cf. D6.2 (Fonio & Clark 2021)). In the first round of assessments, the teams conducted various activities such as local surveys, workshops, focus groups and action research gaming (cf. D6.4). The results from the deep dives are not the focus of this document as explained in the introduction, however, they have helped to inform the ongoing development of the knowledge bases (and subsequent products) in a number of ways, through:

- Local validation of the results from the first round of case assessments.
- Further contextualization of results within the focused scenarios of each case.
- Establishing product/Framework ownership by local stakeholders at case level.
- Assessing local barriers and further development concepts for the second methodology and second round of case assessments.

Data collection for the first round of case assessments took place between November 2021 – March 2022. In total the teams conducted 54 interviews for the cross-case assessment and the survey received 219 responses across the case countries (and 284 across Europe). Deliverable 6.4 (Clark et

al., 2022), provides the results from the first analysis of the data. The first analysis of the interview data was conducted by the case assessment teams between February – June 2022. The first analysis of the survey data was conducted by safety innovation center in April 2022.

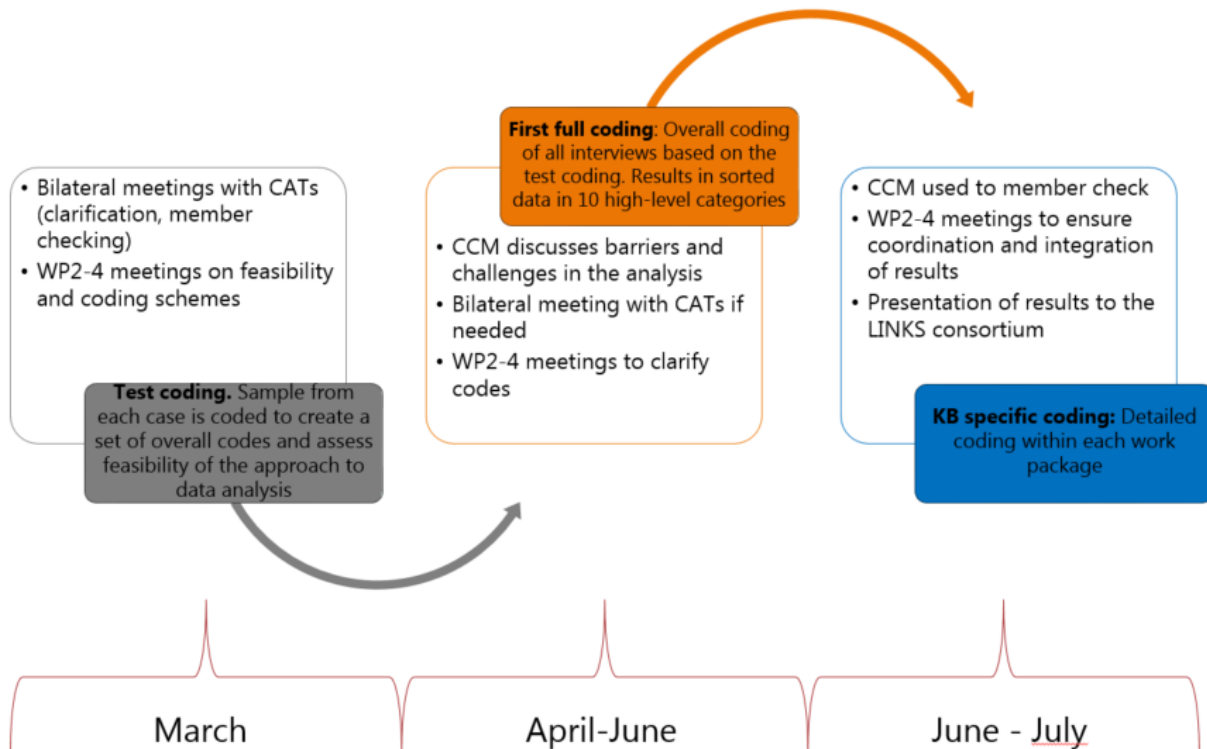
This deliverable builds from the results presented in D6.4 as well as further analysis of the case results by the KB. The results feed into the evaluation and updating of the methodologies and subsequently the methods in the second round of case assessments starting from November 2022, as well as into the overall design of the LINKS Framework.

In the following section the process of analysis for each cross-case method applied is detailed.

2.2 Interviews

As part of the cross-case assessment, the five case assessment teams conducted semi structured expert-interviews. Between May and July 2022, these interviews were qualitatively coded² This was done through three coding cycles as illustrated in Figure 2. WP3 was in charge of the test and high-level coding (cycle 1 and 2) while the detailed coding was done by each knowledge base (cycle 3).

Figure 2: Coding Process



Source: WP3

² NVIVO is a Qualitative Data Analysis software, supporting qualitative analysis of text corpora structurally.

Along the lines of the three knowledge bases DRPV, DMP and DCT that also structured the interviews, WP 2-4 each developed qualitative-codes. These codes align with the research design for the cross-case assessments, developed in the deliverables D2.3, D3.2, and D4.2, enabling the exploration of interlinking themes that connect the three knowledge bases (cf. D6.4.). Furthermore, the codes help to analyse the interviews in a structured manner by applying them to chunks of text while close-reading the interviews, eventually structuring the whole corpus to find patterns. In a first coding round, these codes were applied to a sample of three interviews from each case by two coders, checking for inter-coder reliability and construct validity of the codes. Based on these two criteria, they were refined i.e., merged if they could not capture distinct constructs or adapted their inclusion criteria (MacQueen et al. 1998). Additionally, three codes on Specific Events, Learning and Credibility and Reputation were developed, to capture additional themes from the interviews. Lastly, the refined codes (cf. Table 1) got applied to the interview transcripts. As these high-level codes remain on the “surface-level” (O’Connor & Joffe 2020, p.8) it was deemed as sufficient to keep inter coder reliability checks to the aforementioned sample.

Table 1: Final Version of High-level Codes applied to the entire Interview Corpus

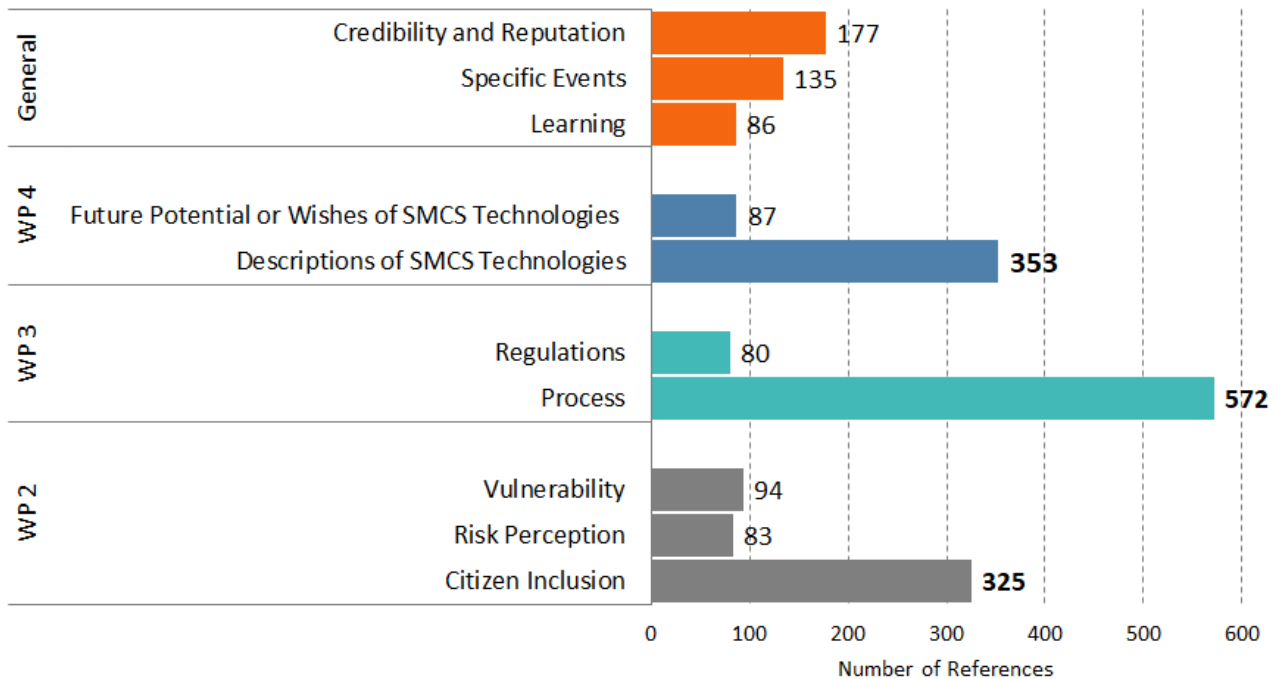
Code	Description
Citizen Inclusion	References to targeting citizens, including citizens, monitoring, and engaging with citizens.
Risk Perception	Perception of risk (citizen perspective), questions of awareness (of risk for example).
Vulnerability	Both static and more dynamic issues. I.e., when interviewees talk about vulnerable groups such as elderly people or exposure and access.
Process	Organizational procedures and processes (both internal and external). Includes coordination between actors. Both formal and informal.
Regulations/Guidelines	Internal and external regulations that the interviewees mention. I.e., both formal regulations/policies organizations must adhere to and organizational/domain specific guidelines.
Descriptions of SMCS Technologies	Names and providers of SMCS technologies (DCT). Functions/types of tasks SMCS technologies are used for (descriptions of functions and/or tasks carried out using one or more function).

Future Potential of SMCS Technologies	Potential functions for future SMCS technologies they would like to have (needs and potentials, their visions, and suggestions for the future). Usage experiences they are interested in (needs and potentials, their visions, and suggestions for the future).
Learning	Organizational learning process e.g., mentions of workshops, reflection processes or knowledge exchange between organizations.
Specific Events	Mentions of specific events by the interviewees to explain situations where for example crowdsourcing was applied, e.g. the Ahrtal-flood.
Credibility and Reputation	Credibility of information (verification), issues of fake news perception of image/brand/response and feedback from citizens about reputation (for example).

Source: WP3

In this first coding cycle, an inclusive coding strategy was employed (i.e. codes were applied generously) to avoid a high share of false negatives. This was perceived as being important because the high-level codes mainly serve to pre-structure the interviews, thus facilitating further analysis in the cross-case assessment. An exclusive application of the codes would thus possibly lead to a loss of information in later stages, because uncoded chunks of text will more likely be excluded from further analysis.

Figure 3: Frequency-Distribution of High-level Codes applied to the whole Corpus of the Interviews



Source: WP3

As displayed in Figure 3 , overall, this strategy led to a frequent application of three catch-all codes provided by WP 2-4: *Description of SMCS Technologies*, *Processes* and *Citizen Inclusion*. As compared to the codes with more narrow definitions, they got applied about 3-5 times more frequently. Because of *simultaneous coding*, i.e. applying more than one code to sections in the interviews (Saldaña 2013, p.80), these can be used in further analysis to subset the data to co-occurrences with other codes.

2.3 Survey

In addition to the interviews, also a Europe-wide online survey on the use, experiences and potentials of social media and crowdsourcing were conducted. The survey was designed intentionally broad and intended to reach as many practitioners from disaster management organisations (DMO) across Europe as possible. Both the operational and strategic levels of the DMO were addressed. Furthermore, it was designed to obtain trends, interesting and helpful examples. Also, the possibility of identifying further relevant contacts (if explicitly desired) was of huge interest.

The methodological principles, advantages, and disadvantages as well as initial planning information of an online survey as a research method were derived in the first methodology deliverables (D2.3, D3.2, D4.2).

In order to avoid language barriers when answering the questions, the survey was translated into the respective languages from the Case Assessment Teams (CATs) (English, Italian, Danish, Dutch and German). The online survey was developed as follows:

- August-September 2021: Development and refinement of the questionnaire lead by WP4 in cooperation with WP2,3 and 5.
- September-October 2021: Bilateral meetings with the CATs and WP9 (for Dissemination) for instructions on the distribution strategy. For this step, a protocol³ analogous to the interviews was developed as a guiding path for the distribution of the survey.
- November 2021: Pilot testing by external participants from the project partners SIC, UCC and FEU. Translation of the finalized English version of the survey by the CATs into their respective language.
- January 2022-March 2022: Distribution of the survey. The survey was distributed by all project partners to their contacts, networks, and related project. It was also promoted on social media (cf. Figure 4). To increase the number of responses the survey was extended in February for four weeks.
- April 2022: Back translation of the individual answers from the respective CAT language into English.
- April-July 2022: Analysis of the survey results within WP2-4.

Figure 4: Social Media Post for the Survey



Source: WP4

³ The online survey protocols can be found in the annex of Deliverable 6.2

A total of 284 respondents answered the survey from 20 European countries. The distribution was not limited to the four case countries, so responses were also obtained from other European countries. The results from the survey provide important impulses for the future course of the project and further concretise the need for research. Many individual positions and attitudes on the use towards SMCS were collected via free text answers. For example, the participants reported which challenges they see in their organisations for a successful use of SMCS. Furthermore, interesting examples and guidance documents for the use of SMCS could be collected. The participants were also asked about known SMCS technologies, which were then integrated in the Technologies Library (cf. Section 3.3). Overall, important information for the development of the LINKS Libraries could be gained (cf. Section 3.3). As was also apparent in the analysis of the interviews (cf. Deliverable 5.3), the complexity and different understandings of the term crowdsourcing also became clear in the answers to the survey. As already indicated, parts of the results directly informed the specific products (cf. Section 3). A summary of the results can be found in D6.4.

2.4 Workshops

Different kind of workshops played an essential role in the development of the LINKS Framework and its products in the first methodology (cf. Section 3). Both LINKS Community Workshops (LCWs) and a workshop with the LINKS Advisory Committee (LAC) were held. In addition, product-specific workshops were conducted with different motivations. These are mentioned at the corresponding product updates in Section 3.

Until August 2022, ten LCWs have been conducted across the LINKS cases. In the first phase of the project, when the products were in the process of being developed, the LCWs were mainly used to create stakeholder networks at the local level such as to present the project and its purposes. This allowed the consortium to have a better understanding of local stakeholders' needs, while receiving relevant feedback on the development of the LINKS products. The list below presents the main outcomes of the LCWs that have taken place so far, in relation to the development of the LINKS Framework's products:

- the consortium has a better understanding of the needs and expectations of local stakeholders dealing with – or affected by - different kind of hazards in relation to the project's expected outputs; this includes both general indications on what they would like to have as final outputs of the project or what kind of problems and needs they should satisfy such as specific ones like how these outputs should look like (e.g., the guidelines developed in LINKS for using SMCS should be short and explicit, should include information about the regulatory aspects for the use of SMCS, and - if possible - text modules which can be accommodated to the specific emergency as well);
- through an assessment of the SMCS Technologies that practitioners (e.g., the German police forces) are currently using, the consortium has a better overview of what is the level of

knowledge and of integration of technologies the different partners have in their disaster management plans and what they still need for a more effective use of SMCS during the different phases of the disaster;

- the LCWs have also offered the chance to discuss the products with regard to the needs of local DMOs. Important insights could be gained, which then have led to numerous changes to the respective products, guiding their development (cf. Section 3). In some cases, the concept design behind the products was presented, while in others some first examples of products contents were provided and discussed.

Detailed information on the implementation and impact of each LCW will be presented in deliverable 8.5 (due November 2022).

Furthermore, SIC organised the second LINKS Advisory Committee (LAC, cf. Deliverable 8.4 (Bianchi et al. 2022)) in February 2022 with the aim of receiving feedback on the usefulness of the

- current categorisation of the SMCS Technologies Library,
- the Guidelines Library in general and
- the structure and layout of the LINKS Community Center (LCC) including the section Networks.

As the LAC consists of selected experts from different type of stakeholder-organisations who are familiar with the project, they received relevant information in advance and thus a more in-depth discussion was possible. In regard to the SMCS Technologies Library, the participants were asked, which criteria should be selectable to find appropriate technologies for different tasks. Additionally, the participants discussed the Guidelines Library in the LCC and the LCC as a whole. Participants were in general convinced about the usefulness of the presented LINKS results and provided some suggestions and recommendations for further improvements. These suggestions and recommendations were implemented where feasible and a follow-up report was sent to the LAC members. A more detailed report about the LAC will be given in the Deliverable 8.5 (due November 2022).

2.5 Assessment and Evaluation of the First Knowledge Base Methodologies

This section, assesses the suitability of the research methods, developed in D2.3, D3.2 and D4.2, to answer the research questions from the first set of methodologies. Due to this multi-faced research interest from three knowledge bases, a threefold strategy for this a-posteriori quality assessment was employed: first, on a meta level a qualitative-quantitative integration (Munk 2019) of our results was used as an overall validation strategy, resonating with the diversity by design approach. Second, by focusing on validity criteria (Adcock & Collier 2001) and third through practical knowledge utilization (Ferguson 2004).

Overall, the interviews and the survey were designed for two distinct, yet complementary purposes. Whereas the survey intends to draw an institutional landscape of how DMOs apply and need SMCS,

the interviews aim to get a rich and in-depth understanding of this phenomenon (cf. D3.2). Insights from one instrument can thus help interpreting the results of the respective other.

A key take away is the difference in how social media is regarded as a means to communication and only merely as a crowdsourcing resource:

First, many stakeholders don't consider civil society as resourceful during a response phase, find them unreliable, and don't perceive the information they receive as trustworthy when operating during an emergency. Second, crowdsourcing is a rare phenomenon in Denmark as disaster management organizations prefer to handle social media manually. The more automatized the use of social media is (i.e. sentiment analysis etc.) the less the participants agree to the questions. This leads to an anticipation that whenever social media gets outsourced or the responsibility is passed along to external partners, they don't fully trust the process.

- Danish CAT, Flood scenario

For both survey and interviews we had difficulties contextualizing the concept of crowdsourcing. Crowdsourcing is not a well known concept in Denmark and especially not under the auspices of social media. Therefore we see that many of our practitioners have trouble relating to and understanding the questions that concern social media crowdsourcing.

- Danish CAT, Flood scenario

This is achieved through the complementary design of the research methods, which is situated in the three knowledge domains. Several conclusions drawn from the interviews can thus be compared to questions from the survey, eventually finding overlaps or divergences. This form of combining qualitative and quantitative methods aligns with a complementary style of integration, i.e., *'Interpreting insights from a quantitative analysis [...] by situating these insights qualitatively'* (Munk 2019, p. 164). The emic perspectives (i.e. the participants' native views (Munk 2019, p. 160)) gained from the interviews can thus help interpret the survey results and vice-versa. Additionally, (dis-) similar results can be used to verify or falsify the results from one standalone instrument.

Exemplary for this complementary approach is the finding from the interviews that many experts expressed little experience with crowdsourcing. The data from the survey is supporting this conclusion. Asking *'In which major hazard has [the participants'] organisation already used crowdsourcing'*, showed that 50.7% of the answers indicated that their organisation has not used crowdsourcing yet. Additionally, the impression of the CAT summarized in the two boxes to the left contextualizes the survey result

by adding that the little knowledge organisations have about crowdsourcing also stems from actively restraining from it.

The validity assessment of the results when is facilitated by the concept of measurement validity, i.e. *"meaningfully capture[ing] the ideas contained in the corresponding concept"* (Adcock & Collier 2001, p. 530). This perception of validity mainly stresses the operationalization. For the LINKS methods that are part of the cross-case assessment the operationalization was conducted in connection to the contextual specificity by breaking down the generic concepts derived theoretically into case specific ones (Habig & Lüke 2021; Nielsen & Andersen 2021). This was facilitated using the

Resilience Wheel as a tool to develop the case specific frameworks for the interviews. By developing case specific versions of the Resilience Wheel in collaboration with the Case Assessment Teams (CATs) (D3.2), the contextual specificity of the interviews was taken into account (Adcock & Collier 2001), while keeping the overarching framework similar and thus comparable across cases. For the survey the contextual specificity is also relevant to target the intended population for each case. This was achieved through rolling out the survey by the CATs in close collaboration with WP2-4 (D 3.2).

In crisis communication, little attention is paid to vulnerable groups. There is no unambiguous definition of who belongs to a vulnerable group. There are many "types" of vulnerable groups to define. Besides the social media tools and technological resources available, it is a prerequisite to build and maintain a relationship with stakeholders in the phases without an incident. Both, with local residents and with professionals.

- Dutch CAT, Industrial Scenario

However, some of the drivers derived from the Resilience Wheel where perceived as vague (i.e. 'learning' or 'processes') or did not resonate with the practices in DMOs (i.e., 'vulnerability'), requiring further specification, as expressed exemplary by the Dutch CAT in the box to the left. The survey results also indicate little attention to vulnerability. Here, 60.6% of the respondents reported that they do not consider vulnerable people explicitly on social media and 85.9% reported this for crowdsourcing. As the

interviews suggest that this might be due to a flawed operationalization of this concept, this contextualizes the result. An insight which could not have been drawn from the survey alone, thus emphasizing the integrated validation strategy (Munk 2019).

Lastly, practicality or knowledge utilization was an important validity criterion. All research questions require an emic (Munk 2019) understanding of domain specific practices, especially in order to develop strategies relevant to practitioners to strengthen SMCS in disasters. Practicality or knowledge utilization relates to the '*utilization [...] of knowledge generated through research for policy and practice decisions*' (Ferguson 2004, p. 19).

Knowledge transfer between academia and practice is thus utilized in two ways to validate and assure the practicality of the products. On the one hand, the research instruments are encouraging inputs by practitioners by design. For example, the interviews, were developed as semi-structured, thus leaving room for side tracks and excursions taken by the interviewees. On the other hand, these inputs were used to refine the products. An example for that can be seen in the textbox to the left on the next side. As mentioned above, it became apparent here that the Wheels driver *Vulnerability* lacks practically: Interviewees often needed further clarification what the term means or stated that vulnerable groups do not play a special role in their actions. As further elaborated on in section 3.7 below, this input was used to redesign the Wheel. Taken together this feedback loop thus assures

"A finding that was particularly striking was that several interviewees mentioned the unintended effects (police) social media communication during crises such as a terrorist attack can have: there is a tendency of populist actors to use the relative insecurity, lack of information or non-verified information in the early phases of such events to instrument and polarize society. Thus, sensitive and timely social media work is not only crucial to keep citizens calm and out of danger but also to prevent the spread false information."

- German CAT, Terrorist scenario

the practicality of our results, by centring around practitioners' perspectives. In conclusion, the three validation criteria showed the suitability of both the survey and the interviews to answer the research questions and inform the products in the LINKS Framework while also pointing out shortcomings. In the ongoing phases of the LINKS project these insights will be used to further develop the products especially in relation to the practicality of the gathered knowledge.

Taken together, section 2 provides an overview of the different methodologies and initial results derived from them during the first cross-case assessment. The evaluation of these, described in section 2.6. showed how these methodologies were suited in relation to the aims set out in the first methodology. Insights that will be used

in the second case assessments and the overall LINKS Framework. The following section 3 provides an overview of the developed products. Amongst others showing, how insights from the different methodologies were employed to update them.

"The primary challenge for DHPol while conducting the case work resulted from the heterogeneity of the interviewees: even within law enforcement interviewees, the tasks, educational background, familiarity with social media, as well as the level of authority to disclose relevant information varied a lot. This made it difficult to generalize results regarding the application and needs concerning social media and crowdsourcing during terrorist incidents."

- German CAT, Terrorist scenario

3. CONTRIBUTION TO THE LINKS FRAMEWORK

The first case assessments provided a foundation to not only to answer the research questions but also to test and enhance the different products feeding into the LINKS Framework. Accordingly, they were also relevant to define and better shape the inputs coming from the knowledge bases into the first version of the Framework, which are presented in D5.3 (First Version of the LINKS Framework) Through and in-depth analyses across the case results and the LINKS knowledge domains, the inputs have been structured along interconnected themes, linked to the products in the Framework (Figure 5 below).

Figure 5: The LINKS Framework



Source: WP5

As outlined in D5.3, the themes touch upon technical, institutional and social aspects and provide useful resources to govern diversity across the three interconnected areas. DMOs can orientate the “compass”, a metaphor used to refer to the LINKS Framework, towards the aspects which are of particular relevance within their organisation and get access to the experiences and the knowledge included in the Framework’s products (see section 4.2.1 for example).

The case's inputs, as well as those from ongoing meetings, surveys, interviews and workshops, are used to advance the maturity of the products, as presented in the following sections, showcasing the knowledge bases' development stages of parallel yet different paths. First, we present a short status overview of the maturity levels of the products. Thereafter we provide details on the implications of the first methodologies and the process of development for each product.

3.1 Overall Status of the Products

- The **SMCS Technologies Library** has been presented in D4.1 (Habig et al. 2021). It was further developed with selected research methods within the first case assessments (cf. Section 3.4) and continuously discussed and refined with different stakeholders (e.g. local fire departments and authorities, special forces of the police, members of VOST⁴ or technology providers (businesses)). Accordingly, it is already in an advanced state, is publicly available in the LINKS Community Center⁵ (LCC) and will be further validated within the second case assessments.
- The **SMCS Guidelines Library** was a direct result coming from the knowledge bases; then it was based on a process of validation and discussion.
- The **SMCS Use Cases Library** is being developed based on needs of practitioners emerged during the first case assessments. A workshop on the library was conducted during the Annual project meeting in June 2022 and various versions of the schema are currently being tested.
- The **Including Citizens Handbook** is at an intermediate level of advancement; this is a consequence of the complexity of the product, that is organized at the moment in four sections (some sections are already advanced, others are at the starting level, e.g., the 'mobilizing citizens' section that was planned to be better developed in the second case assessment phase, as planned in D2.3). Furthermore, the structure of the handbook is strictly connected with the themes of the LINKS Framework, thus it depends also on the phases of their development.
- The **Educational Toolkit** is at a processed status; its development started after the first version of the DRPV knowledge base was provided and on the basis of the results coming from the Italian deep dive it was implemented (cf. Section 3.6). It will be made publicly available soon. The first structure and contents are already under testing with external stakeholders and the toolkit is constantly updated.
- The **Resilience Wheel** was developed as part of the knowledge bases, thus their status is already processed.

3.2 The Model of the LINKS Library

As already introduced in D5.3, the knowledge gathered within the LINKS project is organised in three "libraries". The SMCS Technologies Library, the SMCS Guidelines Library and the SMCS Use Cases Library⁶ serve the purpose of providing structured, accessible, and searchable overviews of information of the respective content.

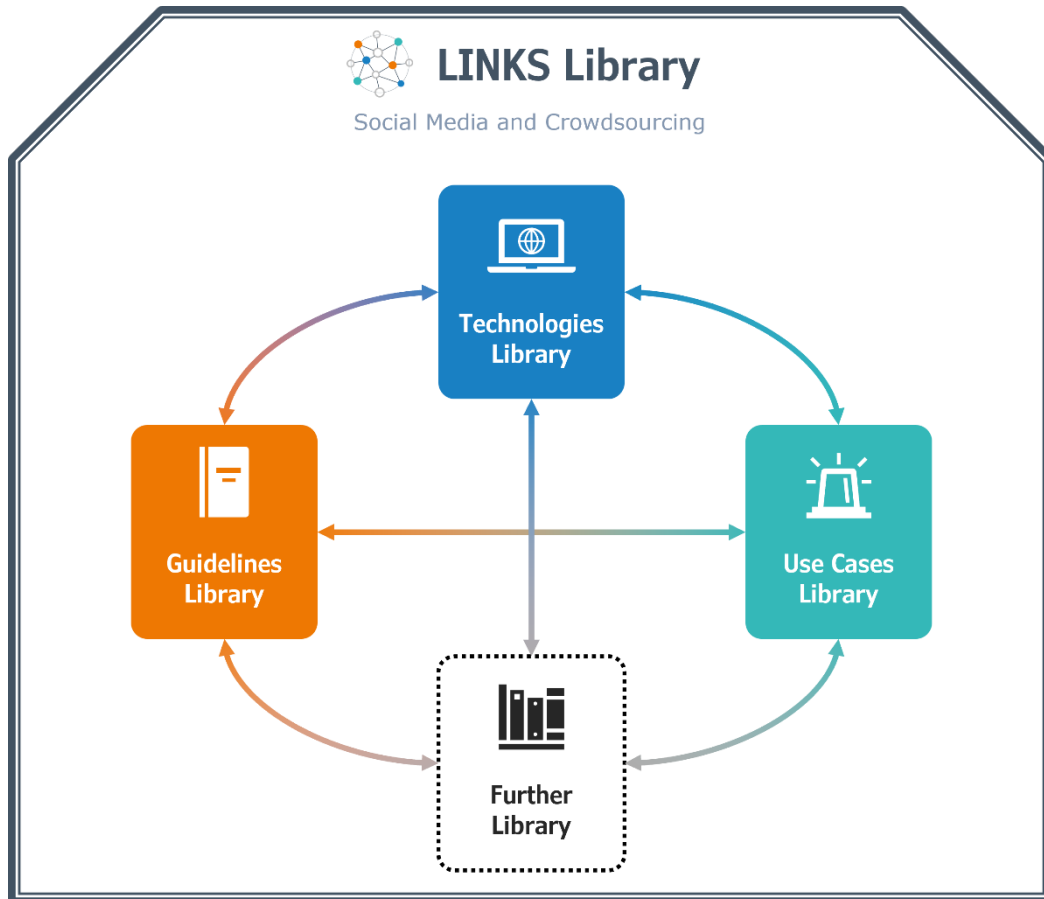
⁴ VOST is an association of digital volunteers who support DMOs in disaster situations. They examine digital sources (especially SMCS) for important information to assess the situation and thus support decision-making. E.g. VOST Europe: <https://vosteuropa.org/>

⁵ https://links.communitycenter.eu/index.php/List_of_Disaster_Community_Technologies

⁶ In August 2022, the name changed from Examples Library to Use Cases Library due to discussions in the respective task force.

Figure 6 illustrates the LINKS Library approach. The “blank” library at the bottom of the diagram represents any further potential libraries that might emerge in the future as the project develops.

Figure 6: LINKS Library Model



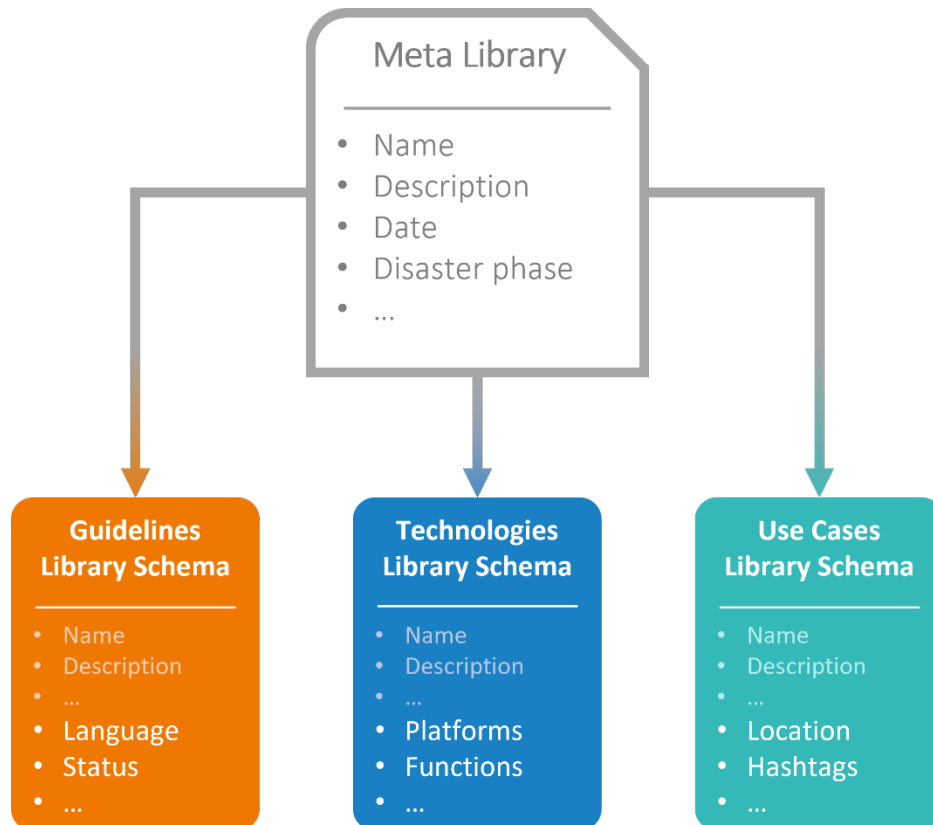
Source: WP4

In order to organize the information within a library, its constituent elements are outfitted with properties such as “target group” or “disaster phase” which helps to build a systematic knowledge structure. These library properties can be selected via different filters also refer to other libraries. For instance, a guideline can have a “covers” property which connects it to the SMCS Technologies Library *covered* in the SMCS Guidelines Library. Conversely, a technology can use a “covered in” property to refer to relevant guidelines. This allows the information to be interlinked in a structured, network-like fashion, which is depicted in the figure by interconnecting arrows.

Initially, each library has a model (schema) which describes the properties each entry in the library can have. The schemata of the different libraries are all based on a common core that can be seen as a “Meta Library” structure which contains properties present in all libraries, such as “disaster phase” (cf. Figure 7). Each concrete library must inherit this common core and extend it with its own specific properties as needed. This creates an inherent layer of connectivity between libraries and allows the user to navigate them via those shared properties. Additionally, this enables the overall

mechanism of the LINKS Library Model to be extended with further libraries at a later stage while guaranteeing that they will be connected to the rest via the common core.

Figure 7: Meta Library Structure



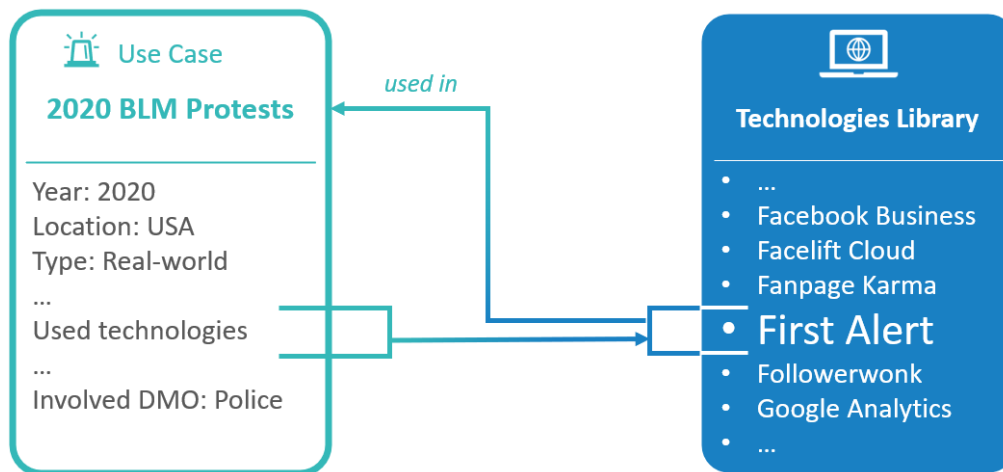
Source: WP4

To illustrate this connectivity on a concrete example, consider the 2020 Black Lives Matter protests in the US. During the protests, the local law enforcement used an SMCS technology called “First Alert” offered by Dataminr⁷ in order to receive early warnings and informational support⁸. This use of SMCS can be stored in the Use Cases Library, while First Alert can be added to the Technologies Library. They can then be linked to each other, for instance, via a “used technologies” property of the use case and “used in” property on the technology, allowing the user to see and navigate the connection (Figure 8).

⁷ <https://www.dataminr.com/>

⁸ <https://theintercept.com/2020/07/09/twitter-dataminr-police-spy-surveillance-black-lives-matter-protests/>

Figure 8: Example Use of the LINKS Library



Source: WP4

This highly interconnected structuring of data allows the library model to aid the user in quickly finding relevant information regarding the usage of SMCS in disaster management. The SMCS Technologies Library which is currently implemented as part of the LINKS Community Center has this model as its conceptual foundation. If a stakeholder, such as a practitioner, is looking for a technology best suited for their needs, they can find a list of appropriate technologies by searching for specific desirable properties in the Technologies Library. Connections to other libraries show the stakeholder how to best utilize the technology by linking it to known usage examples in the Use Cases Library or by displaying a list of available guidelines covering the application of said technology. The bidirectionality of inter-library connections allows navigation in any direction, thus providing a multitude of entry points for knowledge exploration. For instance, in contrast to the previous example where a stakeholder began exploring from a technology, they may start from a use case instead. The situation may be that a practitioner has found an example of a disaster in the Use Cases Library that is similar or identical to something they had experienced themselves or want to prepare for. Following the library links in that use case entry, the practitioner then might find technologies and guidelines that may help with managing such disasters in their own line of work. Similarly, the Guidelines Library or indeed any other library that may be added later may serve as an entry point.

3.3 Update on the SMCS Technologies Library

The concept for the SMCS Technologies Library was already established in D4.1 (November 2020) and presented in a scientific paper at the ISCRAM 2021 conference⁹. The structure of the library is designed as a categorisation schema for Disaster Community Technologies (DCT) to capture,

⁹ http://idl.iscram.org/files/theresehabig/2021/2373_ThereseHabig_etal2021.pdf

describe and compare information about SMCS technologies in a structured and accessible way. The first version of the schema is derived in detail in D4.1 and the overview can be found in Figure-I in the annex. An updated status of the library was also included in D5.3.

During the development phase, the categories were discussed with different stakeholders (e.g. local fire departments and authorities, special forces of the police, members of VOST, technology providers (businesses)) and the selected experts from the LAC, continuously improved and advanced. The following research methods carried out in the first case assessments had a significant impact on the development of the product:

- Cross case interviews
- Europe-wide online survey
- Different kind of workshops
- Ongoing Desk Research
- DCT-Testing

The most important advancements of the SMCS Technologies Library are explained in the following Table 2 and the new structure can be found in Figure 10.

Table 2: Overview of the improvements of the SMCS Technologies Library

No.	Improvements based on different research methods	Primarily derived from
A	The information on the possible functional scope of a technology was widely revised and extended. Eight subgroups were formed within these functions, in which over 40 sub-functions were assigned. For simplicity, the category has also been renamed to "Functions" instead of "Range of functions". Additionally, the category "General technical properties" has been merged into the revised version of the "Functions" (e.g. Collaboration or Options for Multilanguage).	Cross case interviews Online survey Desk Research DCT-Testing
B	The division into the four known phases of the "Disaster Management Cycle" turned out to be impracticable regarding the clear assignment of technologies. From the perspective of the experts, the distinction of the phases into "Before, During, and After" is easier to understand and is therefore incorporated in the new structure.	Workshops
C	The information content of the category "Data Sources" is now presented through a more differentiated consideration of the individual social media "Platforms" . According to feedback, practitioners, it is more important to the stakeholder which concrete platforms the technology gather data from rather than the type of data source.	Workshops
D	The category "General properties" has been split. Some information has been transferred to the "General information" category, while other subcategories have been transferred to two new categories "Used by Practitioner" and "License Model".	Online survey Workshops
E	The collection of SMCS technologies is expanded and the requested categories for the SMCS Technologies Library are elaborated.	Cross case interviews Online survey Desk Research

Source: WP4

Cross Case Interviews

In order to analyse the significant input for the SMCS Technologies Library provided by the conducted cross case interviews, the codes “Descriptions of SMCS technologies” and “Future potential of SMCS technologies” (cf. Section 2.2) have been systematically investigated. Within the dataset, the occurring topics were clustered, and the number of mentions was counted. For further prioritisation, the topics were sorted into four broad non-exclusive categories:

- Needs – nice-to-haves, suggestions, wishes, desirable functions, etc.
- Plans – needs for which concrete actions are being planned or are already underway.
- Concerns – concerns regarding the current situation or future potentials.
- Insights – personal experiences, opinions, predictions, etc.

With this approach, more than 30 topics could be identified, some of which have served as the basis for the most recent changes while others provided confirmation for the already established parts of the SMCS Technologies Library. In particular, the results from the interviews listed below provided a significant input for the refinement of the category “Functions” (**Improvement A**). As listing all these topics would be out of scope for this work, some of the more relevant topics are provided below, for context:

- **Wider reach (Need)**: One of the most often occurring topics in the needs category was the desire to reach as many citizens as possible with content provided by authorities, with reaching the elderly being the most common sub-topic. While the previous DCT-schema has had a minimal representation of this need in the “General citizens warning” function, the updated schema now includes an entire “Post & Schedule” function to better capture a technology’s authorities to citizens (A2C) communication abilities.
- **Social media alerts & monitoring (Need)**: Another commonly mentioned need was continuous monitoring of social media and alerting the user to important events. While this need was already represented in the previous DCT-schema via the “Monitoring” and “Notification” properties, the interviews have demonstrated the high importance of these functions. To reflect this, the new schema contains the “Search & Monitor” function category with more precise information on a technology’s monitoring capabilities, such as keyword and hashtag monitoring.
- **Legal restrictions (Concern)**: By far the most mentioned concern was the issue of legal restrictions, such as data protection laws. This has been addressed in the new schema via the “GDPR compliant” property of the Meta category, as this law is the most important of this type for the European scope of the LINKS project.
- **Analytics (Need)**: Several of the interviewees mentioned various topics related to the automated analysis of monitored social media data, including sentiment, image, and video analysis, all of which fall under the needs category. Similarly, to social media monitoring, this result confirms the validity of the previous DCT-schema, as it already contained relevant functional properties. Nonetheless, the updated schema groups them into the “Analysis”

category of functions, which encompasses the previously existing properties such as image and video analysis and includes several new analysis capabilities like trend analysis.

- Additionally, the interviews were searched for mentions of SMCS technologies that are either currently in use by practitioners or have been used in the past. Based on these mentions, three more DCTs have been added to the Technologies Library (**Improvement E**).

Online Survey

In order to investigate the current use of SMCS with its future potentials, an online survey was conducted with relevant stakeholders, including authorities, disaster management organizations, practitioners and NGOs. The aim of the survey was to collect a comprehensive set of practical experiences with the use of SMCS in disaster management in order to further advance the development of the LINKS Framework with its products. At the end of the survey, participants could also leave their contact email address if they were interested in further involvement in project activities. The 47 respondents who answered positively, offer the possibility to invite them to e.g. participate in upcoming workshops as well as to conduct expert interviews depending on the expertise received in the responses (cf. Section 4.1.3). The survey was filled out by 284 respondents and delivered valuable insights, such as exact specifics of how practitioners use SMCS, their attitudes towards its current and prospective use, as well as associated challenges.

An immediate result was the identification of new DCTs which were not yet contained in the library. Out of 24 distinct technologies mentioned in the survey answers, 8 were not considered, as they could not be classified as DCTs. For example, one survey answer contained a generic description instead of a concrete technology name while another answer mentioned a German warning app. As the focus of the DCT concept is on technologies related to SMCS, warning apps are currently understood to fall outside of its definition. Out of the 16 technologies that were considered, 10 were already part of the Technologies Library. The remaining 6 were subsequently included (**Improvement E**).

Secondly, analysis of survey answers provided the basis for updates to the SMCS Technologies Library, in particular adding the category “Used by Practitioner” (**Improvement D**). This category is of particular use to other practitioners as it allows them to quickly discover technologies that have already proven usefulness for disaster management. Furthermore, analysis of practitioner experiences contained within the survey answers has led to the creation of a new library – the Use Case Library, which collects real examples and scenarios of DCTs being used by DMOs in practice (cf. Section 3.5).

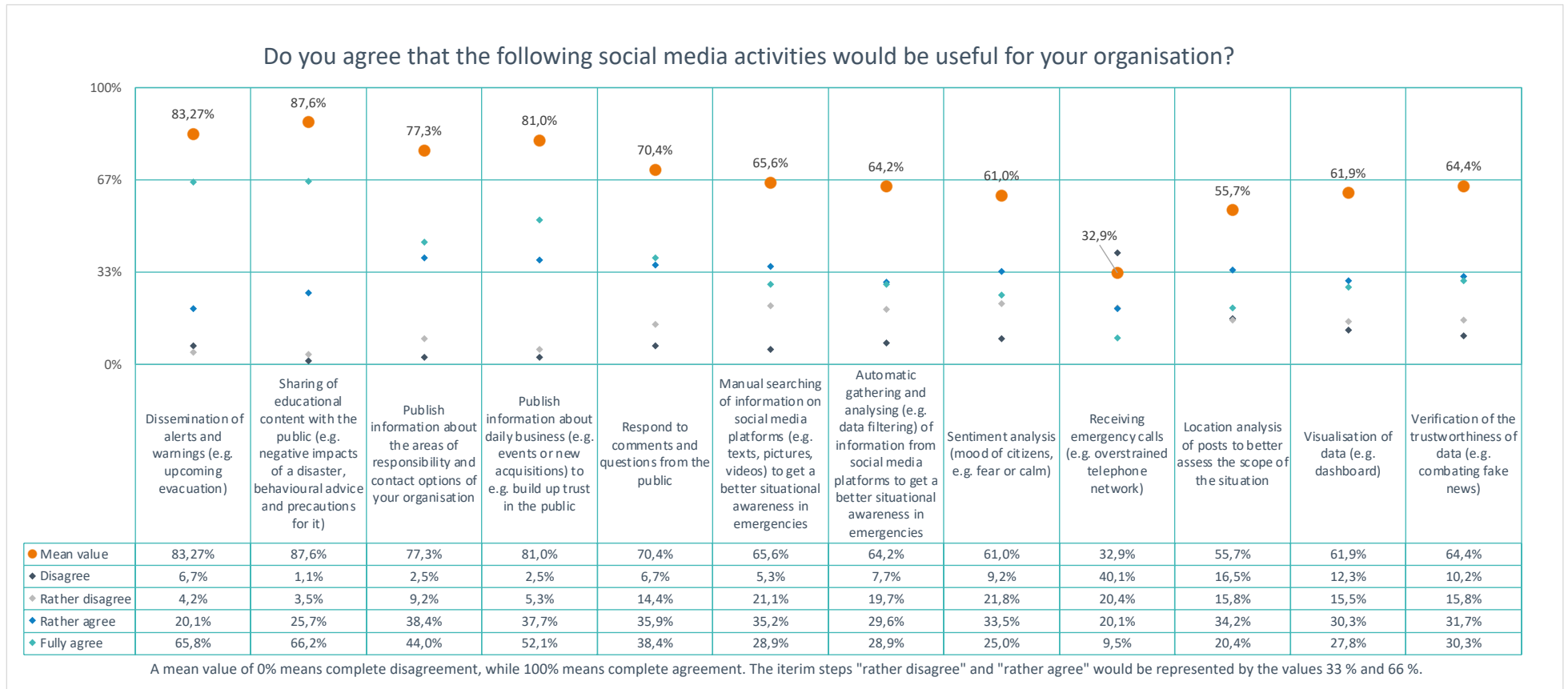
The survey also revealed additional valuable insights on the use of DCT. For instance, the DCT Meta Business Suite (formerly Facebook Analytics) was mentioned the most across all participating countries, closely followed by Obi4wan. Interestingly, according to the survey answers, the latter tool seems to be primarily used in the Netherlands, possibly due to being headquartered there. Such

specifics of SMCS use can only be discovered by investigating practical experiences and open new lines of inquiry for further research. Deriving such questions from practical experiences and considering them in the course of further DCT analysis helps to advance the overall goal of the LINKS Framework and its products. Additionally, the survey answers provided some specifics on the functions of mentioned DCTs, which could otherwise not be identified without contacting the provider.

The survey also contained questions aimed at gathering opinions and experiences of the respondents towards SMCS in disaster management. This allowed to determine the relative importance of the researched and newly discovered DCT functions as well as substantiate their inclusion in the schema, thus validating the overall result (**Improvement A**). For example, most of the survey participants agreed on the usefulness of social media activities related to dissemination and sharing of content (cf. Figure 9). This corresponds to the category “Post & Schedule” and confirms its importance. Similarly, activities related to searching and analysing information enjoyed high approval which underlines the relevance of categories “Search & Monitor” and “Analysis” for disaster management. In this way, many other functions were validated as highly relevant to stakeholders, including “Sentiment analysis” and “Visualisation options”.

Overall, the survey has led to significant contributions to the existing products, prompted the creation of the Use Case Library and underlined the importance of new and established concepts. As can be seen in Figure III in the annex the respondents have rated guidelines and practical examples as highly important aspects of an extended use of SMCS in disaster management, which confirms the high relevance of the Guidelines and Use Case Libraries, respectively. Other insights, such as the highest importance rating being given to the exchange of experiences and inter-organisational dialogue, indicate avenues of further improvement of the LCC (e.g., closer cooperation with DCT providers) as well as directions to take in the next steps of the project.

Figure 9: Survey Answers on the Usefulness of Social Media Activities



Source: WP4

Workshops

A series of different workshops has improved and advanced the development of the SMCS Technologies Library. The feedback and results from the following workshops had a direct impact:

- Second LINKS Advisory Committee (February 2022): Described in Section 2.4.
- LCW “Social media and crowdsourcing technologies in an upcoming heat wave” (April 2022): This LCW has been conducted to discuss the application and potentials of SMCS technologies as well as the categories of the Technologies Library in the scenario of a heat wave. The participants were mainly local stakeholder from the city and district of Paderborn, but also representatives from nationally and internationally operating organisations in the field of disaster management. The outcomes help to understand the current status of the use of SMCS technologies within the practitioners of the local area of Paderborn and to better align the scope of the Technologies Library with their needs in general – and with specific regards to a heat wave.
- LCW “Social media and crowdsourcing Technologies Library and the underlying market analysis” (May 2022): This LCW has been carried out to present and discuss the motivation, concept, and current status of the SMCS Technologies Library and the underlying ongoing market analysis. The participants have exclusively consisted of leaders of special police units. Their specific needs for the categories and for the available technologies in the Technologies Library were discussed. Overall, this workshop has shown that the requirements for the functional scope of a SMCS technology can vary greatly per stakeholder, which is why a very differentiated investigation of the functions were needed.
- During the first annual LINKS meeting in Split (June 2022), the opportunity was also taken to hold a workshop on the Technologies Library with the associated partner Disaster preparedness and prevention Initiative for Southeastern Europe (DPPI SEE). As progress had been made in implementing the Technologies Library in the LINKS Community Center (LCC), this workshop could be held entirely with the LCC. This led also to discussions regarding the user-friendliness, comprehensibility of the structure and accessibility to the information sought. As a result, the Technologies Library could be optimised not only in terms of structure, but also in terms of visual presentation.
- “Digital Week” (November 2021): The “German Society for the Promotion of Social Media and Technology in Civil Protection” (DGSMTech e.V.) organised a week of presentations and discussions on the opportunities of digitalisation in national emergency response. The opportunity was taken to present the idea and implementation of the Technologies Library to an audience specialised in social media and crowdsourcing in disaster situations. Following the presentation, valuable feedback on the future direction of the Technologies Library was obtained and DGSMTech e.V. was won as a valuable partner for future dissemination of relevant LINKS results.

The workshops have proved to be a source of helpful insights. Specifically, significant changes were made to the advancement of the SMCS Technologies Library based on the feedback from the participants. Namely:

- The phases of a disaster were simplified to “Before, During, and After” (**Improvement B**).
- The individual platforms (e.g. Facebook, Instagram, Twitter) instead of the type of data (e.g. microblogs or websites) were considered (**Improvement C**).
- The previous category “General properties” has been split into the “General information” category and two new categories “Used by Practitioner” and “License Model” (**Improvement D**).
 - **Used by Practitioner:** This first-level category contains properties about how the DCT is used. The property “Use case available” indicates if a DCT is part of a use case (cf. Section 3.5). Here, technologies are described which are already demonstrably used by DMOs in crisis response. This use is recorded via entries in the Use Cases Library, thus creating a link between the two libraries. The property “Already used by DMO” indicates if it is known that a DCT is used by a DMO, e.g. from interview or survey data, but no elaborated use case is yet available.
 - **License Model:** This first-level category lists properties related to the license model of the DCT's provider. It contains information about the pricing model (for example, minimum monthly/yearly cost). The property “Freeware” indicates whether the tool is available at no cost. The property “Demo version” indicates if a demo version is available.

Desk Research

Desk research is used as an ongoing activity and continues to be an essential part of the development of the SMCS Technologies Library. On the one hand, this includes the continuation of the business market analysis, which got introduced and explained in detail in D4.1. Within the business market analysis, different sources of information get examined for new, potential DCT. This includes, for example, existing market analyses for SMCS technologies, which have been developed through scientific contributions or market comparisons by technology providers. Also proceedings of relevant conferences, scientific papers and related projects are continuously examined for new DCT. Another important component of the desk research is the search for the information about the DCT to fill the existing categories. This is mainly done via the homepages of the providers (**Improvement E**). However, it has been noticed that the homepages are very different in the scope and depth of information they provide freely accessible. In some cases, it is not possible to identify, for example, the full range of functions a technology has to offer, the relevant platforms a technology can cover or details about the pricing model. Therefore, it became necessary to contact the technology providers in order to discuss details and to insert the information in the Technologies Library as accurately as possible. As direct collaboration with technology providers in form of expert interviews (cf. Section 4.1.2) is part of the planning for the second case assessments anyway, the detailing of information can also be achieved in this context.

DCT-Testing

To get a better understanding of the potential functional scope from DCTs, the application from Ubermetrics Technologies¹⁰ was tested and the following important functions were found to be applicable (**Improvement A**):

- **Search & Monitor:** The DCT offers keyword and hashtag-based searches and can continuously monitor social media networks. The DCT does not differ between hashtags or keywords when doing a search. This was tested using different searches. An example on how the keyword-based search is defined can be seen in Figure IV. Furthermore, search keywords can be combined using Boolean operators and restricted e.g. to specific platforms or languages only. This maps to the “Advanced search features” in the DCT-Schema.
- **Another feature of the DCT is the anomaly detection.** When something unusual happens (e.g. a spike in an activity or a change of the average sentiment) the DCT will send the user a notification. This maps to the “Event monitoring” and “Event notification” functions in the DCT-Schema.
- **Analysis:** The DCT can analyse text, sentiments, and topics.
- **Report:** Collected data are visualised in the dashboard where they can be filtered and exported together with the search result as a (custom) report. The visualisation also provides interactive elements, e.g. it is possible to adjust the timeframe. In addition, automatically identified topic keywords are visualised in a word cloud. Figure V shows an example of the different visualisations inside the dashboard.
- **Metrics:** The DCT shows different kind of metrics (e.g., metrics about the post, metrics per network or the followers). These are shown for individual social media posts in the search results. However, these metrics depend on the post’s data source (the concrete social media network).
- **Collaboration:** The DCT provides a simple user and rights management system. It is possible to assign users to projects (collection of searches) as “Participant (can change certain elements of search results, e.g. manually adjust sentiment)”, “Viewer” (read only) or “Project Manager (edit and delete searches)”.
- **Interoperability:** Data can be exported through the user interface or accessed programmatically via an API. It is also possible to manage searches and other aspects through the API.

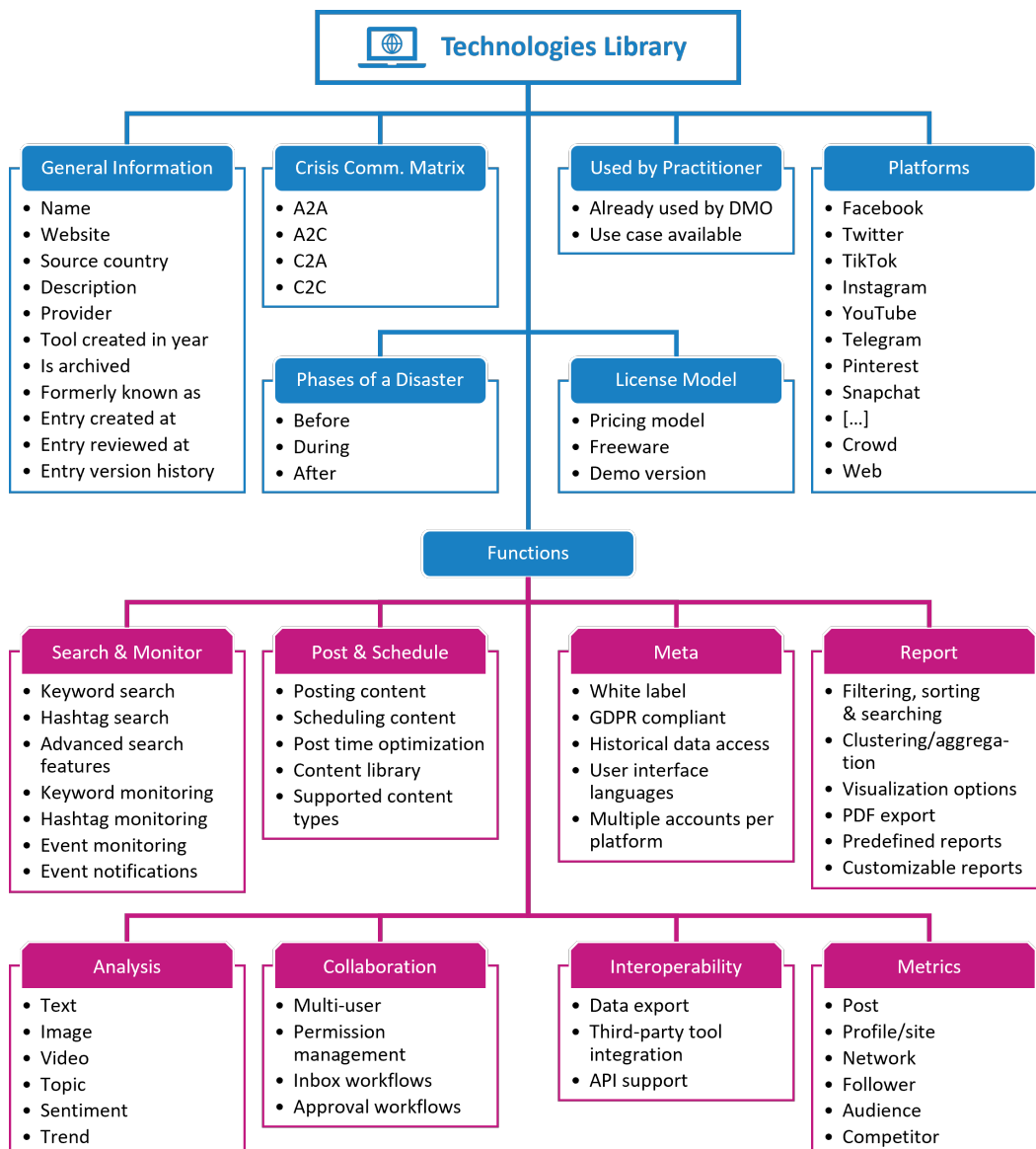
Resulting Structure of the SMCS Technologies Library

Overall, the combination of **Improvements A–E** has resulted in a substantial update and further development. In particular, the refined structure now contains seven first-level properties. The properties “Used by practitioner” and “License model” are entirely new, whereas “Core properties”

¹⁰ <https://www.ubermetrics-technologies.com/>

has been renamed to “General information”. “Disaster management cycle” has been renamed to “Phases of a disaster” and reduced to three phases: before, during and after. The “Platforms” property has been significantly expanded to a total count of 23 social media platforms at the time of writing, while “Crisis communication matrix” remains the sole unchanged property. The largest and most substantial update happened in the “Functions” property which, due to its new complexity, has been split into eight second-level properties, each describing various DCT functionalities identified in the course of the SMCS Technologies Library update. The overall new schema can be seen in Figure 10.

Figure 10: Current Structure of the SMCS Technologies Library



Source: WP4

Next steps

During the next phase of the project, research will ensure that the SMCS Technologies Library is improved and enhanced with further practical information.

The analysis of the “Future potential...” code of the interviews has yielded several research questions that need to be addressed. On one hand, several of the topics identified in the analysis indicate that practitioners are interested in advanced SMCS functionalities (e.g., AI-based results filtering and video analysis) while expressing concerns about its usage, e.g., due to privacy considerations. This suggests that a close cooperation with the businesses providing such technologies would be beneficial, as they possess the expertise to assess what functionality is possible and how to mitigate potential challenges. These advanced functionalities could then be highlighted and explained in the SMCS Technologies Library. On the other hand, the insights gathered from the interviews indicate that SMCS technologies are currently underused in DMOs and many practitioners have little to no experience on how to apply these technologies in disaster management. This suggests the need to expand the connectivity between the libraries, as the Guidelines Library and the Use Cases Library should help mitigate these gaps in knowledge. The first level category “application usage” will therefore be tightly coupled with the Use Cases Library. The contacts with DMOs, including those established during the interviews, will be used to this end. Additionally, businesses developing the DCTs will also be directly engaged (i.e., through bilateral workshops) to contribute their viewpoints on the SMCS Technologies Library.

The category “business model” needs to be elaborated in more detail, as some DCTs only offer a monthly pricing whereas others provide discounts for yearly payments or discounts for NGOs and public authorities. As DMOs are almost exclusively public institutions, they are also subject to procurement rules and might be able to procure only certain DCTs due to payment modalities. This needs to be reflected in the refined structure of the SMCS Technologies Library.

The results of the survey indicate a significant gap between the usage of social media and the usage of crowdsourcing. For instance, almost all respondents reported using social media while only a fraction used crowdsourcing despite thinking that it would be useful. Therefore, further research into the crowdsourcing thematic is needed, i.e., through a mapping of existing crowdsourcing initiatives. This will also contribute to a better understanding of the similarities and differences between social media usage and crowdsourcing.

All the actions described will be supported by collaborating with the participants of the survey who have indicated their interest in participating in further research. In addition, the Technologies Library will be evaluated through expert interviews and thus the quality will be improved (cf. Section 4.1.2).

3.4 Update on the SMCS Guidelines Library

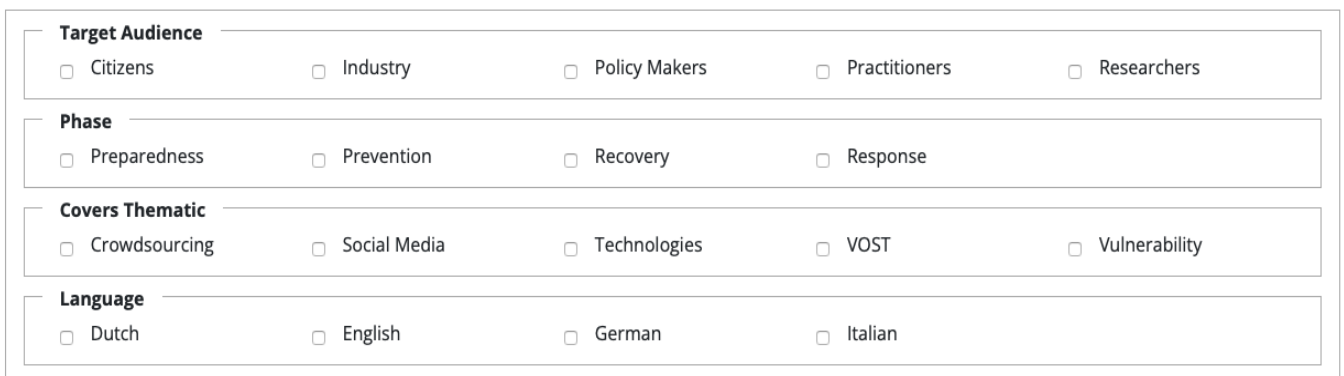
The overall aim of the SMCS Guidelines Library is to provide a comprehensive overview of existing formalised guidelines, standard operating procedures and policy frameworks that can support users, more specifically practitioners, with regards to the application of SMCS in disaster management practices. From the feedback of a practitioner workshop and an LAC meeting evolves that this library should be mainly focussed on the needs of disaster management organisations. In consequence, the practitioner partner FEU came into play to support the development of a practitioner-friendly access to the various guidelines included in the library. A task force was subsequently set up, which included members of FEU, UCPH, SIC and VU.

The task force complemented and updated the guideline registry previously established in D3.1 and D4.1 with the latest guidelines by conducting an extensive desk-research, reproducing the search strategy described in D3.1. New guidelines, policies, and legal frameworks (further referred to as guidelines) on the use of SMCS technologies in disaster management processes were added to the registry, for a total of 43 documents—and counting. The content of the guidelines varies depending on the field of action from the publishing organisation and from the socio-cultural contexts in which the guidelines have been applied and/or thought for.

Starting from the content of the guidelines, appropriate categories were developed in an effort to describe, compare and classify the guidelines. Corresponding information was retrieved from each guideline and organised in a systematic, structured fashion. The categories were subsequently integrated in the LCC in the form of search filters, to allow users to narrow down their search results, and improve the relevance of information and effectiveness of retrieval.

Preliminary filters included publication characteristics (i.e.: publishing year, organisation, language), primary target group, disaster phase, and thematic focus areas (cf. Figure 11).

Figure 11: Initial Filters of the Guidelines Library



Target Audience	<input type="checkbox"/> Citizens	<input type="checkbox"/> Industry	<input type="checkbox"/> Policy Makers	<input type="checkbox"/> Practitioners	<input type="checkbox"/> Researchers
Phase	<input type="checkbox"/> Preparedness	<input type="checkbox"/> Prevention	<input type="checkbox"/> Recovery	<input type="checkbox"/> Response	
Covers Thematic	<input type="checkbox"/> Crowdsourcing	<input type="checkbox"/> Social Media	<input type="checkbox"/> Technologies	<input type="checkbox"/> VOST	<input type="checkbox"/> Vulnerability
Language	<input type="checkbox"/> Dutch	<input type="checkbox"/> English	<input type="checkbox"/> German	<input type="checkbox"/> Italian	

Source: Screenshot from the LCC

The relevance and accuracy of the selected filters were continuously reflected upon in the process, and the filters were iteratively refined during the monthly task force meetings.

Several thematic filter options were developed along the way. All filters are explained/defined in the LCC via hyperlinks on the landing page of the Guidelines Library (cf. Figure 12).

- The “**Disaster management phase**” filters were edited, from “preparedness, response, recovery and mitigation” to “before, during and after crisis”, to better reflect the content of the guidelines.
- New filters have been introduced into the “**Covers Thematic**” section replacing the “Social Media” filter which turned out to be too generic to allow quick retrieval of specific issues related with the use of Social Media, such as “Social Media strategy”, “Social Media team Building”, “Crisis communication”, “Content creation” and “Community Management”.
- A “legal/standards” filter was added in the same section to distinguish legal considerations from practical ones.
- Furthermore “Vulnerability* was changed to “Vulnerable Groups” as the focus of the guidelines and also a Directive is on the accessibility of information for people with any kind of disabilities rather than on the description of vulnerability.
- Trust in information provided via Social Media was highlighted in the 2nd LAC meeting as a major concern. Therefore, a special filter “Verification” guiding user directly to the relevant information was introduced.
- As “unaffiliated volunteers” became more important in mitigating the effect of disasters in recent years a special filter is dedicated to direct readers to relevant guidelines.
- An “**Audience experience level**” filter was added to indicate the level of social media competency of the target audience. The distinction made in the Emergent guideline¹¹ of readers in beginner, intermediate and advanced makes sense for the Guidelines Library.
- In the “**Target Audience**” section “Industry” was changed to “Businesses” for the sake of consistency within the project.
- In the same section following the advice from the LAC “Media” was added as some of the guidelines are especial important for this user group but can of course be also important for Social Media Teams within DMOs.

¹¹ https://www.fp7-emergent.eu/wp-content/uploads/2017/09/20170529_D7.3_Guidelines_to_increase_the_benefit_of_social_media_EmerGent.pdf

Figure 12: Current Filters of the Guidelines Library

Disaster Management Phase				
<input type="checkbox"/> After	<input type="checkbox"/> Before	<input type="checkbox"/> During		
Covers Thematic				
<input type="checkbox"/> Community management	<input type="checkbox"/> Content creation	<input type="checkbox"/> Crisis communication	<input type="checkbox"/> Crowdsourcing	<input type="checkbox"/> Legal/Standards
<input type="checkbox"/> Social Media Strategy	<input type="checkbox"/> Social Media Team building	<input type="checkbox"/> Technologies	<input type="checkbox"/> Unaffiliated volunteers	<input type="checkbox"/> VOST
<input type="checkbox"/> Verification	<input type="checkbox"/> Vulnerable groups			
Audience Experience Level				
<input type="checkbox"/> Advanced	<input type="checkbox"/> Intermediate	<input type="checkbox"/> Starter		
Target Audience				
<input type="checkbox"/> Businesses	<input type="checkbox"/> Civil Society	<input type="checkbox"/> Media	<input type="checkbox"/> Policy Makers	<input type="checkbox"/> Practitioners
<input type="checkbox"/> Researchers				
Language				
<input type="checkbox"/> Dutch	<input type="checkbox"/> English	<input type="checkbox"/> German	<input type="checkbox"/> Italian	

Source: Screenshot from the LCC

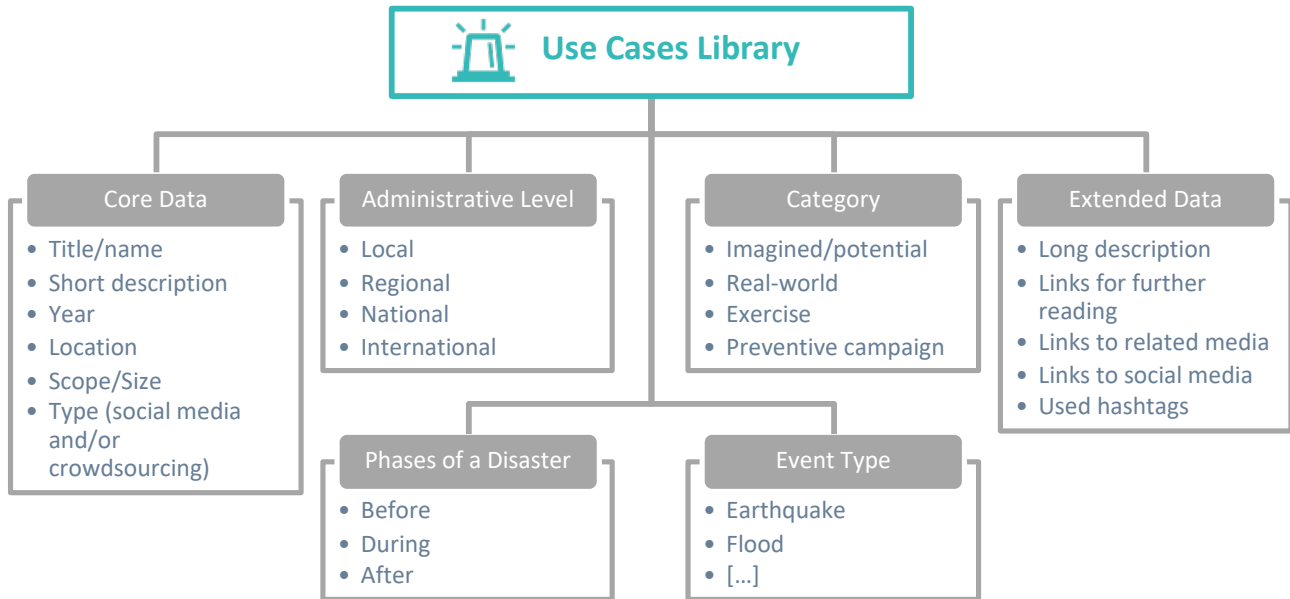
As a next step abstracts with the most relevant information from a practitioner's point of view have been drafted, mainly because some of the guidelines would not attract practitioner's attention because of their pure length, nevertheless containing useful advice. Abstracts are currently being developed for each guideline and uploaded in the Guidelines Library. These abstracts will give the users a complete, yet concise understanding of the material, in a time-effective manner.

3.5 Update on the SMCS Use Cases Library

The Use Cases Library (previously called Examples Library) is the latest LINKS product, having been conceived only in the summer of 2022 as the need for it emerged during the analysis of the cross-case results collected in the first assessment phase. In particular, some respondents to the survey provided interesting examples on how SMCS was used but the majority indicated that they need further guidance on ideas on how to implement or improve their usage of SMCS.

The library is currently being co-designed primarily together with the practitioner stakeholders. To this end, a first draft of the schema for the Use Cases Library was discussed in a workshop during the consortium meeting in June 2022 together with all partners. The draft was improved based on the feedback received and a second, preliminary version of the schema was created (cf. Figure 13).

Figure 13: The current Version of the Use Cases Schema



Source: WP4, Contribution by LINKS Project

In addition to the shown schema, there is also a collection of specific questions, which will be answered in the related use case if possible. Furthermore, the potential answers to the questions allow to establish a connection to the other LINKS Libraries. The following list shows the draft of the collection:

- Which DMOs were involved? (Linked to DMO profiles)
- Which technologies were used? (Linked to Technology profiles)
- Was a technology specifically developed for this use case? If yes, please describe briefly
- What specific functionality was SMCS used for and how? (e.g. gathering of information, dissemination, etc.)
- Which guidelines were used? (Linked to Guideline profiles)
- What problems was the usage of SMCS supposed to solve? What was the overall goal?
- Which vulnerable groups (Disabled, Migrants, Minorities, ...) were specifically involved and how?
- What limitations were identified? What didn't work well?
- What worked well and should be replicated in the future?
- What regulatory or legal hurdles were encountered? How were they overcome?
- How long did the detection of the event from social media take?

This second version was modelled in the EUSurvey tool and practitioners were asked to contribute some use cases using the provided schema within the EUSurvey tool. They were also asked to provide feedback on the relevancy of the schema's components. While participants found the idea in general useful, some remarked that the schema might be too complex and heavyweight. The next step in the development of the Use Cases library will therefore be the reduction of the schema to a

“light” version while still ensuring that the schema provides the guardrails for providing consistent and valuable content. This light version will then be used to collect more use cases and, once sufficient useful use cases have been collected, the use cases will be presented in the LCC so that the whole LINKS Community can learn from them. In parallel, a forum section inside the LCC is available for community members in case they would already like to share interesting use cases. This forum section does not use an elaborate schema but serves as a collection point for ideas. Ideas collected using the forum section will be transformed into structured use cases as the development of the library progresses. The examples collected in the survey will be used in a similar manner and transferred into structured use cases where feasible.

3.6 Update on the Including Citizens Handbook and the Educational Toolkit

Contrary to some of these previous products presented here, the Including Citizens Handbook and the Educational Toolkit, came later in the process of development of the KB, based on the model developed in D2.3 and practitioner feedback during consultation processes.

Their foundations are based on the Disaster Risk Perception and Vulnerability (DRPV) model presented in D2.3 which has informed their structure. The DRPV model was developed in the first step as a theoretical model to discuss how social media and crowdsourcing could impact on vulnerability and disaster risk perception, adopting a dynamic perspective. The model had also the purpose to show how vulnerability and disaster risk perception interact with each other, and what is the role of social media and crowdsourcing in this process. The model shows the multiplicity of factors that impact on the process of producing/reducing disaster risk perception and vulnerability. It is in constant development, as the knowledge base is updated and according to the research results. These changes are reflected in the structures of the products.

The process of turning the DRPV model into products started with the aim of providing a guiding tool for DMOs. The process took place thanks to the inputs received by:

- The first case assessments phase
- The consortium meetings
- The consortium workshops

Details on the process as well as the main results used to inform the products are captured below.

Inputs from the deep dives

Both the approaches, cross-case and deep dives, have contributed to the development of the products. Starting with the deep dive, two deep dives in particular contributed to the DRPV knowledge base and to the development of its products: the Italian one and Danish one.

The Italian case

The Italian case was particularly relevant as it informed the Educational Toolkit development. As described in D2.3, the purpose of the Italian deep dive was to:

- Raise awareness on the use of technologies and SMCS to reduce the risk of disasters
- Promote inclusive communication languages for age groups potentially more vulnerable to the risk of disasters
- Reinforce community resilience through an enhanced engagement and exchange among different age groups
- Promote active citizenship and civic engagement through an appropriate and safe use of technologies.

In order to do this, the Italian case team worked with an intergenerational perspective. Thus, the first year of case assessments was focused in particular on minors, and on their communication capacity.

In particular, between September 2021 and May 2022, Save the Children Italy and UNIFI conducted interactive workshops with children and teachers from the primary school IC G. Fanciulli. The focus of the workshops was on:

- Reducing Vulnerabilities;
- Raise Awareness on Risks;
- Be Better Prepared to Face Emergencies;
- Communicate Emergencies.

The workshops were based on the use of social media and crowdsourcing tools to understand how these technologies could help to prevent or to better face emergency situations.

The workshops consisted of:

1.Action research games: to stimulate children's knowledge of their territory and reflect on risk perception and vulnerabilities in relation to *accessibility, connectivity, mobility*. Participants were introduced to crowd mapping and were given the chance to work on their own maps, identifying places and locations important for them. The actions were presented as 'tasks' to be carried out creatively in small groups. Children had the chance to physically visit these places and identify challenges and limitations to access services and places especially for vulnerable persons with e.g., physical disabilities.

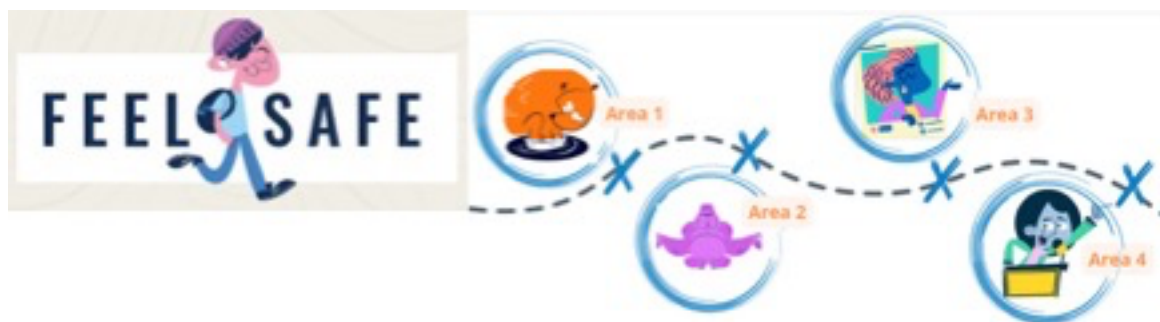
2.Simulations of a risk scenario: the methodology was based on learning from fiction to promote learning and develop skills through the exercise of one's ability to interact with a fictitious risk scenario. These activities were designed as intergenerational, to make children interact with adults (i.e. civil protection volunteers, grandparents, parents). One activity was conducted in school with the participation of civil protection experts and emergency operators to explore the risks affecting our community, reflecting on past events and challenges of the future and the way technologies have changed the way we prevent and respond to emergency situations. Children were able to test a virtual reality simulator (Augmented Reality) for the management of earthquakes which aims at strengthening self-protection skills. Moreover, children were given the chance to build their own social media campaign around the topic of school emergency plans and to promote a message to

disseminate to their peers the importance of actively participating in school emergency plans and on the importance of checking and verifying information.

3.Participation in product's development: Children had the opportunity to effectively participate in the development of *Feel Ready, Feel Safe*, an online Educational DRR platform where you can get information, materials and educational resources on DRR (the educational toolkit as called in this document). *Feel Ready, Feel Safe* aims at:

Children were given the chance to participate in the design and testing of educational activities thus taking over a direct role as decision makers during the validation process of the product.

Figure 14: Educational Toolkit logo 'Feel Ready, Feel Safe'



Source: Save the Children Italy

A mix of **Theory and learn by doing** was important for the success of the activities. Theoretical sessions combined with experiential learning to stimulate new thoughts and allow children to learn by doing. During the sessions, facilitators were able to mix theory and practice, reflection and experience, seriousness and play, learning and fun. Role-plays and simulations were key for children to actively experience and propose their own solutions, to recall with the body and emotions lived experiences, to experience a concrete change of behavior and be better prepared to face similar situations in the future. Debriefing sessions were also of great importance for the successful accomplishment of the activities.

The Danish case

The Danish deep dive carried out 6 focus groups to investigate and examine firstly the citizens' risk awareness of to cloud bursts and other potential hazards at Frederiksberg. Secondly to assess the perception of vulnerability among the participants and their peers and thirdly to get insights into the ways they seek and share information of hazards in crises. In the focus groups, there has been an overrepresentation of elderly people, many retired, and the focus groups therefore provide sound insight into this specific target group.

At this point the main results show that:

- Awareness:

- A high feeling of safety seems associated to high levels of trust in the authorities' (municipality in the specific case) plans to protect local communities.
- This is not necessarily associated to high levels of awareness, as awareness seems to vary, and there is not one threat that overshadows others.
- Awareness and concerns do to a large extent mirror their own previous experiences (e.g., cloud burst and water pollution) and dominant media representation (crime connected to gangs, attack from Russia towards Denmark, large fires in housing blocks)
- Vulnerability:
 - There is a large differentiation if people are aware if peers in their network/neighborhood/community are vulnerable and have specific needs in crises.
 - Responsibility for vulnerable people is considered to be of the municipality to secure.
- Channels of communication:
 - Across age, social media is not the most central and important media channel. Some reject the idea of social media as a resourceful source of information, others state that social media holds a potential.
 - There seem to be a great deal of both non mediated information sharing (people talk to each other) and information sharing on social media, and parallel to this the citizens apply news media to a great extent in crises. Information flows and crosses the three spheres.

As a follow-up of the deep dive, between March and July 2022, UNIFI had two bilateral meetings with the Danish case assessment team as the Danish deep dive collected relevant results for DRPV knowledge base and the further development of the products, especially the handbook.

Inputs from the cross-case assessment

As already described in Section 3.7 on the resilience wheel, the interviews provided important inputs on vulnerability in particular but also on disaster risk perception (as the focus was on knowledge production, behaviour, experience, trust and awareness). Accordingly, the results were discussed with WP3 and used to inform the DRPV knowledge base. This had an impact on the structure of the products and on their wording (see Section 3.7).

About the survey, the results show that a high number of participants is not taking into account vulnerable people in their communication on social media as well as in crowdsourcing activities (where the number is significantly high, see results in D6.4). Minors have been identified among the most important groups to be considered. Furthermore, one of the main challenges emerging from the results is that part of the participants does not see the need for using crowdsourcing for vulnerable people. This lack of need is justified by the limited accessibility of the crowdsourcing platforms for vulnerable social groups and limited representativeness of the results they could obtain in using them. This is confirming the idea that accessibility and representativeness are central aspects to work on and they have been identified as central in the development of the handbook.

Inputs from consortium meetings and workshops

UNIFI has organized several moments of discussion with consortium partners to ensure that the development of the products was practitioner oriented. Details are presented below.

Educational toolkit

The LINKS educational toolkit is an online resource platform managed by Save the Children Italy, on the basis (as described above) of the results coming from the Italian deep dive activities. The educational toolkit, *Feel Ready Feel Safe*, is an online platform where you can get information, materials and educational resources on DRR. Its objectives are to increase:

- Children awareness of Disaster Risk Reduction Culture of safety and risk management
- Active participation of young people in emergency preparedness activities
- Promote awareness on children's rights during emergencies
- Offer educational support to the schools / educating community at large
- The target of the educational toolkit are teachers, educators, relatives, caregivers, institutions, the community.

The Italian case assessment team was entirely involved both in the discussion of the starting idea (e.g., what should be the product?) and in its development. The group met periodically to brainstorm on the idea, expectations and impact. In particular, from January, when the idea of the toolkit was defined, Save the Children was responsible for organizing monthly participatory meetings with all the representatives of the Italian partners involved, the web designer and the consultant involved in the development of the website. UNIFI assisted Save the Children in all the steps to ensure consistency with the DRPV knowledge base and with the purposes of the project which is reflected on the thematic areas that constitute the website architecture: reducing vulnerabilities, be prepared, communicating during emergencies, and increasing awareness.

Furthermore, UNIFI and Save the Children organized some workshops with consortium partners to discuss about the development of the toolkit and the contribution of the other teams to its improvement. The most important events were:

- Workshop in Split (June, 23)
- Online workshop with Dutch partners (July, 13th)
- Workshop in Copenhagen (July, 7th)

The main inputs from these workshops can be summarized as follow:

- to increase awareness on the key role that children can play in emergency management. Partners shared relevant experiences from across Europe that will inform the educational toolkit.
- To increase knowledge and awareness about the importance of the existence of child-friendly emergency plan at local level. Partners agree on the importance of allowing children to

participate into emergency management. They are also main users of social networks and can help connect families, schools, emergency organizations and institutions.

- To explore with children the potential benefit and risks on new technologies, especially linked to safety. New media are changing fast and we need to explore them together with children in order to enhance their capacity to think critically and their civic sense.
- Children, project's partners and key stakeholders engaged in the development of the educational toolkit and in testing/validating educational resources. This helped the process of product development from a stylistic, functional and content point of view.

Including citizens handbook

The Including citizens handbook started from the process of integration of the DRPV KB in the LINKS Framework. This process had place in March 2022, where a first structure of the handbook took place as result of:

- Bilateral meetings between VU (WP5) and UNIFI (WP2)
- DRPV workshop in March 2022 that saw the participation of all the consortium partners, and in particular practitioners.

Other moments were equally important in the further development of the handbook and in particular:

- Bilateral meetings between UNIFI (WP2), UPCH and UCC (WP3)
- Workshop in Split, June, 23 (2022)
- Workshop in Denmark, July 7 (2022)
- Online workshop with Dutch partners, July 13 (2022)

The main results obtained during these meetings were:

- Selection and better focalization of the questions based on DRPV KB
- Collection of inputs for the development of the handbook.

The selected questions significantly influenced the contents and tools provided in the product. Other questions, although less selected, were the same taken in consideration in the product development process. In the following figure how the most selected questions informed the structure of the handbook.

Table 3: How the main Questions informed the Sections of the Handbook

Main questions	Sections of the products
What are the SMCS characteristics or technological functions (e.g., chat, translator, subtitles, private rooms) that can be used to increase/support community awareness/perception?	Handbook sections on <i>How set up your communication channel</i> and <i>Increasing awareness</i>

<p>Who has more difficulties in accessing information and/or in understanding the common language of communication?</p> <p>Do practitioners/first responders have difficulties to communicate with whom and how SMCS could help them?</p>	<p>Handbook section on <i>How to identify accessibility problems</i></p>
<p>How to provide targeted communication?</p>	<p>Handbook section on <i>Accessibility: making information accessible in disasters</i></p>
<p>How can targeted information reduce risks and vulnerabilities and improve the perception of the most marginalized people?</p> <p>Are SMCS an alternative way to receive quality information for the most marginalized people?</p>	<p>Handbook sections on the <i>scientific insights</i></p>
<p>Who mainly use SMCS for active engagement in disasters?</p>	<p>Handbook section on <i>Engaging with spontaneous volunteers</i></p>
<p>How can SMCS mobilize resources/aid and reduce vulnerabilities?</p>	<p>Handbook section on <i>Mobilizing people, sources, ideas</i></p>

Source: WP2

Inputs from WP2 research (external workshops/focus groups)

As planned in D2.3, some activities have been organized by WP2 with the purpose to collect information useful for the implementation of the DRPV knowledge base.

First of all, UNIFI and LCU have organized a workshop during the “Accessibility Days”, a conference organized annually with the purpose to discuss technological solutions for supporting people with physical or sensory disabilities. The workshop took place in Milan, May 20th, 2022.

15 experts of technologies and social media participated. The participants were divided in six working groups. The participants were questioned to discuss some of the main problems linked to social media communication in disaster risk management, focusing on aspects of accessibility, connectivity and mobility, and which could be the solutions to adopt. A second event, for validation and implementation of the results obtained in the first, is planned to be organized in the second phase assessment.

To conclude, Save the Children, with the support of UNIFI and PDT, have organized a session into last Italian LCW with the purpose to discuss the concept idea and further development of the Educational Toolkit with external stakeholders. In particular, the focus group took place in the partner school IC G. Fanciulli on the 27th May 2022 and was held with teachers to validate and

discuss in a participatory manner the design of the education toolkit on DRR and technologies. Participants provided very useful feedback on the structure of the DRR educational toolkit which could help the next phases of development. For example, having a clearer understanding on how DRR activities can fit the school environment and on how experiential learning can be promoted further.

Inputs from the desk research

WP2 continued with desk research, focusing in particular on the improvement of the literature review. On the basis of the new results identified and especially trying to better identify interconnections between vulnerability and disaster risk perception, as purpose of WP2, a new model has been developed and published in July 2022 (Morelli et al., 2022) where specific aspects of the DRPV model are emerging as most relevant in the scientific literature considered. This information, combined with the others described above, helped to review the structure of the products.

The following figure gives an idea of the centrality of some of the concepts in the scientific literature analysed. The two-word clouds (Figure 15 and Figure 16) have been created on the basis of the frequency of the main concepts (their incidence) that compose the DRPV model (accessibility, connectivity, diversity, mobility, awareness, trust, affects, emotion – fear, knowledge, culture/cultural context, behaviour, experience, social values, geographical factors/spatial context, information flow, psychometric factors) distinguishing between the papers focused on vulnerability and the papers that focus on disaster risk perception. The words have been identified as a max of once per paper, even in their variants (e.g., connectivity, connect, connection, etc.) excluding references section and abstract. In addition, the words associated were also considered (e.g., situational awareness). The purpose is purely illustrative and did not affect the research process.

However, it is helpful to show how *accessibility* emerges as a key word in the papers that focus on vulnerability, while *connect(ivity)* is central in disaster risk perception papers. Furthermore, words like awareness, fear, trust and connectivity emerge as relevant in both the concepts, vulnerability and DRP. This is corresponding also to the results that were obtained in the other analysis that has been reflected in the structure of the products.

Figure 15 and Figure 16 – Word clouds based on the literature analysed. The first cloud (Figure 15) is based on papers that discuss about vulnerability, while the second cloud (Figure 16) is based on the papers that discuss about disaster risk perception.

Figure 15: Word cloud based on Vulnerability Literature Review



Source: WP2

Figure 16: Word cloud based on Disaster Risk Perception Literature Review



Source: WP2

All products presented in section 3 above will ultimately be launched for practical application as shown in Figure 8, as so-called *Practitioner Driven Activities*. In combination with *Researcher Driven Activities* these two goals constitute the overall design of the Second LINKS Methodology. How these two flows together in the case assessments but also in the overall LINKS Framework will be outlined in the concluding section 4 of this deliverable.

3.7 Update on the Resilience Wheel

The DMP Resilience Wheel was originally designed as a conceptual assessment tool guiding the research on using social media and crowdsourcing in disaster management processes. The Wheel consists of two layers: a set of drivers that reflect the most important focal points to alter resilience-building through social media and crowdsourcing. Connected to each driver is a set of characteristics that describe the needed qualities for building disaster resilience through social media and crowdsourcing in an organisation. Figure 17 shows the version 1.0 of the Resilience Wheel developed in Deliverable 3.1 (Nielsen & Raju, 2020).

Figure 17: Resilience Wheel Version 1.0



Source: WP3 (D3.1), based on Arup/Rockefeller Foundation (2015)

Following the first case assessments, the Wheel was turned into a management tool for DMOs: A management tool for discussing and assessing what authorities, NGOs and private sector organisations working with disasters need to consider when using social media and crowdsourcing in management processes. It is a tool that helps to kick start holistic and context dependent conversations about potentials and challenges associated with using social media and crowdsourcing in disaster management processes. It assists as a framework to map an organisations' capacities to apply these technologies in disasters.

The Wheel was transformed based on two types of input:

- Practitioners from the LINKS project;
- The interview results.

As a result, the new version of the tool reflects both practical and scientific knowledge aiming to provide an informed and yet applicable tool.

Input from Practitioners

University of Copenhagen and University College Copenhagen conducted bilateral workshops with all practitioner organisations from the LINKS Project. The workshops consisted of open brainstorming on how to redesign the Wheel into a practical tool for DMOs, making use of inputs collected during previous discussions of the Wheel (e.g. the contextualised Wheels presented in D3.2).

The following major shortcomings were identified during the workshops:

- The ambiguity of the scientifically deduced drivers. These were misaligned with actual practices in disaster management organisations
- The drivers were miscommunicated by scientific partners and/or misunderstood by practitioner partners.

All partners from the Netherlands, Germany, Denmark and Italy pointed out that the concept of *vulnerability* was arbitrary and not easy to implement in organisational policy and practice. This also shows in the conducted expert interviews by statements of the interviewees either asking to explain what vulnerability means or saying that it does not play a role in their organisations' work (see exemplary quote in the text box on the left). It was proposed by the practitioners to rephrase this driver to terminology resonating with the organisation's perspective on citizens such as the *inclusion of citizens* or *target groups*. The other drivers were discussed and re-worked to ensure clearness and practical alignment.

Input from the interview study and survey

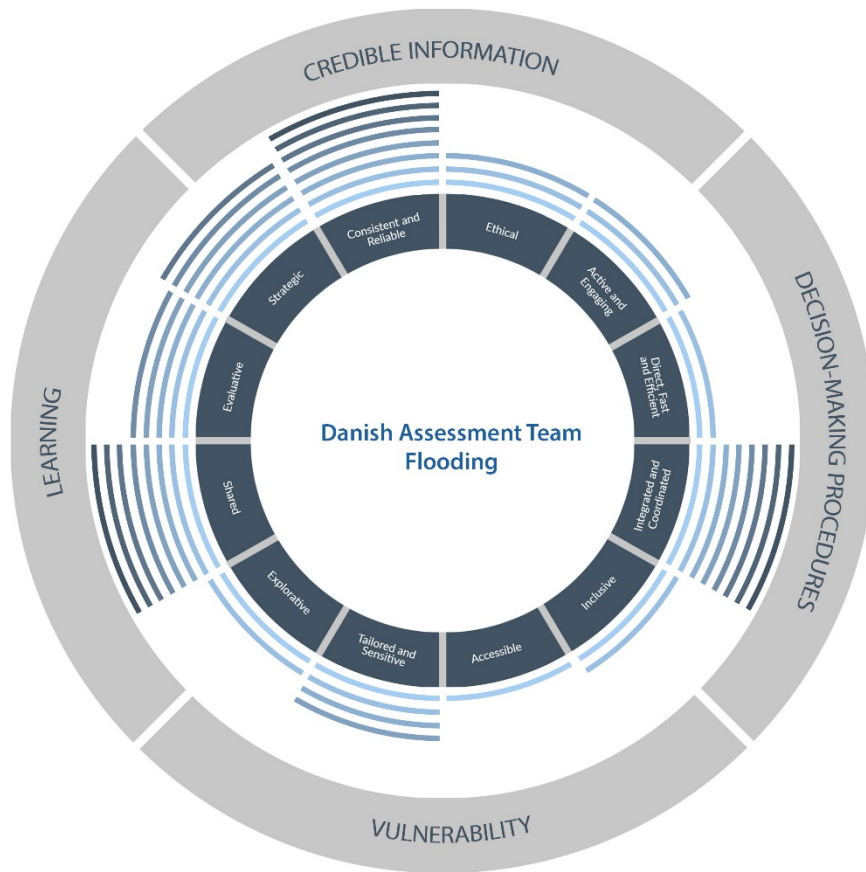
In both the interviews and survey, it became apparent that many organisations have little experience in using social media and crowdsourcing for disaster risk management (see also D6.4). This limited knowledge was on the one hand tied to a demand for learning and knowledge exchange between organisations. On the other hand, the need for a holistic overview of what drives the successful use of SMCS from an organisational perspective appeared to be the missing link (see Boxes on the right). These analytical insights inspired the re-modelling of the Resilience Wheel from a methodological tool to a management tool.

Moreover, the interviews provided insights to how each of the drivers and characteristics resonated with disaster management processes across the five cases. Taking the Danish case, flooding at Frederiksberg Municipality, as an example, the interview data was analysed according to the drivers and characteristics in the Resilience Wheel as part of in the knowledge base specific coding (see Section 2.2). In line with the practitioner inputs, it was found that research on some topics were easier to discuss and resonate with than others for the research participants (see Figure 18). Interviewees had many reflections and examples of how communication on social media needs to be well-coordinated across organisations and between departments partaking in responding to a disaster. Similarly, they wanted to learn and partake in learning activities that would improve knowledge and skills on how to use SMCS in their organisations. They were also preoccupied with the issue of false information and ensuring the credibility of the organisation's communication efforts. On the contrary, most interviews had great difficulties making sense of the questions related to the vulnerability driver as mentioned above. The same holds true for question related to the effect of using SMCS and the organisations pro-active engagement on social media. They asked for clarifications and examples and had little to share on how this was approached in their organisation. This both indicates an issue with our definition and framing these themes in the Wheel as well as a potential issues of addressing them in disaster management processes.

Interviewer: [...] If you were to break this down [...], would there be certain functionalities that you would still like to see for your work with social media? So, if you could build yourself a social media tool [how] [...] could [it] [...] improve your work.

Participant: This is a very difficult question because, as I said, we do not use it at all in our daily work. Otherwise, I really couldn't say, so I mean, the question of data protection is always a big issue [...]

Figure 18: Analysis of the Danish interviews. The Wheel's Meaningfulness to Research Participants.



Source: WP3 (D3.2)

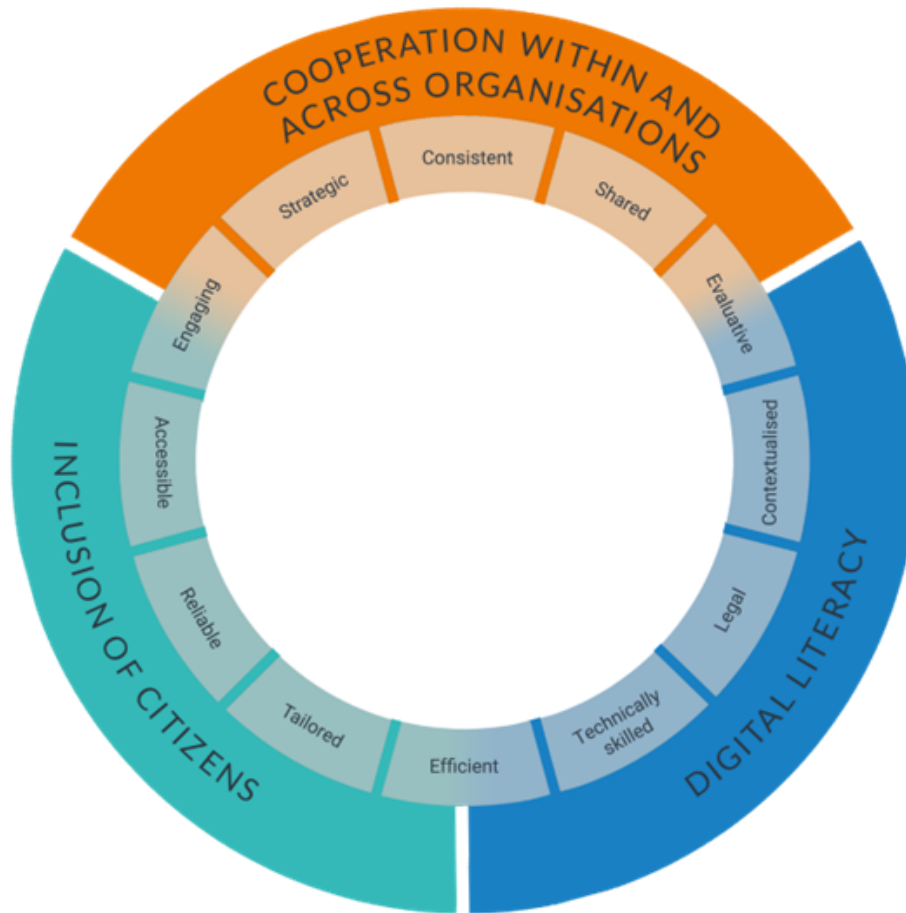
The Resilience Wheel Version 2.0

To tackle the issues identified in both workshops and in interview results the following changes were made:

- Drivers and characteristics were re-worked to match findings and terminology;
- Descriptions and materials were developed to support the Wheel in two identified functions: communication and self-assessment (see 5.3). Both support the Wheel in practically guiding disaster management organisations in their introduction of SMCS to the organisation (assessment function) and how to ongoingly apply and develop their SMCS strategy holistically in exchange with partners (communication function).

Figure 19 shows the version 2.0 of the Resilience Wheel as the result of consolidating the original theoretical model with practice views and empirical findings.

Figure 19: Resilience Wheel Version 2.0



Source: WP3, based on the City Resilience Framework developed by the Rockefeller Foundation and Arup

Digital Literacy

- SMCS platforms and processes should be selected and *contextualised* to the needs and identity of the organisation(s) using them;
- The use of information obtained through SMCS platforms should be grounded in *legal* principles and adhere to existing regulations concerning privacy and data protection;
- Organisations need the right *technical skills* and know-how to act digitally in disaster management processes;
- SMCS use should support a direct, fast and *efficient* communication and allocation of resources in disaster risk management processes.

Inclusion of Citizens

- SMCS use has immense potential of informing and mobilising citizens if it is active and *engaging* allowing for citizens to contribute and partake in disaster management efforts;
- Information communicated through SMCS should be made *accessible* to all citizens across digital divides. This includes considerations about the extent to which information provided through SMCS also must be provided via other means for those outside the digital world;
- *Reliable* and trust-worthy communication between organisations and citizens allow for greater coordination and collaboration of action and limits false information;
- The use of SMCS should be carefully *tailored* to diverse perceptions of risk and be sensitive to a broad range of people with different cultural, social and economic backgrounds.

Cooperation within and across Organisations

- Organisations should take on an *evaluative* approach to lessons learned within and across organisations;
- SMCS use should be *strategic* and integrated in communication plans and cooperation agreements. The purpose of using SMCS and its audience should be taken into consideration in the strategic planning;
- Information communicated through SMCS should be *consistent* across organisations to avoid confusion and mistrust in the information communicated from different organisations;
- Experiences and know-how of applying SMCS should be *shared* within and across disaster management organisations to allow for better integration and coordination.

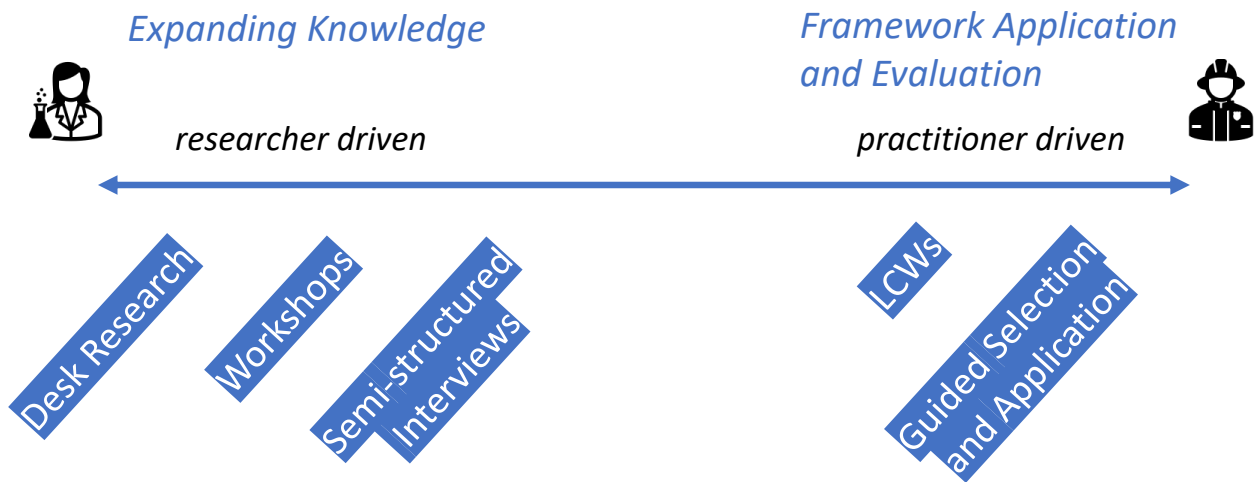
4. RESEARCH DESIGN OF THE SECOND METHODOLOGY

The first methodologies had a traditional research-driven approach allowing us to map and explain the use and application of social media and crowdsourcing (SMCS) in disasters across our five cases. This resulted in new insight into the current landscape of SMCS use in disasters in Europe (see D6.4) and informed the products included in the LINKS Framework (D5.3). The second methodology offers a different approach and takes its departure from the results of the first case assessments as well as the experiences and organizational setting of our practitioners in the LINKS consortium. Consequently, the second methodology is designed across the three knowledge base perspectives (social, institutional, and technical) and around two main approaches:

- A set of researcher-driven and;
- A set of practitioner-driven activities.

Combining research with practice in the second methodology allows us to generate new knowledge in a systematically (research-driven activities) while further testing, grounding, and co-producing results from the first phase of the project directly with practice (practitioner-driven activities). Like the first case assessments, the second case assessment is a multi-sited design that allows for case activities in the five LINKS cases (cf. Section 2). The five LINKS cases are sites that are informative and rich in experiences that lessons can be drawn from them. They provide a basis for further elucidating concepts and results for improved European disaster resilience (e.g. the Including Citizens Handbook) as well as a testing ground for applying some of the more developed products in practice (e.g., the Technologies Library). Moreover, the second case assessments provide another opportunity to understand the use of SMCS in disasters beyond a single scenario or regional context (see D2.3, D3.2 and D4.2 for more information on the case selection). The rationale behind the design is presented in Figure 20 below. Both approaches, the Expanding Knowledge (Section 4.1) and the Framework Application and Evaluation (Section 4.2), contain a set of methods, which are described in the following.

Figure 20: Research Design of the Second Knowledge Base Methodologies



Source: WP2-5

4.1 Expanding Knowledge in the LINKS Project

The expanding knowledge phase is a joint effort between WP2-4 with support from WP6 (case assessment teams). It aims to further seek and understand the application boundaries and future potentials of SMCS use in disasters. The research informing the three knowledge bases provided the core foundation for our understanding of SMCS in disasters. Some of the results need to be updated and further explored to fulfil the following goals:

- Collect new data on how to best address the identified needs and challenges from the first case assessments for further improvement of the knowledge bases and the LINKS Framework.
- Collect updated information and ensure extensive collections of information further fill the LINKS products.
- Get an in-depth understanding of some of the dynamics of SMCS use in disasters reflected in the results from the first case assessments.
- Identify future potentials, opportunities, and risks of SMCS usage in disasters.

These goals are ultimately intended to facilitate the further development of the three knowledge bases and the LINKS Framework in all its components. The developed products then enable the DRM community to make informed use of SMCS in an operational environment. The expected results of this approach are updated and further elaborated versions of the knowledge bases, the products, and the LINKS Framework.

This approach is researcher-driven meaning that the research partner in each of the case assessment teams leads activities and define what are relevant for own knowledge base or local case. Practitioners support and inform all activities in each case context through local ad-hoc

meetings and methodological taskforces (cf. D2.3 and D3.2). The knowledge generation and analysis follow classical criteria for conducting qualitative research (cf. Section 2.5).

A series of methods was identified that suits the purpose of the researcher-driven approach and will help us to collect new data for the knowledge bases and products of the Framework through:

- Desk Research (Section 4.1.1)
- Workshops (Section 4.1.2)
- Semi-structured Interviews (Section 4.1.3)

4.1.1 Desk Research

Desk research has been at the basis of the project from the beginning. This research method has been applied to realize the literature reviews, to establish the knowledge bases and to continuously further develop all the products on the basis of the gathered knowledge. It is a continuous process and has already been explained in the deliverables of the first methodology (cf. D2.3, D3.2, D4.2).

In addition to practical testing and exchange with different stakeholders, desk research provides the foundation for filling and shaping, for example, the Technologies and Guidelines Library. The systematic and structured analysis of various sources (scientific literature, guidelines, good practices, related projects) provides a significant contribution to the filling and refinement of the libraries. This process will be guided by WP2-4, that, on the basis of the KBs requirements, will continue to provide key-words and specific indications for proceeding with the data collection.

Also, part of the desk research is the continuous business market analysis for DCT existing on the market, which is carried out in WP4. Also, Section 3.3 already gave a small impression to which extent WP4 have applied SMCS technologies. The purpose of this is to expand the knowledge around the technologies and to refine the Technologies Library. In this context, WP4 will apply more technologies to further deepen the expertise, to be able to better compare the technologies and to present use cases of technologies.

The desk research will also contribute to development of the Uses Cases Library. Some of the partners have already started at a deep dive level producing a mapping of the good practices or use cases available in their country in the use/implementation of SMCS in DRM. Accordingly, the Case Assessment Teams (CATs) will be responsible to proceed providing the use cases. CATs are invited to support the work of the research partners, informing about any use case of their knowledge. In particular, they are invited to fill out the schema for the Use Cases Library that will be used to collect information about the use case, kind of disaster, main characteristics, usefulness of the technology, level of accessibility, etc. For a screenshot of the current version of the schema, please see Section 3.5.

To conclude, the desk research will continue to be fundamental also for the implementation of the Including citizens and Educational Toolkit, that are informed by external and existing resources and

on the basis of the made working to promote innovative approaches to communication and citizens involvement.

4.1.2 Workshops

A set of workshops including focus groups has been included with the specific purpose to address needs coming from the knowledge bases and product owners, to implement their contents. Thus, - WP leaders can decide to use them to ensure consistency within the products and further develop their knowledge bases. These workshops will require the participation of experts, called to provide specific knowledge and identify solutions on the basis of the questions identified in the project. Research participants should be selected according to the kind of product (e.g. for the Including Citizens Handbook programmers and developers and for the Educational Toolkit educators and teachers will be selected, in order to strengthen the common understanding of crowdsourcing within the consortium, experiences and initiatives will be selected to improve the Technologies Library).

As they are not necessarily case-related, the workshops and focus groups can take place online with the participation of people coming from different contexts and levels of experiences according to the different needs of the organizing teams. Thus, the main purposes will be:

- To develop new knowledge/collect existing knowledge that informs the products
- To explore how the products could be implemented
- To evaluate the products
- To provide input for the next version of the products

A more detailed description about workshops as a research method can be found in the first methodological deliverables of the knowledge bases (cf. D2.3, D3.2, D4.2).

4.1.3 Semi-structured Interviews

Semi-structured interviews will be carried for the LINKS products. Descriptions of the methods, including interviews, have been presented in D2.3, D3.2, and D4.2. The purposes of the interviews will be updated according to the status of the work, thus also the structure of the questions.

In particular, in contrast to the interviews in the first case assessments, new interviews will be used to dig deeper into the subject of the products. For the SMCS Technologies Library, potential interview partners will mainly be participants who already have been interviewed for the first case assessments and now are able to discuss about the product in depth. Also the interested survey participants are valuable candidates and experts for further interviews and could support the evaluation of the Technology Library. Providers and developers (businesses) of the SMCS technologies are another interesting category of fruitful interview participants, as they have an appropriate technical expertise and experience. For the optimisation of the Technologies Library, it is no longer necessary to collect knowledge on a broad level, but to conduct expert discussions in

depth about the product. Therefore, the objective of these interviews is to evaluate parts of the Technologies Library according to the expertise and to improve and enhance the product to achieve a next level of maturity.

4.2 Framework Application and Evaluation

The second approach to the case assessments is implementing, evaluating, and validating the LINKS Framework with all its components (the LINKS products) through a) guided applications of the learning paths and b) the application and improvement of the products in practice. This approach takes the practitioner's needs and viewpoint as a point of departure, asking disaster management organisations in the LINKS consortium to try to answer their needs using a set of methods (cf. Section 4.2.1). It should be noted the Framework consists of both the learning paths, as explained in D5.3, and the products. The first learning paths orient and point DMOs towards specific directions in which they can find knowledge and experiences embedded in the products. Hence, a comprehensive evaluation must revolve around the "directions" (or learning paths) along relevant themes (engaging with citizens and improving communication), and the core components of the Framework, namely the products.

To do this, a "guided application" will be used. The "guided application" method aims to understand how the overall LINKS Framework brings about change in practice, e.g. if and how the DMOs adapt, change or improve their communication strategies through the Framework. This method sets out a series of steps that supports LINKS practitioner partners in achieving selected aims of using SMCS in their organisations. It begins by identifying the needs and aims of the LINKS practitioner partners, which are then linked to the LINKS Framework and its products through continuous guidance and support from research partners.

It also provides the opportunity to the practitioners to self-evaluate their level of awareness regarding the use of SMCS in their organisations by reflecting on results from the assessments. In this way, the overall objective is two-fold: 1. to implement tangible solutions included in the LINKS Framework into DMOs and 2. to contribute to the improvement of the LINKS as a whole, starting from the co-development of the products, as described below.

Specifically, in this practitioner-driven approach, case assessment teams are invited to:

- **reflect on their needs**, especially those referring to the uses and potential challenges in applying SMCS within their organisations.
- **reflect on their aims**, specifically SMCS-related objectives within their organisation.
- **Contextualise the needs and aims within the themes** (engaging with citizens and improving communication) and the sub-themes (engaging with citizens: collecting and analysing information; mobilising volunteers, mobilising citizens. Improving communication: targeting communication, ensuring the quality of information, making information accessible) of the

LINKS Framework and provide feedback on how pre-defined learning paths (see D5.3, Section 2.2) can be of help.

- **apply one or more learning paths**, assess the usefulness of the LINKS Framework and **implement the products included in the LINKS Framework** to solve needs and challenges. The Case Assessment Teams (CATs) and practitioner organisations decide the specific products to be applied in each case (cf. Section 4.2.1 for the process) and contribute to their aims.

The strength of this applied approach is that it facilitates a testing ground for project outputs. It will help to understand how beneficial the results from the first case assessments and the products are within the settings they were generated from. The overall goals of this approach are:

- To apply and evaluate the LINKS Framework as a whole.
- To receive feedback on how the Framework is better adapted to suit the needs of the practitioners partners.
- To receive feedback on how the products can work together in providing solutions/answers.
- To promote the development of further practitioners-oriented content that could be implemented in the LINKS Framework.
- To create impact in the organisations and communities partaking in the LINKS consortium.

An important result of this approach is the concrete feedback on re-designing the LINKS Framework to make it more accessible and applicable beyond LINKS.

In the following subsection we explain in details the steps for Framework application and evaluation approach. This includes:

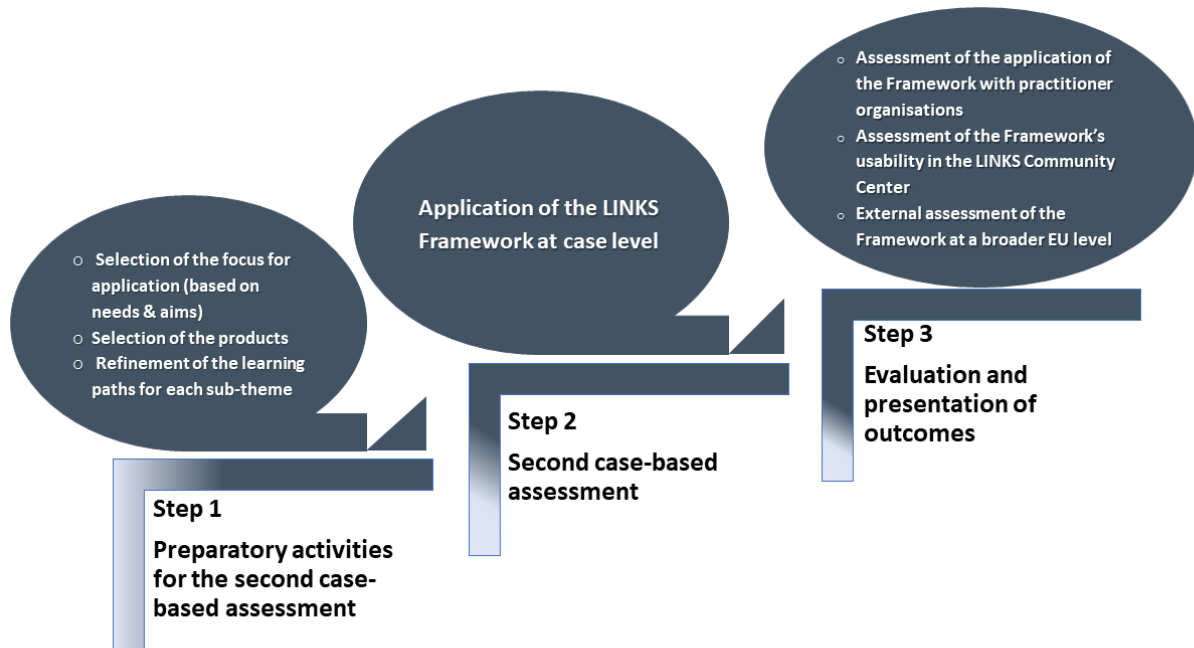
- Step 1: Preparatory activities for the second case assessment
- Step 2: Second Case Assessments
- Step 3: Evaluation

We then go on to explain the function of the LINKS Community Workshops in the second assessments, and well as the considerations made for the societal impact strategy and research ethics in the upcoming case work.

4.2.1 Guided Selection and Application of the LINKS Framework

The steps for the guided selection and application of the LINKS Framework are captured in Figure 21 below:

Figure 21: LINKS Framework's Guided Application towards Evaluation



Source: WP2-5

Step 1: Preparatory activities for the second case based assessment¹²

The first step of the guided application method consists of:

- a) the selection of the focus for application (based on the needs and the aims) and the selection of the products.
- b) the refinement of the learning paths for each sub-theme;

The activities described below shall be carried out in parallel from August to October 2022 as they pave the road for the next steps.

LINKS practitioners are involved in reflecting on their needs and aims and then in contextualising their needs/aims or challenges within the learning paths provided in the LINKS Framework. These aims or needs are being formulated to solve specific problems or to overcome challenges related to the use of SMCS in disasters on an operational level. The LINKS Framework should serve as a solution – oriented approach, which implies an active and strategic commitment to apply and test the Framework within practitioners' organisations. Practitioner partners should use the formulated needs/aims posed in the DRPV workshop (updating questions in D2.3) and the contextualised

¹² A detailed timeline and description of the activities will be outlined in the next work plans (D6.3).

version of the Resilience Wheels to select what aspects to address in the next case assessment. All materials are made available to partners before the meeting for easy access and navigation.

The refinement of the path for each sub-theme, namely all questions that orient the users and all answers that point them towards the products, will be carried out with the product owners. This will ensure that the learning paths are designed in a way that emphasise the added value and the potential of each product. The refinement must be as much comprehensive as possible to capture in detail what can be pulled out from each of the product. An initial implementation of the learning paths in the LCC must also start in this phase. Once the learning paths have been refined, pilot testing with at least one case assessment team will be carried out to assess if the paths, the interconnections across the themes and the resources available through the LINKS products match the needs and expectations at case level.

As mentioned in D5.3, the two main themes in the Framework, **engaging with citizens** and **improving communication**, have been selected based on the outputs across the KBs and the first round of case assessments. The themes and the subthemes capture recurrent issues related to communication, citizens' engagement, and the need for more knowledge, which emerged both from the main DRPV, DMP and DCT themes and various activities with the case assessment teams.

At this stage, it is key to take the themes and the sub-themes as points of departure to assess and explore the pre-defined learning paths with the case-assessment teams. Practically, this entails providing a set of guiding questions for each of the sub-themes that guide the users through a path for acquiring knowledge derived from the LINKS products included in the Framework. **By doing this, the navigation and orientation across the themes and connections with the LINKS products will be validated.**

This will be done through guided sessions with the case assessment teams. The sessions will provide a "walk-through" of one or more learning path to show how LINKS practitioners can benefit from the Framework in their organisations based on their needs or gaps they want to address. The LINKS practitioners will start from an objective or aim (making information accessible) and will be guided to solutions provided from the LINKS products answering to several questions that cover various aspects (institutional, social, technical and scale). In the application sessions the entire learning path will be presented with an emphasis on the knowledge and the resources available that will be pulled out from each of the product.

For instance, in Figure 22, an example of a "walk-through" is provided. Specifically, it is described the thinking and action process that practitioners have to follow so to find solutions regarding the improvement of their communication plans and accessibility of information to vulnerable groups. This is done by answering specific questions of 'who', that cover the social aspect of risk communication plans. For this example, the question of interest for an organisation according to its

identified needs to improve communication by making information accessible to vulnerable groups is “Who do you want to access the information?”. This question is then linked to relevant answers provided from the Including Citizen Handbook.

Figure 22: Example of a Learning Path



Source: Updated version of Fig. 4 in D5.3

The Handbook is providing actions to be taken as recommendations for more inclusive risk communication plans, for instance (summarised) recommendations to the organisation that is interested to include disabled -hearing & visual impaired may be to:

- Write large sections of text in 'all-caps'
- Putting valuable information in headers and footers as screen readers will ignore them
- Underlying large blocks of text as it reduces readability

The sessions will be evaluated via a set of questionnaires¹³ and hands-on applications. The questionnaires will focus on gathering feedback on the learning paths (content), the user experience and the session itself. While in the hands-on applications, the LINKS practitioners will be prompted to explore and apply the pre-defined learning paths and products within their organisation.

¹³ The questionnaires for the evaluation of the Framework will be included in the next work plans (WP5-6).

This will be followed by the ongoing joint identification of the products between WP2-5 and practitioner partners.¹⁴ The aim is to match the needs and aims identified in the previous activities with the components of the LINKS Framework (D5.3).

The preparatory phase will lead to:

- Map the expected outcomes in detail (what, when and for whom);
- Design a process for application where the products are used independently or jointly to address the issue(s);
- List a set of success criteria for short and long-term linking the needs/aims with impact in the organisation;
- Identify challenges and main barriers and assess how the LINKS Framework can overcome them.

To encourage dialogue and collaboration for the application of the Framework and implementation of the products in a hazard-case perspective, site visits will be organized. They can be organized between partners that have identified similar needs or interests for some specific products.

Step 2: Second case assessments

The second case assessments will be carried out between November 2022 and February 2023 and consists of the application of the LINKS Framework at case-level. In this phase, the Case Assessment Teams (CATs) will use the knowledge and experiences included in the Framework within their organisations. This entails the implementation of one or more learning paths based on specific needs to address or aims to achieve (step 1). Practically, it consists of the development and application of the Framework in the daily operations of the LINKS practitioner organisations. For instance, one organisation may want to focus only on how to make information accessible to a specific target group. In this case, the application entails both the exploration of the respective learning path and the implementation and improvement of the products that can address the organisation's needs. A co-creative approach is needed to ensure that needs and expectations are met. This part of the case assessments is practitioner-driven and needs to be facilitated and implemented case level with support from the knowledge bases.

This is done in close consultation with product owners. To coordinate this process, the methodological taskforces (cf. D2.3, 3.2) will be used as a platform to discuss progress, issues and preliminary results. The taskforce is a consultation process that involves a mix of research and practitioner partners across all cases.

Step 3: Evaluation and presentation of outcomes

¹⁴ It should be noted that many partner organizations are already engaged with the ongoing development of LINKS products, many of which have emerged from the establishment of the first knowledge bases and activities in the case assessments.

The evaluation of the Framework will consist of:

- The assessment of the application of the Framework with practitioner organisations. The application and evaluation at case level should be considered as an on-going process that will continue even after the evaluation;
- The assessment of the usability of the Framework in the LCC;
- External assessment of the Framework at a broader EU level.

During February 2023, the final step of the guided implementation the outcome of the process is evaluated together with the practitioners using the success criteria developed in step 1. Thus, providing an assessment of the guided implementation that is tailored to each organizational context. The evaluation has three focal points:

- **Assessment of the Framework in relation to needs:** It is evaluated how well the applied learning path(s) was aligned to address the needs. This is meant to set a scope for the next part and to evaluate the practicality of all Framework components;
- **Assessment of the application:** here the aim is to assess the actual application within the organisation. Alongside posing more general questions (i.e. What is the acceptance of the Framework within the organisation? Were the needs addressed through one or more products?), the main goal of this step is to apply the success criteria to the application process.
- **Usability in the LCC:** user experience of the learning paths and accessibility to the products in the LCC.

Furthermore, the external evaluation of the Framework will actively engage the LAC/LCWs members. To assess the usefulness of one of the main outputs of the project with experts ranging from scholars to practitioners starting from December 2022. Moreover, at the European Commission level, representatives from various DGs (e.g. JRC/DRMKC, DG ECHO, HOME) as well as relevant networks (The UCP Knowledge Network) will be engaged during workshops or already scheduled events (the DRS event, November 2022) to assess how the Framework can contribute and/or integrate with Commission initiatives. In addition, practitioners from countries not involved in the case assessments, will be invited to assess the potential implementation of the Framework in the frame of regional or national DMOs.

In the following an example of the guided selection and implementation method is described.

The municipality of *Waterland* is interested in improving communication with its citizens as well as in collecting and monitoring important information from social media in crisis situations. *Waterland* is a small town in the north of Europe exposed to flood risk. The municipality is generally well prepared for heavy rain and flooding. A staff member manually searches social media in crisis situations to try to elicit important information from citizens, e.g. about urgent

focal points and developments of the floods. The staff member found out about the LINKS project through research into technical applications for the automated monitoring of social media.

Accordingly, looking to the Framework components, they think the first option they can use is 'finding technologies' that refers in particular to the SMCS Technologies Library. They think this could be a useful product to get awareness of the technologies market and support them in selecting an appropriate solution to automatically monitor the social media activity around Waterland.

Furthermore, the municipality of Waterlands already owns an app for the communication with their citizens. The app has also a section for crowdsourcing, where citizens are asked to report on specific problems existing in the urban context. This process is supporting the constant mapping of needs and challenges the municipality is promoting.

However, the municipality has some difficulties to ensure that citizens constantly inform the system and participate actively to it. Furthermore, they would like to apply crowdsourcing also to aspects of flood risk prevention and preparation but they do not know how to do this.

Secondly, they discover that the including citizens handbook has a specific section on engaging with citizens, both to promote involvement and in general increase participation of communities. This section is also connected to the educational toolkit, that is providing some experiences of crowd mapping with children. Accordingly, the municipality decides to also test these products. Going through the handbook, they see there is also a section about 'increasing awareness' and they think this is another important point for them, thus they decide to take a look, because they suppose that the reason for low participation of citizens is their low level of risk-awareness.

In using the products, the municipality sees that some information is at the moment lacking and needs to be implemented, thus they suggest that:

- The SMCS Technologies Library could have further selection criteria, that could make easier the research;
- The Including Citizens Handbook's section on 'increasing awareness' could be implemented with an introductory assessment tool that could support stakeholders to assess their work and what is lacking in the process at the moment
- The Educational Toolkit is not providing documents in their local language, but they think some docs could be useful to be translated

All the suggestions are introduced in the 'product sheet' where the municipality also specifies how they can assist the process to implement the products. The product sheet is collected by WP5 and the results are shared with each product responsible. Then, a plan on how to implement the work is done during a taskforce meeting that involves the Waterlands municipality responsible, the product responsible, and WP5 leader.

4.2.2 The LINKS Community Workshops

The LINKS Community Workshops (LCWs) are workshops for capacity-building at the local level, conceived as a means to foster knowledge and experience exchange within the community. They are organised locally by partners and are crucial for communicating information regarding the project's objectives and scope, for exchanging good practices among different stakeholders on the use of SMCS in disasters, and for the development, testing and validation of project's results.

While in the first phase of the project – when the project's partners were in the process of developing the results – the LCWs were mainly used to create relationships with relevant local stakeholders, in the next phase of the project case assessment teams will further orient their LCWs objectives towards external testing and validation of the products developed by the knowledge bases as part of the Framework. This is expected not only to reflect the user-centred approach the consortium intends to adopt, but also to contribute to the uptake of project's results by allowing stakeholders early access in the development and ownership of the results.

The main characteristics of the LCWs as the research method developed to inform and test the products and the LINKS Framework are described in D8.2 (Bianchi & Giacinti, 2022).

According to Deliverable 8.2, LCWs will be organized in the different cases. Responsible for the organization of their content are the Case Assessment Teams (CATs). The types of content and stakeholders in the LCWs will therefore be assessed locally and based on the specific inputs needed in each case. However, the LCWs represent key moments to support the process to implementation and validation of the products and of the Framework. Accordingly, specific working times on the products are recommended to take place during LCW; these moments will be planned with the support of WP5.

As presented in D8.2, the general objectives for the LCWs are:

- To improve information and knowledge sharing among the stakeholders in local cases, together with relevant stakeholders and experts in the broader LINKS Community;
- to collect data and inform the assessments of the LINKS knowledge bases and the development of the LINKS Framework and the products it encompasses;
- to test and validate the products for selected disaster scenarios.

Depending on the purpose of the evaluation phase, workshops will be organised earlier or later in the research cycle: if participants are expected to contribute to the initial findings or hypotheses, earlier in the cycle would be better; if participants are intended to validate or test research findings, later in the cycle makes more sense. All the process will be managed in collaboration with WP5 and 8.

4.3 Societal Impact of the Research and Ethics Recommendations

The methods identified are expected to ensure the **societal impact** of the project. This is particularly true for the methods included in the 'Framework Application and Evaluation'. The process is finalized to test the capacity of the Framework and of the products to answer real needs of the stakeholders and it will be used also to guide the implementation of the products. In particular, the approach is important (as required in the societal impact strategy, D1.5 (Bonati & Morelli, 2020) and D1.6 (Nardini & Bonati, 2021) to:

- Further strengthen the direct involvement and active collaboration between academic and non-academic stakeholders;
- ensure the societal relevance of the project (usefulness and consumability of the project);
- such as the capacity of the Framework to work across countries.

Accordingly, all partners are reminded that when they are planning their research activity, they must take LINKS **ethics recommendations** into consideration and remember a series of protocols and rules that have been established in the LINKS project, and in particular:

- One month before the research activity starts, partners responsible for the research must compile the research self-ethics assessment survey and send a copy to the EAB;
- before the research activities start, research participants must receive the information sheet, that must be adjusted according to the kind of activity and participants (D10.1 (Bonati & Graziani 2020));
- before the research activities start and in case personal information is collected, research participants must receive also the informed consent, that must be adjusted according to the kind of activity and participants, that will be signed and sent back to the research partners (D10.1)
- If necessary, research partners need to present an updated request to the national ethics approval that should authorize research before it starts;
- Finally, all the research partners must guarantee the privacy/anonymisation and the management of the participants' data as described in the internal document "LINKS Data Management Plan" (D10.3, Clark 2020).

More information on ethics in research are available in D1.5 (Bonati & Morelli 2020) and D1.6 (Nardini & Bonati, 2021). All the research partners are invited to consult them.

To conclude, as described in the internal document "Diversity Awareness Strategy" (van der Lee & Bonati, 2022) and also specified in the D1.6, it is important to consider the diversity concept in terms of risk perception and vulnerability among the different communities of individuals as a way to strengthen the disaster resilience through involvement and inclusion. In particular, accessibility, inclusivity and participation must be key words in research. Specific recommendations on how to consider the diversity in research, following "the why", "the who", "the what", and "the how" steps,

are included in the document. Accordingly, all the partners in charge of research for the second assessment phase are invited to take in consideration the diversity awareness strategy in planning their research and any other project initiative.

5. CONCLUSION

According to the Grant Agreement, the second methodology has the main purpose to guide and support the development of the LINKS Framework and the second case assessments. Accordingly, this deliverable had a twofold aim:

- 1) to evaluate the first case assessments to present how the outcomes led to the current status of the project (development of the LINKS Framework with the products) and
- 2) to provide a description and a new version of the methodology in order to guide the second case assessments.

In particular, the second methodology described in this deliverable has the purpose to provide a strategy on how to support the process of the LINKS Framework and of the products' evaluation and implementation.

Accordingly, **Section 2** of this document provides an overview of the first methodologies highlighting how the research methods used for the cross-case assessment were applied and used in the five LINKS cases. Furthermore, an evaluation of the cross-case research, including in particular the semi-structured interviews and the survey carried out in the first case assessments, was presented. Some considerations are also provided on how the LINKS Community Workshops contributed to improving the knowledge about the use and potentials of SMCS in the five cases, integrating the information obtained with the cross-case assessment. In general, the results shows the complementarity of the methods used and gave the consortium the possibility to increase its awareness about the limits and potentials of SMCS Accordingly, the diversity (of the people involved, of the places and cultures, etc.) emerged as a key concept and as one of the main points to be discussed to ensure the implementation of the LINKS Framework and of the products, as also asked by the Societal Impact Strategy of the project (Morelli & Bonati, 2020).

Section 3 was about the contribution to the LINKS Framework. The section provided an overview of the LINKS Framework and products' status and how the first assessment phases, including both cross-case and deep-dive research, contributed to their development and design. Each sub-section is dedicated to one of the products, describing how their development benefited from the various actions implemented by the consortium partners.

Last section, **Section 4**, is the crucial one because it provides the design of the second methodology which can be divided in two main phases (not necessarily temporally sequential): expanding knowledge and the application and evaluation of the LINKS Framework. The first phase is conceived to be researchers- driven and it includes different kinds of methods (like the desk research, the semi-structured interviews and the workshops). The second phase is conceived as practitioners-driven and the steps described are based on a guided method with the aim of evaluating and applying the LINKS products and the LINKS Framework.

Thus, what is suggested with this second methodology is to move from a research-driven approach to a more practitioner-driven one. Although some methods are planned to continue to be organised by researchers, to ensure the advancement of the knowledge bases and hence the products, on the

other hand, a new set of methods were thought and conceived for ensuring a central role of practitioners in the development and implementation of the results and outputs.

5.1 Next steps

This deliverable sets the methodological basis for the final stages of development of the LINKS Framework (D5.5 Final version of the LINKS Framework) and for the Second LINKS case and broader context report (D6.5). It goes hands-in-hands with the Second Version of the LINKS Framework (D5.4) and the Third work plan for the five cases (D6.3) (November 2022). While in D5.4 the evaluation of the Framework which is outlined in this document, is described in detail, in D6.3 a comprehensive roadmap of activities for the case assessment teams is provided.

The next steps with regards to the LINKS Framework and the cases entails:

- The **refinement of the LINKS Framework as a whole** (learning paths and its products). Practically, this implies applying a user-driven approach so that the Framework can serve the needs and expectations of the practitioners' organisations involved in the project. The outcomes of this process, already underway, will feed into D5.5 and D6.5. The refinement phase, as explained in this deliverable, consists of the guided application and implementation at case level through a set of activities, including the application of the Framework within practitioners' organisations. From November 2022 to March 2023 the case teams will be actively involved in, on the hand, assessing, on the other improving the LINKS Framework so that it can help addressing needs, gaps and challenges with regards to the application of SMCS. Specific instructions for the case assessment teams will be provided in D6.3;
- The development of the **Final version of the LINKS Framework** (D5.4) based on both internal and external evaluation. The last stage of development stems from the reports at case level (D6.5) which consist of the outcomes of the activities carried out in the second-based assessments. The final version will also be developed by taking into account the feedback from the broader DRR community;
- The implementation of the **LINKS Framework in the LINKS Community Center (LCC)**. This will be done gradually (through different stages of application and testing) and according to both the steps for the guided selection and application of the Framework and to the maturity levels of the products.

With regard to the further development of the KB, this deliverable lays the methodological foundation for the refinement of the KB through the second case assessments conducted in WP6. The findings from the evaluation of the LINKS Framework, its products and guiding learning paths will provide important feedback and produce input for the final version of the LINKS Framework. Furthermore, the KBs will be able to improve the respective knowledge (DRPV, DMP, DCT) in order to create positive impact in the case-related disaster management (D2.5, D3.4, D4.4). In the next

step – and until the end of the project – a continuous discussion between different stakeholder will be promoted (especially with the help of LCWs and the LCC as a platform) to achieve and monitor effects of the KB beyond LINKS.

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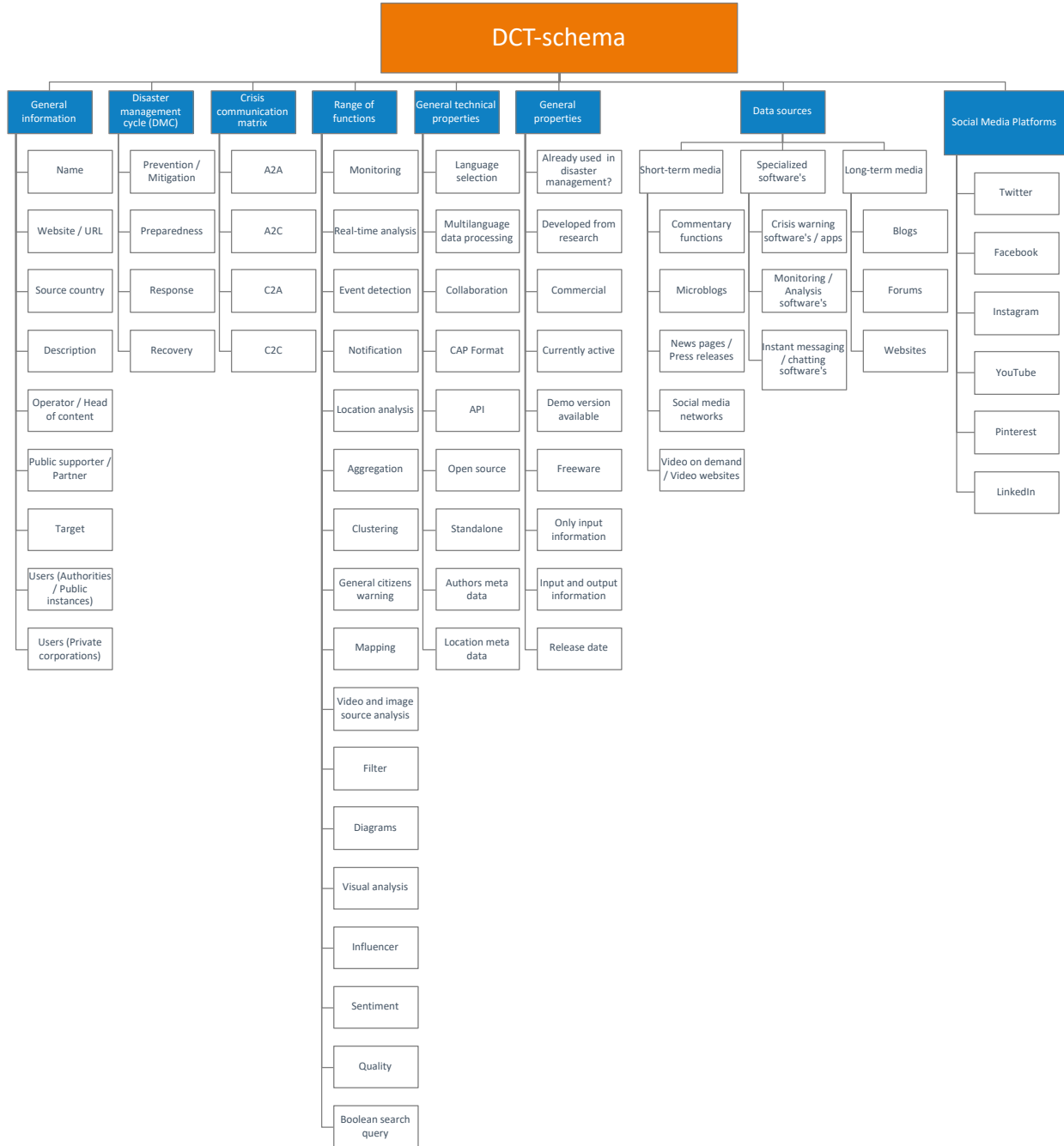
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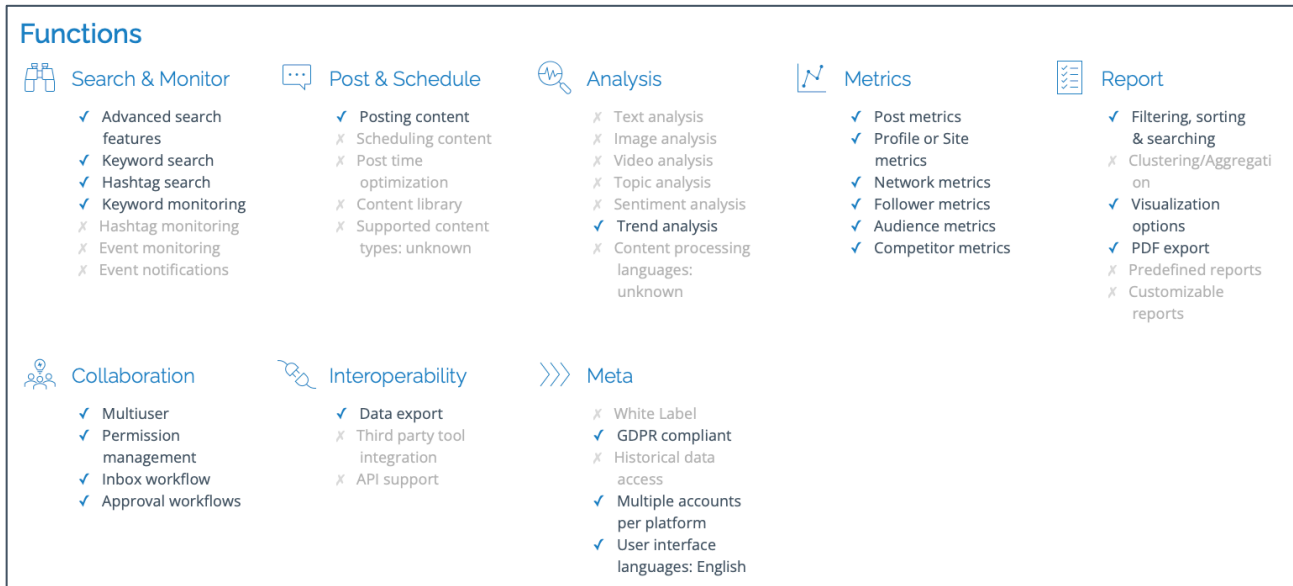
7. ANNEXES

Figure-I: Overview of the first Version of the DCT-schema



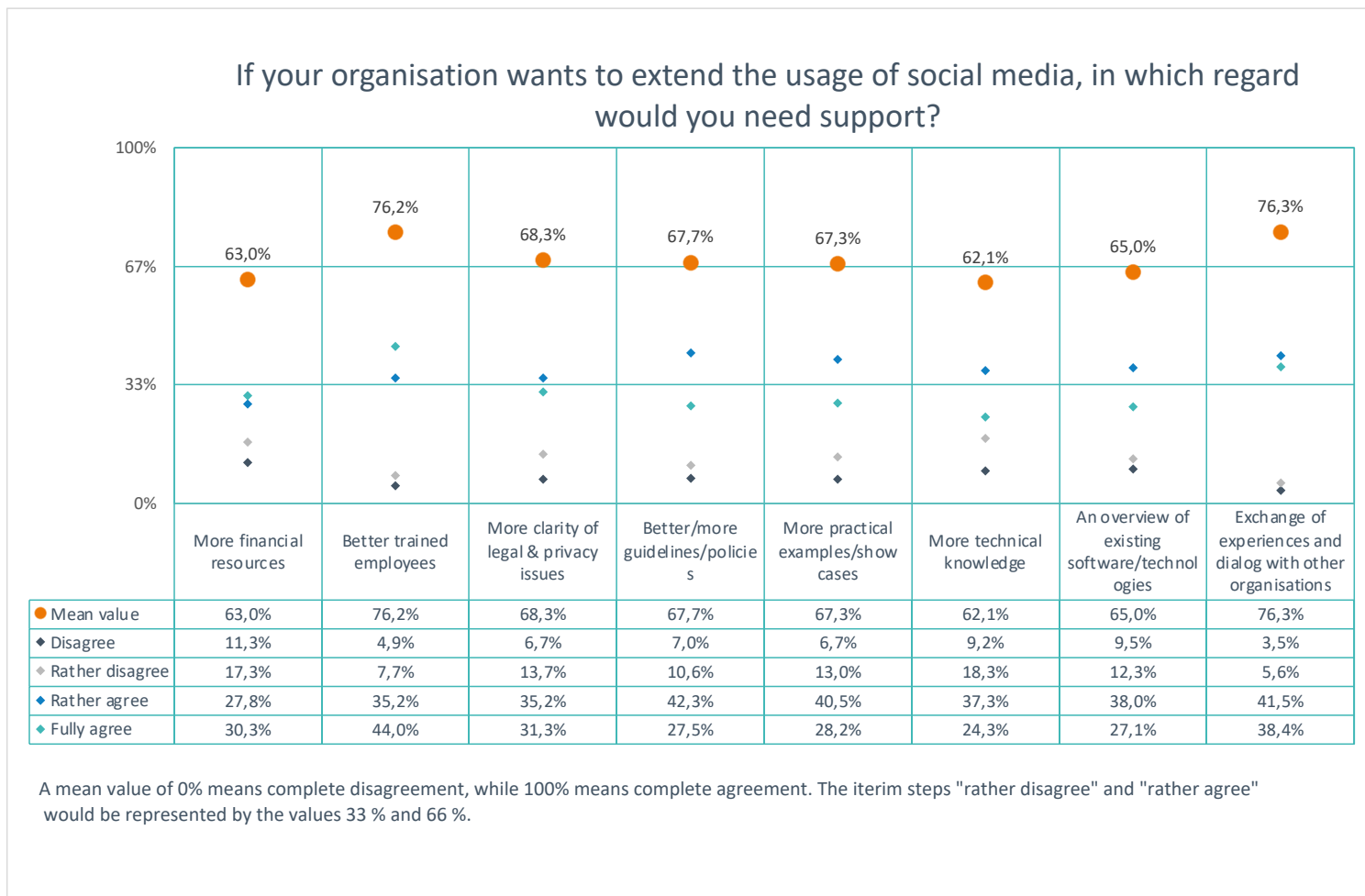
Source: Deliverable 4.1

Figure-II: Overview of the Category "Functions" in the Technologies Library



Source: LINKS Community Center (<https://links.communitycenter.eu>)

Figure III: Survey Answers on the need for Support for the Usage of Social Media



Source: WP4

Figure IV: Ubermetrics Technologies Key Word Search

Ubermetrics Your Searches in "All Projects" Last 7 Days

Dashboard
Overview
Mentions
Analysis
Comparison
Reports
Alerts
Configuration
Searches
Settings
Crowdsourcing
Login Management
Project Assignments

Create Search Agent > Simplified Mode

Input **Filter** Output

Please input your keywords:

flooding OR
heavy rainfall OR
non stop rain OR
severe weather OR
+ Add keyword

exclude these keywords
Sources: All
Search in all abo media segments
Languages: All

AND

insurance OR
advert + Add keyword

exclude these keywords
Sources: All
Search in all abo media segments
Languages: All

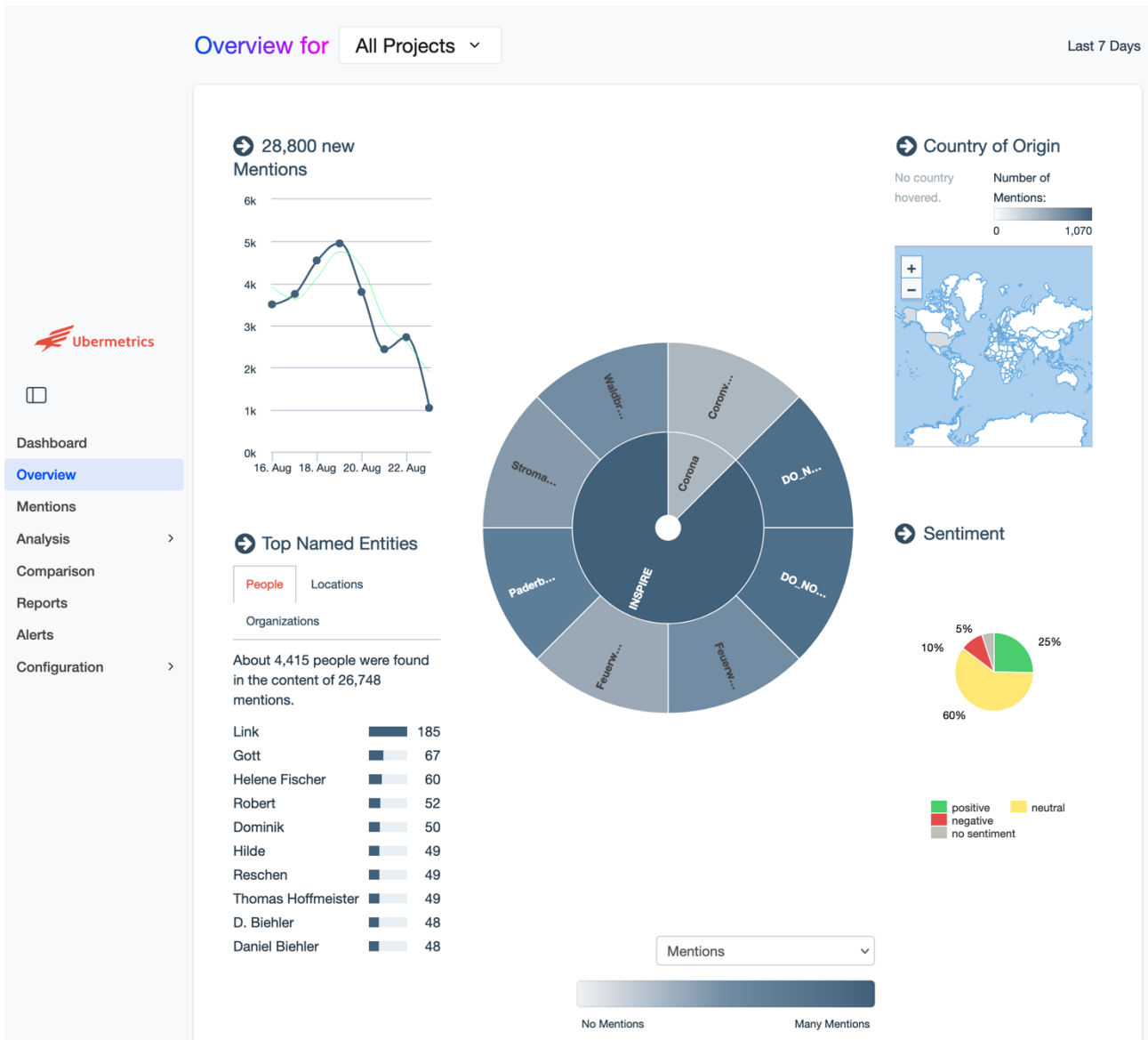
+ Add "AND" group

← back * cancel → next

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Source: Screenshot from Ubermetrics Technologies

Figure V: Ubermetrics Technologies Dashboard



Source: Screenshot from Ubermetrics Technologies