

# LINKS

Strengthening links between technologies and society  
for European disaster resilience

## D4.4 CASE ASSESSMENT REGARDING DISASTER COMMUNITY TECHNOLOGIES

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 consists of learning materials, such as scientific methods, practical tools, and guidelines, addressing different groups of stakeholders (e.g., researchers, practitioners, and policy makers). 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 (D4.4) is the fourth and penultimate deliverable of work package (WP) 4, which explores the use and potential of social media and crowdsourcing (SMCS) technologies. Due to an overwhelming market and the heterogeneity of the technologies, an overview of the technologies (SMCS Technologies Library) was developed at the beginning of the project and improved and tested in the first case assessment (November 2021-April 2022). In this context, the need for a structured overview of practical examples of the innovative use of SMCS has become clear, whereupon the Use Cases Library was launched by WP4 and implemented in the LINKS Community Center (LCC). These two LINKS products were then further improved, tested in practice and validated with different activities in the second case assessment (November 2022-March 2023). This deliverable presents

the impact of the second case assessment on the WP4 knowledge base, which consists of the Technologies and Use Cases Library and the methodology for product refinement and development. Overall, the case assessment has fulfilled the following tasks in relation to the two libraries:

- By focusing on specific scenarios (LINKS cases), real-world problems and challenges or situations, the practical relevance and applicability of the libraries was assessed. The structured approach in the different contexts of the cases allowed to evaluate and validate the libraries and thus to support the refinement process.
- The case assessment involved multiple stakeholders, such as disaster management organisations, research organisations or local communities. Involving these stakeholders fosters the stakeholder's engagement, collaboration, co-creation, and knowledge exchange. Engaging stakeholders is key to build a growing community within the LCC.
- As the case assessments were carried out in different European countries and different contexts, a mutual knowledge transfer was made possible. In research elaborated knowledge into practice and the already existing knowledge in the field of social media and crowdsourcing back into research.

This deliverable reports not only on the improvements of the SMCS Technology and Use Cases Libraries, but also on the case assessment activities that have had a relevant influence on the WP4 products. This includes, for instance, an intensified continuation of the work in the organisation, expert validation discussions, pilot tests, the third LINKS Advisory Committee meeting or site visits by partners from the cases.

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## LIST OF ACRONYMS

Acronym / Abbreviation	Description
BBK	Federal Office of Civil Protection and Disaster Assistance
CMINE	Crisis Management Innovation Network Europe
D	Deliverable
DCT	Disaster Community Technologies
DMO(s)	Disaster Management Organisation(s)
DMP	Disaster Management Processes
DRPV	Disaster Risk Perception and Vulnerability
DRMKC	Disaster Risk Management Knowledge Centre
DRM	Disaster Risk Management
EENA	European Emergency Number Association
EMSC	Euro-Mediterranean Seismological Center
KI-CoP	Knowledge & Innovation - Community of Practice
LAC	LINKS Advisory Committee
LCC	LINKS Community Center
NGO	Non-governmental organisation
SMCS	Social Media and Crowdsourcing
TRL	Technology readiness level
Vfdb	Association for the Promotion of German Fire Protection
WP	Work Package

## DEFINITION OF KEY TERMS<sup>1</sup>

Term	Definition
Case	Context-based study, realised through fieldwork, to assess the LINKS Framework. A case implies an empirical inquiry that investigates a real-life hazard scenario.

<sup>1</sup> The key terms of the project are defined in the LINKS Glossary, accessible under: <https://links-project.eu/glossary/>

Case Assessments	The assessment of the LINKS Framework in local cases.
Crowdsourcing	Describes a distributed problem-solving model where the task of solving a challenge or developing an idea is 'outsourced' to a crowd. It implies tapping into 'the wisdom of the crowd'.
Disaster Community Technology (DCT*)	<p>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.</p> <p>* In the course of the project we have adapted the name of the DCT-schema (cf. D4.1) to Social Media and Crowdsourcing (SMCS) Technologies Library and thus tended to avoid the term DCT. This is a matter of presentation with no impact on the content.</p>
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 organisations (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	The LINKS Framework consolidates knowledge and experiences on the uses of social media and crowdsourcing in disasters, into products for relevant stakeholders. The Framework is accessible online through the LCC and can be used by stakeholders to openly explore knowledge, or as a strategic planning tool for guiding disaster management organisations in their planning for using social media and crowdsourcing in disasters.
LINKS Knowledge Bases	The outputs and knowledge obtained from the assessment of the three knowledge domains. The knowledge is used to develop the LINKS Framework.
LINKS Knowledge Domains	The three crucial domains of analysis for studying European disaster resilience and SMCS. These include: Disaster Risk Perception and



	<p>Vulnerability (DRPV), for assessing changes in the citizens' perception of disaster risks induced by SMCS, as well as assessing the changes in the vulnerability of practitioners and citizens. Disaster Management Processes (DMP) for analysis of how SMCS changes the procedures and processes within the crisis and disaster management. Disaster Community Technologies (DCT), for assessing SMCS related technologies used by practitioners (and citizens) in disasters.</p>
<p>Scenarios</p>	<p>The LINKS scenarios refer to the hazards in each case (case 1, earthquake, Italy; case 2, industrial, the Netherlands; case 3, drought, Germany; case 4, flooding, Denmark; case 5, terrorism, Germany). They are informed by methodological choices and are instrumental for the case-based assessments of the Framework as they are the real-life scenarios through which the LINKS Framework is assessed.</p>
<p>Social media</p>	<p>A group of Internet-based applications that build on the ideological and technological foundations of the Web 2.0 and that allow the creation and exchange of user-generated content. Forms of media that allow people to communicate and share information using the internet or mobile phones. Web 2.0 is the Internet we are familiar with today in which people are not just consumers of information but producers of knowledge through social networking sites and services like Facebook, Twitter and Instagram.</p>

## 1. INTRODUCTION

The influence of social media and crowdsourcing (SMCS) on the communication culture of global populations, both in personal and professional spheres, is not a recent development. This phenomenon has been shaping the way people communicate for many years. The emergence of Web 2.0, where individuals transition from being consumers to producers, has facilitated the availability and rapid networking of information. This shift has enabled almost real-time access to a vast amount of information through social media and other collaborative platforms. The ongoing changes in society make it necessary to adapt structures within disaster management organisations. A crucial aspect involves the integration and application of technologies to access, analyse and utilize disaster-related information from SMCS platforms to enhance the capabilities and effectiveness of disaster management organisations in managing and responding to crisis. In the event of a disaster, for example, collecting, filtering, and processing social media posts that show or describe damage that has occurred, allows the disaster management team to assess a situation more quickly and comprehensively. As a result, resources such as emergency forces and relief supplies can be coordinated more efficiently. Likewise, a well-planned social media presence of disaster management organisations offer numerous benefits. It enables direct and instant communication to the public, enhancing transparency and providing real-time updates during emergencies. Maintaining an active social media presence builds trustworthiness and credibility, fostering trust in government and the organisation's capabilities. Additionally, social media platforms provide a valuable channel for combating fake news and disinformation by promptly sharing verified information and correcting misleading narratives. By leveraging efficient use of social media with the support of technologies, disaster management organisations can enhance public safety, engage communities, and establish reliable channels of communication during critical situations.

Work package 4 explores the application of these SMCS technologies and elaborates on the increasing heterogeneity of technologies and a complex and non-transparent market as a major challenge for their use in practice. To address and face this challenge, the SMCS Technologies Library has been developed and is introduced in D4.1<sup>2</sup> (Habig, Lüke, Sauerland, & Tappe, 2021). D4.1 explains the need for a transparent SMCS technology overview and access for the use of SMCS based on a literature and market analysis as well as the presentation of the state of the art. Accordingly, the SMCS Technologies Library gathers and structures information about existing SMCS technologies to grasp the overwhelming market and to guide disaster management organisation with the selection and application of suitable technologies.

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<sup>2</sup> D4.1: Disaster Community Technologies Knowledge Base, November 2020

The methodology to further develop and refine the SMCS Technologies Library and test it within the first case assessment (November 2021-April 2022) is described in D4.2<sup>3</sup> (Gehlhar, Habig, Lüke, & Marterer, 2021). Qualitative interviews, a Europe-wide online survey as well as different kind of workshops were derived and adapted to the needs for the further development of the SMCS Technologies Library. In the first case assessment, the need for an exchange of experiences and practical examples also became particularly clear. The SMCS Use Cases Library was created to meet these needs. In the library helpful examples (positive and negative experiences, key facts etc.) about the innovative application of SMCS in disasters are collected and presented in a structured way. The aim is to provide interested organisations and individuals with concrete examples and inspiration.

The experiences and results from the first case assessment were analysed (presented in D6.4<sup>4</sup> (Clark, et al., 2022)) and incorporated into product updates in D2.7<sup>5</sup> (Lüke, et al., 2022). Also, the concept of the SMCS Use Cases Library is explained in D2.7.

Likewise, D2.7 describes the relevant research methods that were developed by the knowledge bases to further develop the products within the second case assessment (November 2022-March 2023). In addition to the expansion of knowledge through desk research, workshops and expert interviews, the practical application of the LINKS Framework and thus of the products comes to the center of actions within the second case assessment. D6.3<sup>6</sup> (Larruina, et al., 2022) describes the final work plan for the second case assessment and details how the research methods from D2.7 are translated into activities in each case. D6.5<sup>7</sup> (Larruina, et al., 2023) summarizes the results of the second case assessment and interaction of the case assessment teams with the LINKS Framework and the products.

Building up on the methodologies from D2.7 and the research activities described in D6.5, the present D4.4 describes and explains how the second case assessment informed and contributed to the evolution of the knowledge base of SMCS technologies. The knowledge base consists of the SMCS technologies and Use Cases Library and the first and second methodologies to ensure continuous improvement. The described workflow of the project can be seen in the following Figure 1.

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<sup>3</sup> D4.2: First Disaster Community Technologies Methodology for the LINKS Framework and Case Assessments, June 2021

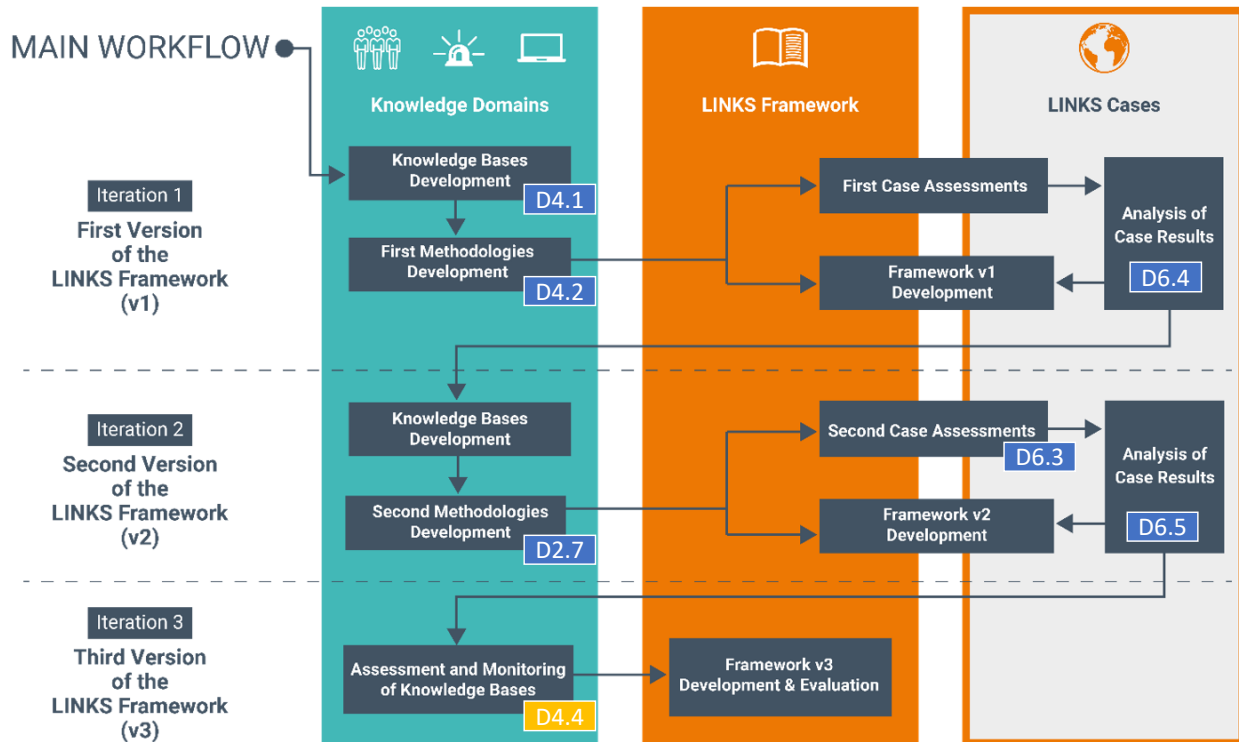
<sup>4</sup> D6.4: First LINKS Case Report, May 2022

<sup>5</sup> D2.7: Second Knowledge Base Methodology for the LINKS Framework and Case Assessments, September 2022; Contrary to the original planning according to the Grant Agreement, the second methodology deliverables (D2.4, D3.3 and D4.3) were combined into one deliverable (D2.7). 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 collaboration.

<sup>6</sup> D6.3: Final Work Plan for the LINKS Framework and the Five Cases, November 2022

<sup>7</sup> D6.5: Second LINKS Case and broader Context Report, April 2023

**Figure 1: Main Workflow of LINKS**



Source: LINKS

To report about the resulting impact of the second case assessment, this deliverable is divided into four further sections. **Section 2** gives an overview of the underlying research approach and the case activities carried out to improve and validate the Technologies and Use Cases Library. The validating, changes and further developments of the mentioned products resulting from the case assessment and parallel continuous research activities in WP4 are summarized and explained in **Section 3**. In particular, new, identified potentials of the libraries are also explained here as a basis for potential further research in the disaster management community. In this context, the points of reference to the LINKS Framework and the associated products to be available as a helpful resource for user guidance are also explained. **Section 4** outlines the relevant case activities and places them in a deeper context with the two WP4 products. Finally, the next steps till the end of the project and future plans beyond the duration to establish the products as a sustainable helpful resource are touched upon in **Section 5**.

## 2. OVERVIEW OF THE CASE ASSESSMENT

The main objective of LINKS is to strengthen European disaster resilience by consolidating knowledge and generating learning on the uses of social media and crowdsourcing (SMCS) in disaster management processes. An essential step towards achieving this goal are the five cases, which contribute significantly to the development of LINKS products in two case assessments. Together with the LINKS Framework, the knowledge bases defined and derived a mix of different research methods for the case assessments. Furthermore, the substantive questions for the improvement and validation of the products were defined. In LINKS there are the following cases:

- 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

The first case assessment ran from November 2021-April 2022 and was mainly used for knowledge generation and exploration through interviews and surveys (cf. Section 2.1). The second case assessment (November 2022-March 2023) focused more on the application and validation of LINKS products in a practical context.

### 2.1 Review first Case Assessment

The case assessment teams utilized various research methods, guided by protocols and guidelines, to gather information on experiences, good practices, needs, and challenges of DMOs in using SMCS for disaster management. The case assessment involved engaging different stakeholders and experts, including local fire departments, authorities, special police forces, technology providers, and others. Various research methods were employed, such as cross-case interviews, Europe-wide online surveys, workshops, ongoing desk research, and testing of technologies. The research methods conducted within the first case assessment has provided valuable insights for the development and assessment of the Technologies and Use Cases Library. The following research methods carried out in the first case assessments had a significant impact on the development of the Technologies and Use Cases Library:

- **Cross case interviews:** Spread across the cases, a total of 54 expert interviews were conducted about SMCS. To analyse the significant input for the Technologies Library the codes “Descriptions of SMCS technologies” and “Future potential of SMCS technologies” have been systematically investigated and the topics were clustered into the categories “Needs”, “Plans”, “Concerns” and “Insights”. Through this approach, over 30 topics were identified, some of which formed the foundation for updates, while others validated existing sections of the Technologies Library. The insights gained from the interviews played a crucial

role in enhancing the “Functions” category (e.g. the need for a wider reach or concerns about legal restrictions). Furthermore, the interviews were examined to identify any references to SMCS technologies that are presently employed by practitioners or have been utilized in the past. As a result of these references, three additional technologies have been incorporated into the Technologies Library.

- **The Europe-wide online survey:** The survey conducted aimed to explore the current use and future potential of SMCS in disaster management. It gathered insights from relevant stakeholders such as authorities, disaster management organisations, practitioners, and NGOs. The survey provided valuable information on the practical experiences, attitudes, and challenges related to the use of SMCS. Additionally, it identified new technologies that were not previously included in the SMCS Technologies Library, leading to their incorporation. The survey also resulted in updates to the library, including the addition of the category “Used by Practitioner”. The survey responses also helped validate the importance of various functions.
- **Different kind of workshops:** In the course of the first case assessment, the second LINKS Advisory Committee (LAC) meeting, three LINKS Community Workshops (LCW) (cf. D8.5<sup>8</sup> (Giacinti , Bianchi, Vieilleveigne, & Nuessler, 2022)) and a workshop during the first LINKS annual meeting were held to further develop the Technologies and Use Cases Library. The workshops led to significant changes and improvements based on participant feedback. These changes include simplifying the phases of a disaster, considering individual platforms instead of data types, and introducing new categories such as "License Model."
- **Technology-Testing:** Testing of SMCS technologies within the first case assessment was essential to gain a comprehensive understanding of the functional capabilities and features of the technologies. It allows to explore the various functions offered by the technologies, compare them to each other and assess their effectiveness in real-world scenarios. It also allows to assess whether these technologies meet the desired requirements from different stakeholders involved in the case assessment.

The inception of the Use Cases Library occurred in the summer of 2022 in response to the identified need during the analysis of cross-case results in the first case assessment. Notably, while some survey respondents shared intriguing instances of SMCS utilization, a majority expressed a desire for additional guidance and ideas on implementing or enhancing their use of SMCS. As a result, the SMCS Use Cases Library was developed to address these needs, providing practitioners with a valuable resource of real-world examples and practical guidance for effectively leveraging SMCS. As the library was added in the course of the project, the LINKS Library model was also designed. This gives the libraries a similar structure with identical core data and opens up the possibility of connecting further libraries to the model and mutually linking the contents. A more detailed

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<sup>8</sup> D8.5: Second LINKS Community Workshop and LINKS Advisory Committee Report, November 2022

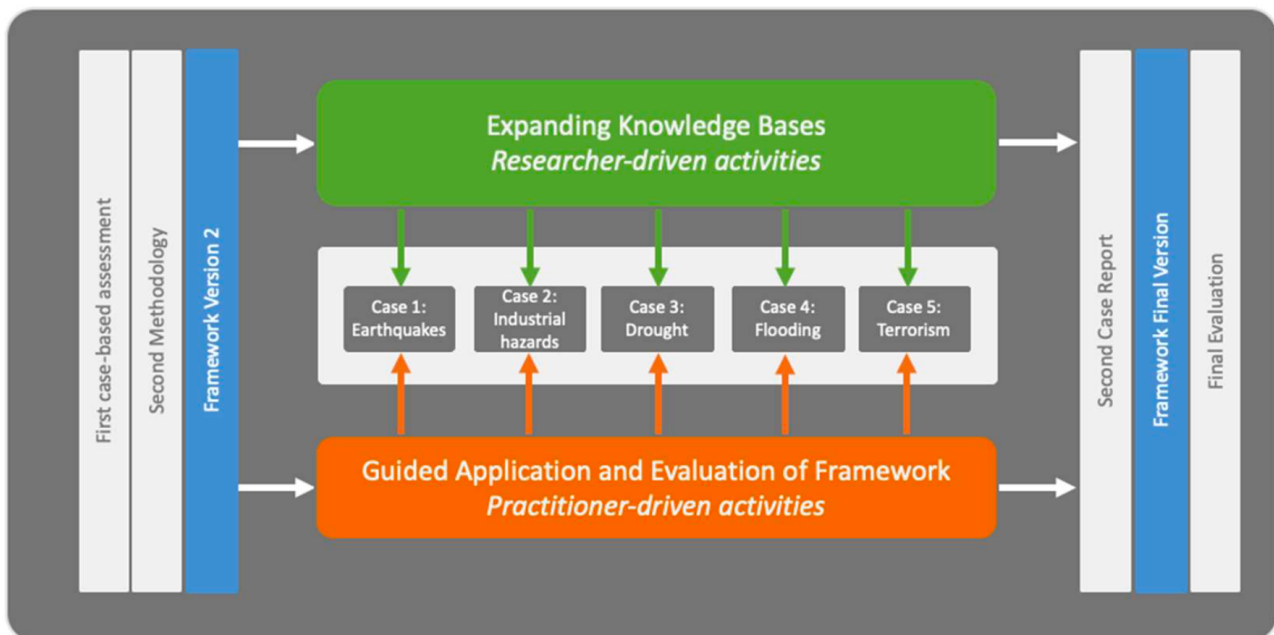
description of the research methods used in the first case assessment, their influence on the products and the library model can be found in D2.7.

## 2.2 Overview second Case Assessment

To refine and improve the LINKS products after the first case assessment and to integrate them within the LINKS Framework, a second knowledge base methodology (D2.7) was established for exploring interrelated themes and questions across the three knowledge bases in all cases during the second case assessments. This methodology used a combination of researcher-driven and practitioner-driven activities. Combining research with practice in the second methodology allows us to generate new knowledge in a systematic way (researcher-driven activities), while further testing, grounding, and co-producing results from the first phase of the project directly with practice (practitioner-driven activities).

As shown in D6.4 and D6.5, the five LINKS cases provide a rich source of information and experiences to draw lessons from and further develop concepts for improved European disaster resilience. Additionally, these assessments offered an opportunity to test more developed products in practice and understand the use of SMCS in disasters beyond a single scenario or regional context. The Expanding Knowledge and Framework Application and Evaluation approaches in the second methodology included methods for gathering data on experiences, good practices, and feedback from stakeholders on the products. The case assessment teams were equipped with guidance and protocols for the application of these methods, as outlined in D6.3. The research design fundamental to the second case assessment is shown in Figure 2.

Figure 2: Research Design for the second Round of Case Assessments



Source: D2.7

The two research perspectives "Expanding Knowledge Bases" and "Guided Application and Evaluation of Framework" were defined in D2.7 through more specific research methods. In the frame of WP4, the following Table 1 gives an overview about the research methods which had influence on the SMCS Technologies and Use Cases Library.

**Table 1: Overview of the Activities within the second Case Assessment**

Activity	Section
<b>Desk Research</b>	4.1
<b>Product Task Forces and Workshops</b>	4.2
SMCS Technologies Library	4.2.1
SMCS Use Cases Library	4.2.2
SMCS Guidelines Library	4.2.3
<b>Site Visit</b>	4.3
<b>Expert Validation</b>	4.4
Business Providers	4.4.1
Networks of Civil Society	4.4.2
Practitioners	4.4.3
<b>Pilot-Tests</b>	4.5
<b>Application of Technologies</b>	4.6
<b>Validation through Dissemination &amp; Exploitation</b>	4.7
Research for Civil Protection-Congress	4.7.1
EENA-Conference 2023	4.7.2
Annual Conference 2023 of the Association for the Promotion of German Fire Protection	4.7.3
KI-CoP ENGAGE	4.7.4
<b>3<sup>rd</sup> LINKS Advisory Committee</b>	4.8

Section 3 gives a more detailed overview of the activities of the case assessment teams, which had an impact on the SMCS Technologies and Use Cases Library from the perspective of WP4.



### 3. UPDATES ON THE TECHNOLOGIES AND USE CASES LIBRARY

With recent developments and the more frequent usage of social media and crowdsourcing (SMCS) platforms, data and information analysis become increasingly important for both disaster management and public authorities. New possibilities emerge from the dynamic development of technologies and the accompanied expansion of social media platforms and ways of communication leading up to the need of further investigation of social media data analysis to make use of potential benefits. Recent developments include not only the COVID-19 pandemic but also the war of aggression in the Ukraine, the rising discussion about climate change and its consequences in form of increasing natural disasters (e.g. droughts, heat-waves, floodings).

Social media platforms enjoy a growing popularity especially during times of isolation due to the covid pandemic. Turning into a highly relevant factor for social life, they fulfill psychosocial needs to battle loneliness and social isolation (Marciano, Ostroumova, Schulz, & Camerini, 2022). Anyhow, with the increasingly frequent usage of social media and limitation of social life to online platforms, a growing number of radical influencers can be observed (Hollowell & Longpre, 2022). In Germany, a movement called the Querdenker (lateral thinkers) emerged fighting the covid restrictions and doubting the dangers of the coronavirus (Jarynowski, Semenov, & Belik, 2020). Decentralized and anonymized communication make it difficult for authorities to identify and respond appropriately to citizens who oppose covid measures because data analysis has not yet improved sufficiently. Mostly, they connect via social media and share their values and beliefs in an opinion making fashion which underlines the advantages of data analysis to predict possible dangers in the enforcement of covid precaution measures in specific areas (Jarynowski, Semenov, & Belik, 2020).

Posts on social media play a major role in political education as videos and personal written reports coming directly from the Ukraine spread rapidly (Zasiekin, Kuperman, Hlova, & Zasiekina, 2022). In fact, in the three months leading up to the Russians' first attack on Ukraine, social media data analysis supported Ukraine by identifying Russian aggression against Ukraine on social media as preparation for war (Horbyk & Orlova, 2023). Furthermore, the ongoing information war between the Ukraine and Russia takes place on various platforms (TikTok, Instagram, etc.) and with the help of bots, social media is used to provoke viewers to either defend the Ukraine or support the Russian attack (Shen & et al., 2023). Such opinion making does not stop at misinformation campaigns by the Russian government and persuasive materials which are spread across various channels on social media (Park, Mendelsohn, Field, & Tsvetkov, 2022). Furthermore, the inflationary spiral and energy crisis connected to the war offer further research potential in social media data analysis. For now, vast floodings of posts on uncountable channels outline the challenge for emergency response to detect potential dangers arising from decentralized radical movements.

Not only radical groups form on social media but activism profits from social media platforms as well. Climate activists (e.g. Fridays for Future, Extinction Rebellion) communicate and coordinate

protests via social media and call for action on online platforms (Hautea, Parks, Takahashi, & Zeng, 2021; de Moor, De Vydt, Uba, & Wahlström, 2021).

During the 2021 floods, many volunteers reacted to shared information on social media and organised food and other supplies entirely online (e.g. Facebook-groups) and independently from organisations (Moghadas, Fekete, Rajabifard, & Kötter, 2023). Crowdsourcing platforms were established in real-time which facilitated and accelerated resource management (Songchon, Wright, & Beevers, 2021). Due to the self-made analysis of data on the flood disaster social media users were able to respond quickly to the needs of affected people. To collect data in an organised fashion could speed up disaster responses by means of gathering information on required resources and potential dangers in providing them.

The briefly described developments of SMCS since the project started in 2020 make clear, that the potential of technological advancements is not yet exhausted. Recent events show the high value of online platforms and the usage of provided information in both disaster preparedness and disaster response. The vast amounts of data generated by the platforms needs to be collected, processed, and analyzed to understand the public and community dynamics in disasters. Also, technological support is needed when it comes to real-time monitoring to stay updated in evolving situations and to be able to rapidly spread-out information to the public. The actuality of various issues shows the need for further research in technologies to support SMCS data analysis to make use of possible benefits.

To understand, capture and analyze the increasing complexity of SMCS applications, the SMCS Technologies and Use Cases Library are continuously being improved. The SMCS Technologies Library provides an overview of the market, the changing technologies, and their characteristics. Section 3.1 provides a summary of the changes for the Technologies Library since September 2022. Besides the overview of technologies, the first case assessment has revealed the need for practical examples to supplement the application of SMCS. For this reason, WP4 launched the Use Cases Library in July 2022. The progress achieved through the second case assessment is explained in Section 3.2. While the Technologies Library had a technology readiness level (TRL) of 6 before the start of the second case assessment (cf. D5.4<sup>9</sup> and D5.5<sup>10</sup>), the Use Cases Library was rather new and had a TRL of 3 before the second case assessment. For this reason, the further development of the Use Cases Library is more comprehensive and, above all, more dependent on external contributions of content (use cases).

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<sup>9</sup> D5.4: Second Version of the LINKS Framework, December 2022

<sup>10</sup> D5.5: Final Version of the LINKS Framework, June 2023

### 3.1 SMCS Technologies Library

The following refinements and further developments have been adopted for the SMCS Technologies Library and the implementation in the LINKS Community Center (LCC) is ongoing:

- The case activities, particularly those involving practitioner organisations, have demonstrated a need for detailed information on whether a technology offers a demo version and under which conditions. The first-level property “License Model” already contained a rudimentary option to record whether a demo version is available for a technology with a binary yes/no answer (cf. D4.1). However, the demand for more details necessitated the creation of a more detailed property “**Demo Version**” which contains the original category describing whether the technology offers a demo version (now called “Demo Version Availability”) alongside two new categories. The “Limitations” category describes whether the demo version is fully functional or restricted in functionality and/or time. The “Accessibility” category describes how the demo version can be accessed, as many demos are only available on request or require a registration. All this information is aimed to help the user of the LCC to easily gauge the amount of effort it would take to test a particular technology. The original “License Model” property has been renamed to “Pricing” and now focuses solely on specifying whether the technology is free to use, paid or a combination of the two. The following Figure 3 summarizes the overall structure of the new “Demo Version” property:

**Figure 3: Draft Implementation of the First-level Category “Demo Version”**

Demoversion availability	?	Yes	✓	/	No	✗
Limitation	?	No	✓	/	Functionality	☹
Accessibility	?	Free download / Free download after registration / On request				

Source: WP4

- The property “**Used by Practitioners**” was developed further. By design, it contains information on known uses of a technology by practitioners, such as DMOs, including any recorded use cases. By learning from the experiences of other organisations and gaining insights into what works well and what does not, DMOs can improve their own decision-making processes and effectiveness. However, based on feedback from the case assessments, this information requires more evidence. This is already mostly covered within the category “Use Case available”, as it would ideally link a technology to an elaborated use case prepared by the involved organisation. However, the “Already used by Practitioners” category requires more in-depth information or proof if the question has been answered

with a “yes”. For this purpose, additional data providing the source for such claims has been proposed in the following form:

- Information was sourced from the official website of the technology provider,
  - confirmed by an organisation with an indication of the organisation name,
  - or confirmed by an organisation without an indication of the organisation name.
- During case assessment activities, stakeholders have expressed interest in being informed about technical requirements of technologies. Following this feedback, four types of data have been identified as the most relevant for this context and grouped together into a new property called “**Technical Properties**”. The “Open Source” category indicates whether the technology is available as open-source software. This can be of high importance to some practitioners, as certain organisations are not allowed to use proprietary closed-code software due to security or licensing considerations. The “Required Infrastructure” category indicates whether the technology can be operated/instantiated on own infrastructure (internal) or runs exclusively on remote (external) setups. This is important because working with externally operated software can be a security risk and therefore disallowed by security policies. On the other hand, internal setups are more cost-intensive, so practitioners with a limited budget could be interested in external solutions. Finally, the “Cloud/client-based” category shows whether the technology operates on cloud services which usually offers more security in terms of data loss and stability but has similar considerations as using technologies on an external infrastructure.
- Another need identified during case assessment activities was the possibility to assess the level of technical skill required to use a particular technology. As users may vastly differ in their proficiency or expertise with technology, providing such information is especially crucial to smaller teams or individuals without appropriate technical support and should help them find technologies that would not be too difficult to use. To that end, a new property called “**Technical Complexity**” has been developed. It consists of three complexity tiers of easy, medium and hard. Each tier is represented by its own category which contains the reasons for why a technology would be considered to fall into a particular tier. For example, a technology that can be used directly in the web browser without any installation would be considered easy. Conversely, a technology that requires programming or setting up a server would be considered hard.

**Figure 4: Draft Implementation of the First-Level Category “Technical Requirements”**

**Technical Properties**

Open Source	?	Yes	✓	/	No	✗
Required Infrastructure	?	Internal / External				
Client Based	?	Yes	✓	/	No	✗
Cloud Based	?	Yes	✓	/	No	✗

**Technical Complexity**

easy	Use in browser Registration needed
medium	Install clients program
hard	Programming / scripting Install internal server

**Source:** WP4

## 3.2 SMCS Use Cases Library

The Use Cases Library aims to provide detailed real examples of applying SMCS technologies to disaster situations, analysing their potential, practicality and pitfalls. As the latest addition to the LINKS products lineup, it is not as advanced as the other products yet. Nevertheless, it has enjoyed considerable progress as a result of the second case assessment. In particular, since October 2022 the number of collected use cases grew from 8 to 24, which represents an increase by 200%. This not only means an increase in the quantity of available data, but also an expansion in the breadth of topics covered and hazardous situations considered. To promote further growth and improvement of the Use Cases Library, a digital **contribution form** has been developed for the LCC and distributed among the consortium members to allow them to submit new use cases with the prospect to make the form accessible for external contributors in the future.

### 3.2.1 Presentation of the Contribution Form

The contribution form has been implemented as a page on the LCC that is accessible via a special link. By filling out the form and saving it, a registered user can create a new use case directly. The form also appears when a user attempts to edit an existing use case and thus serves as a more user-friendly editing interface when compared to the standard Wiki editors.

Each field inside the form corresponds to a first-level property or a category of the use case schema. Since the number of fields is too high to comfortably fit on the screen, they have been sorted into four major groups that are loosely connected by the topics they cover or the kind of information they provide. Each group is implemented as a tab inside a tabbed interface, thus making the form easier to navigate.

Since the fields are connected to the use case schema (cf. D2.7), anything the user enters into the form becomes computable data and can be used for further processing. Indeed, all the filters in the Use Case Library get their values from this data and thus the users provide selectable values for the filter whenever they enter new values into the form fields. For properties with fixed values, both the filter and the contribution form provide multiple choice fields or checkboxes, depending on whether more than one answer is possible. All multiple-choice questions additionally offer a “none/unknown” option for when the user does not have an answer. These values are ignored by the filter as are empty text fields. This gives the user the flexibility to not answer questions they have no answer to without disrupting the filter functionality. On the other hand, the more fields the user fills out or answers, the easier it will be to find the use case later with the filter’s help.

In the following paragraphs we will explain the contribution form in detail, going through each of the field groups and their corresponding fields.

The first field group is “Core Data” which, as the name implies, contains the “core” information about a use case, i.e., basic and factual data. It consists of seven fields (Figure 5):

1. **Category** field describes whether the use case was a real-world event or not, with the non-real-world options currently being “exercise” and “preventive campaign”.
2. **Year** in which the use case occurred.
3. **Location** of the use case.
4. **Hazard** indicates the type of disaster or hazard the use case is connected to, such as “hurricane” or “earthquake”. The user can select multiple hazards from a drop-down list and/or type in a new hazard manually, which will then become an available drop-down choice for subsequent uses of the contribution form (and also a selectable value in the filter, as described above).
5. **Scale** provides a rough indication of how large the hazard or use case was, the current options being “city”, “county” or “country”.
6. The **overall timeframe of the use case** gives a rough estimation of how long the event or use case lasted. This is currently a multiple-choice question with three options of “less than a day”, “between one and three days” or “longer than three days”.
7. Finally, the **Brief Summary** field is intended to provide a short descriptive text for the use case, no longer than 200 words. This field is required.

Out of this field group, the fields “Hazard”, “Category” and “Scale” are currently used in the filter. Most other fields like “Brief Summary” and “Year” can be seen on the use case’s profile.

**Figure 5: Core Data of the Contribution Form for the Use Cases Library**

Core data	Extended data	Questions	Meta
<b>Category</b>	<input type="checkbox"/> Exercise <input type="checkbox"/> Preventive campaign <input checked="" type="checkbox"/> Real-world		
<b>Year</b>	2022		
<b>Location</b> <small>City and country.</small>	Paderborn, Germany		
<b>Hazard</b> <small>e.g., earthquake, flood</small>	<input type="button" value="x Storm"/> <input type="button" value="x Tornado"/>		
<b>Scale</b> <small>Leave at "none" if you don't know the answer.</small>	<input type="radio"/> None/unknown <input checked="" type="radio"/> City <input type="radio"/> Country <input type="radio"/> County		
<b>What is the overall timeframe of the use case?</b> <small>Leave at "none" if you don't know the answer.</small>	<input checked="" type="radio"/> None/unknown <input type="radio"/> Less than 1 day <input type="radio"/> 1 to 3 days <input type="radio"/> More than 3 days		
<b>Brief summary</b> <small>Required. This text will also appear in the list of all use cases.</small>	<p>This use case gives a broad overview of the application of a social media technology (Ubermetrics) while a tornado hits the city of Paderborn. The gathering and analysis of information is shown.</p>		

**Source:** Screenshot from the LCC

**Figure 6: Filter Options for Hazard within the Use Cases Library**

Filters ✕

[CLEAR FILTERS](#)

Theme +

Hazard —

[SELECT ALL](#) | [CLEAR ALL](#)

<input type="checkbox"/> Amok	<input type="checkbox"/> COVID-19
<input type="checkbox"/> Earthquake	<input type="checkbox"/> Fire
<input type="checkbox"/> Flooding	<input type="checkbox"/> Fuel supply disruption
<input type="checkbox"/> Homicide	<input type="checkbox"/> Landslide
<input type="checkbox"/> Major fire	<input type="checkbox"/> Pandemic
<input type="checkbox"/> Police Work in General	<input type="checkbox"/> Storm
<input type="checkbox"/> Terror	<input type="checkbox"/> Terrorism
<input type="checkbox"/> Tornado	<input type="checkbox"/> War

Category +

Scale +

Thematic +

Disaster Management Phase +

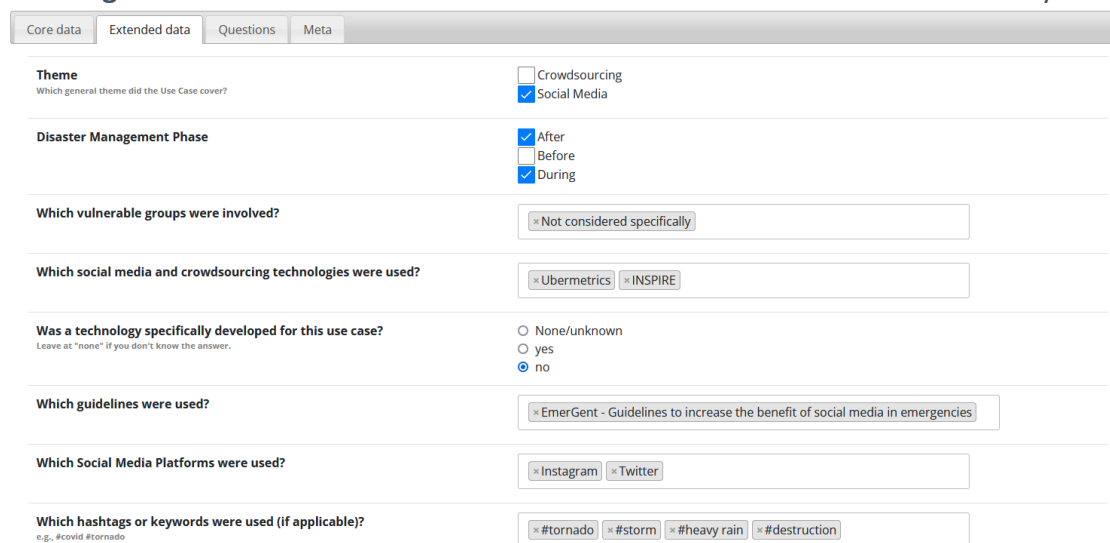
**Source:** Screenshot from the LCC

The second field group is “Extended Data”, which can be seen in Figure 7. This group also provides factual data but goes beyond basic facts and focuses on contextualizing the use case from the perspective of other LINKS products. It consists of eight fields:

1. **Theme** field indicates whether the use case focuses on crowdsourcing or social media.
2. **Disaster Management Phase** indicates whether the use case focuses on the “before”, “during” or “after” phase of a disaster. Multiple phases are selectable.
3. **Vulnerable groups** field offers the opportunity to indicate which vulnerable population groups were involved. This field functions similarly to the “Hazard” field and offers both a predefined selection via a drop-down and the possibility to enter a new value which will then become selectable in the corresponding filter.
4. To interlink technologies with use cases, the user has the opportunity to type in any known **social media and crowdsourcing technologies** that were used in the corresponding field.
5. Should there be any technologies involved, contributors can state whether they were **specifically developed for this use case**.
6. Similarly, the user has the opportunity to select or type in any **guidelines** that were known to have been followed.
7. If any specific **social media platforms** have been used, the contributor can indicate this as well to interlink the use case with them.
8. Finally, any known **hashtags or keywords** used for data analysis can be given.

As can be seen, the fields of this group attempt to create semantic connections between a single use case (and by extension the Use Case Library itself) and other parts and products of the LINKS Community Center. This will allow the user to quickly navigate the product landscape to find relevant information while the overall high level of interconnection supports the holistic approach to the use of SMCS in disasters.

**Figure 7:** Extended Data of the Contribution Form for the Use Cases Library



Source: Screenshot from the LCC



The third field group is “Questions” (cf. Figure 8). It focuses on the deeper analysis of the use case and consists of six fields or questions that aim to provide in-depth or additional information that might not be automatically processable, but offers added value to the user nonetheless. The fields are as follows:

1. In the **Description** field, the user can provide a longer and more detailed description of the use case compared to the brief summary. As presented in the “Tornado in Paderborn” example, this field should contain accounts of all relevant events and developments to provide the user a clear and concise overall picture.
2. Next, the contributor can describe the **overall goal of the use case** to foster a deeper understanding of the aims that the use case tried to achieve.
3. The use case should also fall under one of the thematics defined in the User Guidance as it would make the use case discoverable for other users via the User Guidance page. For that, the user must identify and select any appropriate **thematics that are closest to the goal of the use case**. For more information on User Guidance refer to Section 0.
4. The **limitations** field should contain information on challenges and potentials for improvement that were identified in the use case.
5. Conversely, particularly successful aspects of the use case that can be recommended further can be put into the **recommendations** field.
6. Finally, the **Links for further reading** field provides links to any additional and supplementary information that the user might be interested in, such as relevant articles, videos, social media posts etc. This field can also be used to store links to sources.

The fields of this group make up the bulk of the reading text on the use case’s profile. Unlike other groups, these fields are mainly intended for a human reader rather than for automated processing and can offer personal and subjective insights and analyses. The only exception to this is the thematics field which enables the User Guidance functionality and is therefore mandatory.

**Figure 8: Questions of the Contribution Form for the Use Cases Library**

Core data	Extended data	Questions	Meta
<p><b>Description</b> If you would like to extend the brief summary, you can do so here.</p>		<p>On the 20th of May 2022, a tornado cut a swath of devastation from west to east across the city over a width of 300 meters. Throughout the district, roofs were torn off, metal insulation and other materials flew for kilometers, the fire department said. Severe damage was reported, over 1000 trees were uprooted, many buildings and cars destroyed. Public transport, including railroads, was severely affected. Overall, 43 people were injured, 13 of them seriously.</p> <p>As usual for such events, citizens produced a lot of information (texts, pictures and videos) and provided on different social media platforms. From the development of a research project with the safety innovation center as the coordinator, the fire department of Paderborn is using INSPIRE for the monitoring and analysis of social media information.</p> <p>The gathered information granted the fire department helpful insights in the management of operations.</p>	
<p><b>What was the overall goal of the Use Case?</b></p>		<p>Gather and filter an overwhelming amount of information when a disaster or crisis-related emergency occurs.</p>	
<p><b>Which thematics are closest to the goal of the Use Case?</b></p>		<p><input checked="" type="checkbox"/> Collecting and Analysing Information from SMCS  <input type="checkbox"/> Ensuring Credible Information  <input type="checkbox"/> Making Information Accessible  <input type="checkbox"/> Mobilising Citizens  <input type="checkbox"/> Mobilising Volunteers  <input type="checkbox"/> Targeting Communication</p>	
<p><b>What limitations were identified?</b> e.g., regulatory hurdles</p>		<p></p>	
<p><b>What worked well and could be recommended to others?</b></p>		<p></p>	
<p><b>Links for further reading</b> Important tweets, sources, articles, photos, videos, etc.</p>		<p>× <a href="https://www.iamexpat.de/expat-info/german-expat-news/tornado-strikes-german-city-paderborn-leaving-">https://www.iamexpat.de/expat-info/german-expat-news/tornado-strikes-german-city-paderborn-leaving-</a>  × <a href="https://edition.cnn.com/2022/05/20/europe/paderborn-germany-tornado/index.html">https://edition.cnn.com/2022/05/20/europe/paderborn-germany-tornado/index.html</a> × <a href="https://www.you">https://www.you</a>  × <a href="https://www.youtube.com/watch?v=luornMt9ie0">https://www.youtube.com/watch?v=luornMt9ie0</a></p>	

**Source:** Screenshot from the LCC

The last group is “Meta” which consists of two fields: “Entry created at” and “Entry reviewed at”. These fields are part of the envisioned quality assurance process and should help end users and reviewers identify outdated use cases. As such, these fields are not connected to the content of the use case directly, but rather on a meta-level.

Overall, the implementation of the use case contribution form has led to a significant expansion of the Use Cases Library, prompted enhancements to the filter options, and underlined the importance of collecting further use cases. During the development of the questions and fields for the form based on the feedback from case assessment activities, new insights were gained on how users interact with the library, what they expect, or find difficult or intuitive. These insights will guide the next steps in the project towards increased usefulness of all products and improved user experience.

The Use Cases Library holds the highest demand for content contributions, as it uniquely focuses on providing practical examples shared directly by stakeholders, aligning with the community-driven concept. Furthermore, since a single use case can be linked to both technologies and guidelines, it increases the overall interconnectivity of products, thereby strengthening the envisioned holistic approach. Thus, an easy-to-use and intuitive way to contribute new use cases achieved by the introduction of the contribution form is an important step towards the overall project goal as it encourages users to bring in more content. To incentivise even more contributions in the future, this approach will be extended and applied to other libraries as well.

### 3.2.2 Content Enrichment

In the course of the second case assessment, additional use cases were collected by the project consortium and external partners, thus increasing the total number of use cases from 8 to 24. This entails not just a rise in the volume of accessible data, but also a broadening of the range of topics addressed and disaster situations taken into account. The following examples are intended to give an impression of the inspiring potential of SMCS use and thus provide the basis for a community-driven exchange of knowledge.

The use case focuses on a regional government in Japan that utilized a Twitter-based AI Disaster Risk Management Solution during a flooding and landslide disaster in 2020. The objective was to confirm the extent of the damage and provide contact information for multiple rescues. The solution collected and analysed information from social media, ensuring credible and accessible information for mobilizing citizens and targeting communication. The case highlighted the successful use of the AI solution by officials from Oita Prefecture, who found a post from isolated residents requesting help. The government responded via Twitter, providing contact information for the disaster headquarters, which led to the dispatch of rescue officials and ensuring the safety of the affected residents.

The limitations identified include the reliance on forecast information and the potential for sudden landslides without prior anomalies. It is crucial to interpret forecast information accurately and leverage the latest technology to estimate risks and damages. The use of social media and AI solutions, although effective, does not replace the need for careful interpretation of forecast data.

Twitter was the main social media platform utilized in this use case, and Twitter Analytics was used for data collection and analysis.

In April 2017, a terrorist attack occurred in central Stockholm, where a hijacked truck was driven into crowds, resulting in five deaths and 14 serious injuries. The attack was the first major terrorist

incident of its kind in Sweden. Following the attack, the city center was locked down, and social media, particularly Twitter, played a significant role in disseminating information and coordinating support efforts.

The use of social media had both positive and negative impacts. On the negative side, graphic images of the attack were widely accessible, and Facebook faced criticism for not promptly removing these images. Rumors of additional shootings spread, fueled by circulating images of the security operation. Far-right groups also exploited the incident to spread misinformation and fake news.

On the positive side, Stockholmers used social media, especially Twitter, to mobilize support for the affected individuals and coordinate various efforts. The hashtag #openstockholm emerged, similar to hashtags used during previous attacks in other cities. It quickly gained traction and facilitated engagement and mobilization. People used the hashtag to indicate safe places, share information about transportation, childcare, food availability, and provide updates on the situation. The hashtag was widely used, with thousands of tweets and retweets in the days following the attack.

However, some limitations were identified. The crowd-enabled actions were primarily initiated by local people rather than the authorities responsible for crisis management. Official engagement with the hashtag was relatively passive, missing an opportunity to leverage the mobilization effectively. Additionally, as political debates on immigration and government operations unfolded, the hashtag was hijacked by accounts promoting islamophobia and anti-immigrant views. This shift demonstrated how functional crowd dynamics can quickly turn dysfunctional, highlighting the role of social media in shaping public discourse and the potential for collective expressions to transform into hate.

In 2022, a large fire broke out in an apartment building in Vanløse, Copenhagen, resulting in the evacuation of 200-300 residents and the complete destruction of the building. The goal of the use case was to ensure the safe evacuation of affected citizens and provide them with accurate information about the incident and their situation via social media.

During the incident, a citizen reported the fire, and emergency services used live streaming to monitor the situation. An SMS alert was sent to citizens, allowing them to follow the fire's development via their phones. All residents were evacuated to an evacuation center established by the Greater Copenhagen Fire Department. Personal contact with the residents at the center was effective, and special considerations were given to residents with specific needs.

Rehousing, social support, and insurance assistance were provided to the affected residents. Some limitations were identified, such as difficulty in contacting residents with relevant information and constraints on the fire department's internal communication resources. Twitter was the social media platform used during the incident, and hashtags like #HBR and #Grøndalsparkvej were used to discuss the event.

The project "Volunteers for Education" was initiated in response to the educational crisis caused by the Covid-19 pandemic. Its main objective was to support the learning and motivation of children between the ages of 9 and 17. The project involved trained volunteers who were matched with one or more children for online study support. The project emphasized collaboration with schools and

worked in coordination with families and schools to provide personalized study assistance to children. A central team of professional educators supervised the volunteers' commitment to study support.

Save the Children successfully recruited and trained 2,360 volunteers, with approximately 1,600 volunteers being activated within a year to reach 3,100 students. For that purpose Facebook, Instagram, LinkedIn, Twitter, and WhatsApp were utilized to recruit the volunteers and reach out to the students. The support focused on various subjects, such as humanities, scientific subjects, L2 Italian, foreign languages, preparation for middle school, and homework support during the summer. The objectives of the support varied, including strengthening basic skills, motivating students to learn, and addressing gaps in specific areas. The project also provided tablets to children who didn't have access to one.

The project's online approach was considered innovative and had several advantages. It allowed for a significant impact during the lockdown period, enabling connectivity despite physical distances. The online platform facilitated the relationship between students and volunteers, even across different geographical locations. It also proved beneficial for students with special educational needs, as the digital environment supported their learning. Additionally, for children facing social anxiety, the online setting was perceived as safer.

Some limitations were identified during the project. One challenge was the disengagement of volunteers once the emergency period was over. To address this, it was crucial to plan and maintain periodic engagement strategies to ensure their availability for future emergencies. Another limitation was the need for increased control and reporting mechanisms as the project scaled up and volunteers interacted directly with beneficiaries, ensuring the safety of the program.

### 3.3 User Guidance in the LINKS Framework

The LINKS Framework has been developed within WP5 with the objective of providing guidance to interested users in the LCC. It aims to assist in navigating through the available products and finding the most relevant ones for the needs. The LINKS Framework achieves this by presenting a set of targeted questions that users guide to relevant content. By leveraging the LINKS Framework, users can make more informed decisions and improve their utilization of the resources provided by the LCC, ultimately enhancing their effectiveness in addressing various challenges and scenarios. The application of the Framework is practically described by user stories in D5.4 and D5.5.

The development of the LINKS Framework was carried out in three iterations. The first iteration was to gather inputs from the knowledge bases, structure them into themes and sub-themes and identify interconnections between them (cf. D5.3). In a second iteration, the learning paths for each of the sub-theme were defined and in collaboration with the knowledge bases, an evaluation approach for the Framework was designed (cf. D2.7 and D5.4). In the third iteration, the learning paths were revised and simplified into a user guidance approach (cf. D5.5). In each of these interactions the product owners participated and in the last two interactions matching exercises were carried out more than once. The aim was to identify and analyse which theme, sub-theme and question the Technologies and Use Cases Library could contribute answers to with their content.

The way in which the content of the libraries is assigned to the questions of the Framework is done via a suitable selection of the respective categories (technically in the LCC via preselected filter criteria). As an example, the Technologies Library provides a selection of technologies that fulfil the functional scope "Search & Monitor" or "Analysis" in response to the questions<sup>11</sup> "How can you search and monitor information?" or "How can you carry out content analysis?". In this way, the user is guided directly to a selection of technologies that cover the needs expressed by the questions. The practical usage of the LINKS Framework with the Technologies Library as a product have been already described in D5.4 (cf. Section 2.2.1) as a user story narrative from the Danish case and Federation of European fire officers (FEU) (cf. Section 4.4).

Concerning the integration of the Use Cases Library within the user guidance a more holistic approach was taken. We included a thematic category consistent with the sub-themes of the Framework (shown in Figure 9).

**Figure 9:** Thematics of the Use Cases Library

- Which thematics are closest to the goal of the Use Case?**
- Collecting and Analysing Information from SMCS
  - Ensuring Credible Information
  - Making Information Accessible
  - Mobilising Citizens
  - Mobilising Volunteers
  - Targeting Communication

**Source:** LINKS Community Center

Due to the opportunity to contribute own experiences in dealing with SMCS in disasters to the Use Cases Library, the Use Cases Library has the potential to cover all topics of user guidance. By selecting one or more thematics within the contribution of a use case, the use case is assigned to the sub-theme of the user guidance. If a sub-theme is now selected in the user guidance, all use cases relevant to the sub-theme are made available to the user due to the similarity of the content.

<sup>11</sup> The questions of the framework were last updated in the third iteration in May 2023. The final version can be found in D5.5.

## 4. ACTIVITIES WITHIN THE SECOND CASE ASSESSMENT

In this section, the activities of the second case assessment, which have an influence on the development of the Technologies and Use Cases Library, are presented and explained. The methodology was developed in D2.7 and a summary and overview of the implemented activities is given in Section 2.2.

### 4.1 Desk Research

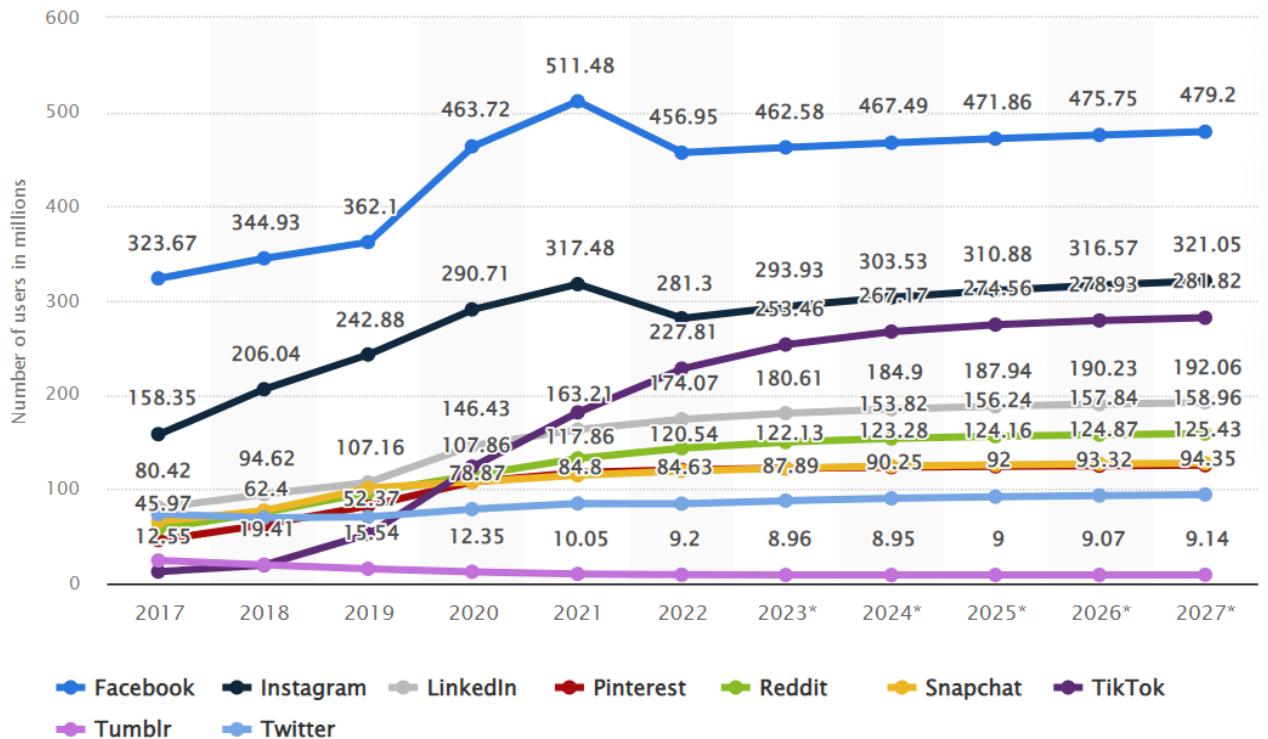
Desk research has been an integral part of the WP from the beginning, involving literature reviews, knowledge base establishment, and continuous product development based on acquired knowledge (cf. D4.1, D4.2 and D2.7). It serves as the foundation for populating and shaping the LINKS Libraries with systematic analysis of various sources. Accordingly, desk research remains an ongoing activity. It involves several components, including the continuation of business market analysis to explore SMCS technologies. This analysis examines various sources such as existing market analyses, scientific contributions, market comparisons, conference proceedings, scientific papers, related projects and expert magazines from the field of civil protection (e.g. Crisis Prevention<sup>12</sup>) to discover new technologies. Another aspect of our desk research is the identification of information to fill existing categories within the data structure of the LCC. This is primarily done through the providers' websites, although the depth and scope of information available freely vary. Additionally, we continuously monitor the current social media and crowdsourcing (SMCS) landscape such as emergence of new social media platforms or obsolescence of existing networks. Current trends, important events and usage figures are further areas of interest<sup>13</sup>. Based on our findings, we continuously adjust the relevant elements of the LINKS Community Center (LCC), for example, by including new platforms in the “Platforms” filter. Another example would be putting four most populous platforms in a special group that always appears before others when selecting a social media platform in the technology filter.

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<sup>12</sup> <https://crisis-prevention.de/>

<sup>13</sup> There are numerous opportunities to learn about social media and crowdsourcing trends and activities. The best known are <http://www.statista.com> and <https://datareportal.com/>

**Figure 10: Number of users of selected social media platforms in Europe from 2017 to 2027, by platform**



Source: (Statista, 2023)

It's important to note that social media landscape is dynamic, and the figures and developments can change rapidly. Figure 10 shows the development of user numbers in Europe since 2017 with forecast until 2027. What stands out is that the TikTok social media platform has grown significantly in Europe over the course of the project. The platform's emphasis on short-form videos, often set to music, has resonated with users, particularly younger generations who enjoy its fast-paced and visually appealing content. Consequently, the content and filters of the LCC and the associated research work are also adapted to such developments and trends are monitored.

## 4.2 Product Task Forces and Workshops

Task forces were established for each product in the project to drive forward the targeted development of the product. In addition to the product owner, these task forces are made up of several partners who can contribute content based on their background and are interested in the practical use of the product. As product owner of the Technologies and Use Cases Library, WP4 leads the respective task forces and participates in the Guidelines Library Task Force.

### 4.2.1 SMCS Technologies Library

The ongoing activity of feedback and testing with different stakeholders of the Technologies Library in the LCC plays a crucial role in enhancing the library's overall quality. By conducting continuous



tests on the content, usability, and intelligibility of filters, the library can be continually improved to better meet the needs and expectations of its users.

The testing process involves a thorough examination of the technologies, including their descriptions, functionalities, and corresponding use cases. This helps to ensure that the content is accurate, up-to-date, and relevant. Additionally, the usability of the library is also evaluated, considering factors such as navigation, search functionality, and user experience. By analyzing these elements, potential areas of improvement can be identified and addressed to make the library more user-friendly and accessible.

The quality of filters is also a key component of the testing process. This involves analyzing the effectiveness of the filters in helping users to find the information quickly and easily they need. By assessing the clarity and relevance of the filters, the library can be optimized to help users efficiently navigate through the available technologies and locate the ones that are most relevant to their needs.

The following improvements were achieved in close cooperation with WP7 for the Technologies Library:

- Graphical updates and presentation of the library,
- continuous improvement and revision of explanatory texts to improve intelligibility/user friendliness,
- completion of several technology profiles,
- adding and analysis of new technologies,
- and improved filter logic<sup>14</sup>.

#### 4.2.2 SMCS Use Cases Library

In addition to the activities described in the task forces of the Technologies Library (cf. Section 3.2.1), a contribution form for the contribution of use cases and the example use case "Tornado in Paderborn" were developed in the task force and workshops on the Use Cases Library.

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<sup>14</sup> Feedback from several activities expressed that the libraries produce too many results for the searches. This is due to the growth of the content in combination with the OR logic of the filters. The OR-filter logic is a method of filtering data in which results can be found if at least one condition is met. The biggest advantage of OR-filter logic is that there is a higher likelihood of finding relevant results as conditions can be combined. This means that OR-filter logic overall has fewer restrictions and provides a larger number of results. The biggest disadvantage of OR-filter logic is that it may provide too many irrelevant results as not all conditions need to be met. For this reason, the filter logic was changed to the AND-filter logic, in which results are only found if all conditions are met. The biggest advantage of AND-filter logic is that it provides more accurate results as all conditions need to be met to be considered relevant. This means users will spend less time sorting out irrelevant results and can be more specific about what they are searching for. Another advantage of AND-filter logic is that it is more precise than OR-filter logic as it combines a larger number of conditions to find relevant results.

The **contribution form** (explained in more detail in Section 3.2.1) for the Use Cases Library in the LCC was developed and implemented after a series of workshops and discussions. The form enables first consortium members, and then in a second step interested external stakeholder, to independently contribute their own use cases to the library, promoting collaboration and knowledge-sharing within the consortium. By establishing a standardized process for submitting and reviewing use cases, the quality and relevance of the content within the library is increased. The contribution form also encourages the active participation of community members, allowing for a diverse range of use cases from different areas and regions of disaster management to be shared. With the successful implementation of the contribution form, the Use Cases Library is continually evolving and growing to better serve the needs of the LINKS community.

With the development and distribution of the contribution form for the Use Cases Library within the consortium, the constant possibility was created to directly enrich the LCC with Use Cases. To provide inspiration for other organisations within the consortium to contribute use cases as well, the **example use case “Tornado in Paderborn”** was developed. Local practitioners were involved in demonstrating the types of valuable information social media can provide in disaster management and what type of information a use case should include.

In general, it is also important to ensure that the content meets the standards and provides sufficient applicable information. After extensive discussions, plans for a quality assurance concept were drawn up as a result of the development of the Contribution Form.

The example use case demonstrates the concept of the product for externals and facilitates the contribution of further use cases by others. Furthermore, the interests of technology providers are addressed as they can integrate the use of their technology in a use case and directly hyperlink the pages.

#### 4.2.3 SMCS Guidelines Library

Another important activity is the participation in the task force and workshops for the Guidelines Library. The three LINKS Libraries operate as a tightly integrated information model, which is made accessible through the same technical solution (via the LCC) and filtering mechanism. (For more details on the LINKS Library model, see D2.7). Working in similar task forces offers numerous benefits, particularly when it comes to addressing common challenges in terms of usability and feedback. For example, the filter change from AND to OR affects all three libraries. This can lead to a common quality assurance process that ensures that all libraries maintain a high standard of quality and usability.

### 4.3 Site Visit

The project partners from the Danish case: Copenhagen Fire Brigade (HBR), Frederiksberg Municipality (FRB), University College Copenhagen (UCC) and the University of Copenhagen (UCPH)

and from the Dutch case: Sitech Services (ST) and the Zuid-Limburg Security Region (VRZL) visited us for a two-day working meeting in Paderborn. The aim was to discuss the current status of the LINKS Libraries and, in this context, our work in the field of SMCS in cooperation with the Paderborn fire brigade. As already mentioned in section 4.3.3, we are cooperating with the Paderborn fire brigade in the area of social media. Through a national project (INSPIRE<sup>15</sup>), we collect, filter and analyse data from social media for the Paderborn Fire Department for operational use. This component was demonstrated to the project partners during the site visit. This example also allowed us to explain in detail the functionality of SMCS technologies to the partners. This sparked new ideas and initiated the revision of the Technologies, Guidelines, and Use Cases Libraries. Through discussions with participating practitioner organisations, a better understanding of their requirements and objectives was gained, leading to customization of the LINKS products to align with their interests and potential implementations.

The workshop also provided input for improving the usability and understandability of the libraries. Recommendations were made to enhance the applicability of the Technologies Library to meet users' needs and goals. Insights into stakeholders' interests and motivations in social media monitoring led to refinements in categories and tooltips to better accommodate non-technical users. The filter logic of the Technologies Library was adjusted based on expert interviews to provide more intuitive and user-friendly search. In the context of the site visit, FRB's own commitment to establish a social media monitoring was also discussed and advanced. Together with FRB we have chosen a selection of suitable technologies and discussions were held with the IT department of FRB.

Discussions about the Use Cases Library offered valuable feedback on the requirements and goals of participating organisations, as well as insights into stakeholders' interests and motivations for utilizing examples of SMCS applications. This feedback led to refinements in categories and improvements in the intelligibility and usability of the Use Cases Library. We were also able to discuss the draft of the use case "Tornado in Paderborn" and optimise it for implementation. Overall, the site visit contributed to the ongoing development and customization of the LINKS Libraries and the foundation was laid for the subsequent pilot-tests (cf. Section 4.5) of the libraries and the procedure for this was agreed.

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<sup>15</sup> INSPIRE contributes to the networking of innovative technologies for civil security. Existing solutions and potential new developments are accessible and combined in one platform. The subprojects Social Media, Smart Home/Building, UAVs and Personal Flow Measurement provide examples: <https://www.inspireprojekt.de/en/>

## 4.4 Expert Validation

As described in D2.7 an important role in the further development were the expert interviews<sup>16</sup> to validate the status of the products with relevant representatives. The goal was to leverage the expertise of the interviewees for the validation of the SMCS Technologies and Use Cases Library. For this purpose, business providers, i.e. suppliers of SMCS technologies, civil society networks and practitioners were interviewed.

### 4.4.1 Business Providers

In WP4, collaborations with SMCS technology providers are an important part of the research activities. While a longer cooperation with Ubermetrics<sup>17</sup> already exists (cf. D2.7), a cooperation with PublicSonar<sup>18</sup> was also initiated. In the second case assessment, the cooperation was expanded to include expert validations. Both companies<sup>19</sup> offer technologies with a wide range of technical features that empower users to effectively work with data from social media during crisis situations and events. By employing identification, filtering, and analysis techniques on public social media data, the respective technologies enable the utilization of valuable information from individuals affected by a crisis, benefiting disaster management organisations. After the live demonstration, the different functions, especially the sub-functions of the categories "Search & Monitor" and "Analysis" were shown and discussed in detail in a subsequent expert interview. Discussing the scope of performance, potentials and limitations of the sub-functions increased our technical competences and helped to validate these categories within the SCMS Technologies Library. The criteria for when a technology fulfils the respective function and thus receives a positive entry could also be defined more clearly.

Besides the deeper understanding of the functions, the rest of the categories in the Technologies were also discussed and provided valuable insights from the perspective of a crisis-related company. The potential for companies to present themselves in the Technologies Library with updated information as well as to contribute a use case describing the application of the technology was also addressed.

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<sup>16</sup> Based on the purpose of the expert interviews, we consider the description "expert validation" to be methodologically more adequate. Expert validation is used to assess the validity and credibility of research findings, methodologies, or proposed models by seeking the input and evaluation of experts in a specific field or subject area. It is a crucial step in ensuring the quality and reliability of research outcomes.

<sup>17</sup> <https://www.ubermetrics-technologies.com/>

<sup>18</sup> <https://publicsonar.com/>

<sup>19</sup> Ubermetrics and PublicSonar are both companies that specializes in social media monitoring and analytics. They provide advanced tools and solutions for collecting, analyzing, and interpreting data from various social media platforms, online news sources, blogs, forums, and other digital sources.

Both technology providers are also interested in future project activities and would be a suitable candidate for workshops, for example, as they bring in the perspective of the Businesses stakeholder group.

#### 4.4.2 Networks of Civil Society

In February 2023, an expert interview was conducted to gain comprehensive insights into the work and utilization of the technologies used by VOST Portugal<sup>20</sup> (Virtual Operations Support Team). The interview involved engaging with the leader of VOST Europe and VOST Portugal, allowing for a deep dive into their expertise and experiences. The interview provided valuable input for the products development process. VOST showcased different technologies that focus either on engaging with crowd-based platforms or monitoring and analysis of social media content. These innovative technologies have the potential to enhance the capabilities and effectiveness of crowd-based operations.

Furthermore, as a result of the expert interview, VOST Portugal contributed a **use case**, in which the work of VOST Portugal and the application of a crowdsourcing platform is described in a national fuel crisis 2019. VOST Portugal played a significant role in disseminating accurate and timely information regarding the fuel situation and its availability to the general public. They utilized their online presence to crowdsource information and maintain effective communication with the public, thereby keeping them well-informed and minimizing panic and confusion. Additionally, VOST Portugal played a key role in coordinating volunteer efforts and providing support to those affected by the crisis. Through the utilization of digital technologies and social media platforms, VOST Portugal made a crucial contribution in assisting the country in managing the challenges posed by the fuel crisis. This specific use case serves as a practical illustration of how VOST's technologies and methodologies were successfully applied within a specific context, offering valuable insights and demonstrating the tangible impact of their solutions in real-world scenarios.

Overall, the expert interview with VOST Europe and VOST Portugal served as a pivotal step in gathering insights, expanding the technological repertoire, and fostering collaboration within the product development process.

#### 4.4.3 Practitioners

In addition to the interviews, we presented and discussed the products with **local practitioners** from Paderborn. The Paderborn fire department is using the social media monitoring tool Ubermetrics and thus monitors relevant content in social media in the Paderborn area and reports to us about their experiences. These identified needs and requirements are of high importance as practical input for the further development of the libraries: The importance of application examples that describe

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<sup>20</sup> VOST Portugal is the leader of VOST Europe, which is a collaborative network of Virtual Operations Support Teams across Europe. With their specialized knowledge and experience, VOST Portugal actively contributes to the development and implementation of innovative solutions and best practices within the VOST EU network.

the application of technologies, including their benefits and challenges, and the interlinking of technologies with the other two libraries were identified as essential requirements. Within a workshop with Paderborn Police Department, we discussed the impact of having a structured and comparable overview of existing technologies to establish a dedicated social media monitoring team. Therefore, the ideas and requirements here are essential and the filter criteria of the libraries were discussed as assistance to their needs.

All interviews led to valuable discussions on the usability, understandability and filter options of the three Libraries.

#### 4.5 Pilot-Tests

During the months of November and December 2022, an extensive user testing phase took place. The primary objective was to explore the practical implementation of various libraries within participating practitioner organisations and to discuss and enhance their application.

The first pilot-test was carried out by the Municipality of Frederiksberg (FRB) and aims to implement a social media monitoring technology to monitor social sentiments especially on Facebook. FRB as a practitioner partner in the Danish Flooding case specifically addresses risk awareness of flooding and communication processes. Initial assessments and social media analysis highlight the significance of Facebook in Denmark for communication activities, particularly during the preparedness phase. The findings have the potential to facilitate improved communication strategies that are customized to address specific information requirements that may arise during online discussions. Furthermore, they can enhance citizen engagement in both preventive measures and crisis situations.

The second pilot-test was carried out by a member of the Federation of European fire officers (FEU). This member is experienced with technologies in disasters in general and is already monitoring social media manually on a daily basis. He is now seeking technological assistance to streamline his time-consuming work with social media. After experiencing localized vortexes resembling "small tornadoes" during a recent storm in his city, he wants to be better prepared. Also, he wants to avoid being misled by numerous companies and tools claiming to be the best technical solution. He believes there is a lack of an independent website offering detailed analysis of available tools for the disaster management community. As dedicated staff is not feasible, a tool that supports the Fire Service on platforms like Facebook, Twitter, and Instagram is needed. Essential functions include search and monitoring, text analysis, and metric analysis. Accordingly, the pilot-tests revolves around using the filters system of the Technologies Library to compare suitable technologies.

The user testing and hands-on sessions yielded significant insights for improving the libraries' usability, including arguments for the refinement of the filter logic (cf. Section 4.3). Another outcome was the recognition of the importance of disclosing the technology provider and its country of origin.

## 4.6 Application of Technologies

As explained in D2.7, the continuous, testing, and implementation of SMCS technologies are essential components of our ongoing efforts in WP4. Working with SMCS technologies has allowed us to develop a comprehensive understanding of technical requirements, functionalities, and differences between the solutions. To showcase our progress, we have documented the results with the technology Ubermetrics in a use case titled "Tornado in Paderborn," which is accessible within the Use Cases Library. The use case and the application of the technology Ubermetrics happens in direct cooperation with the fire department Paderborn. This allows access to relevant data from social media the advantage of direct feedback on the application of technologies usefulness of the libraries. This use case serves as a tangible demonstration of our active exploration and application of SMCS technologies, showcasing their potential as well as the interconnections between technologies, guidelines and use cases following the idea of the LINKS Libraries.

This use case presents a comprehensive illustration of how the Ubermetrics social media technology was applied during a tornado incident in the city of Paderborn (cf. Figure 11):

Figure 11: Use Case “Tornado in Paderborn”

[VIEW ALL USE CASES](#)

Created: 2022-11-23  
Reviewed: 2022-11-23

## Tornado in Paderborn

This use case gives a broad overview of the application of a social media technology (Ubermetrics) while a tornado hits the city of Paderborn. The gathering and analysis of information is shown.

Hazard: Storm, Tornado
Year: 2022
Location: Paderborn, Germany
Scale: City

**Category**

Real-world

**Theme**

Social Media

**Thematic**

- Collecting and Analysing Information from SMCS

**Disaster Management Phase**

After, During

**Description**

On the 20th of May 2022, a tornado cut a swath of devastation from west to east across the city over a width of 300 meters. Throughout the district, roofs were torn off, metal insulation and other materials flew for kilometers, the fire department said. Severe damage was reported, over 1000 trees were uprooted, many buildings and cars destroyed. Public transport, including railroads, was severely affected. Overall, 43 people were injured, 13 of them seriously. As usual for such events, citizens produced a lot of information (texts, pictures and videos) and provided

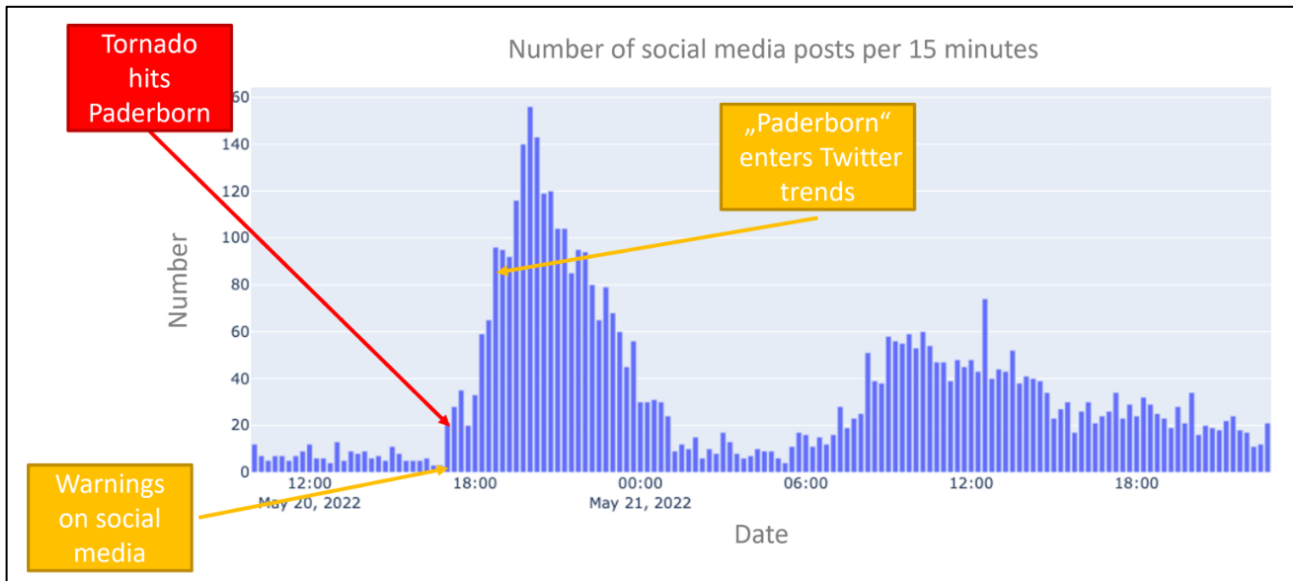
**Source:** WP4

On May 20, 2022, a destructive tornado tore through the city, causing significant damage and disruption. The fire department of Paderborn, in collaboration with the safety innovation center, utilized social media monitoring and analysis related to the tornado. This enabled the fire department to gain valuable insights for effective operational management. The overarching goal of this use case was to efficiently gather and filter a vast amount of information during a disaster or crisis, facilitating effective and coordinated response.

The information collected primarily originated from Twitter, as indicated by Figure 12, the displaying the number of social media posts during the tornado event.



**Figure 12: Twitter Activity before, during and after the Tornado**



Source: WP4

To **enhance situational awareness**, a combination of hashtag and keyword searches can be employed to filter the massive volume of social media posts. By narrowing down the relevant posts, disaster management organisations could gain a clearer understanding of the situation. The fire department of Paderborn, even before arriving at the affected areas, was able to assign social media information to specific operation sites, allowing them to assess the situation and adjust their deployment of resources accordingly.

Furthermore, some SMCS technologies (as Ubermetrics) are able to detect anomalies in observed social networks. This included monitoring the rate of increase in search results over a specific period. If a significant increase was detected compared to the previous hours, the fire department would receive automatic **event notifications**.

More details, screenshots and further links are described in the use case within the LCC: [https://links.communitycenter.eu/index.php/Tornado in Paderborn](https://links.communitycenter.eu/index.php/Tornado%20in%20Paderborn)

By showcasing what and how SMCS technologies can be used in practice, our aim is to empower practitioners to make informed decisions and leverage SMCS technologies for improved situational awareness and response coordination.

As a further result of applying technologies as well as working through the use cases, connections are made. 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. 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.

## 4.7 Validation through Dissemination & Exploitation

The participation in several dissemination and exploitation events is crucial for the validation of the Technologies and Use Cases Library as these events provide an opportunity to receive feedback and validation from experts and stakeholders in the field. Through presentations, demonstrations, discussions, and networking, we can engage with a diverse range of perspectives and expertise. This feedback helps to validate the research methods and products, ensuring the robustness and reliability. Also it is key to identify potential areas of improvement. By disseminating the libraries, the LCC gains visibility and exposure within the disaster management community. This visibility not only helps to establish the project's credibility but also fosters collaboration opportunities and potential partnerships for deeper collaborations on the products.

### 4.7.1 Research for Civil Protection-Congress 2023 by the Federal Office of Civil Protection and Disaster Assistance

In January 2023, the Technologies Library within the LCC was showcased and discussed at the Federal Office of Civil Protection and Disaster Assistance (BBK) expert congress called "Research for Civil Protection." The primary objective of this activity was to gather valuable input and feedback to validate the library. The congress, organised by the served as a platform to bring together scientists from diverse disciplines involved in civil protection.

During the presentation, the Technologies Library received insightful feedback. The discussions at the congress also facilitated significant connections with other national projects. For example, cooperation was initiated with a national project that also described different social media monitoring and analysis technologies with a set of criteria. This collaboration opened doors for potential future partnerships and knowledge exchange in the field.

Consequently, the input obtained from the congress had both immediate and strategic implications. In the short term, the insights from the national project were utilized to enhance the existing entries in the Technologies Library. The profile pages of specific technologies were improved to offer a more valuable resource to users.

Moreover, the input received during the congress had strategic implications. It generated new opportunities and ideas for promoting the LCC. Based on suggestions at the BBK expert congress, another strategic implication to be discussed could be to look more closely at SMCS use in the everyday routine of organisations.

#### 4.7.2 EENA-Conference 2023

We presented and discussed the LINKS Libraries and the format in the LCC at the LINKS booth within the EENA<sup>21</sup> Conference 2023. The European Emergency Number Association (EENA) is a non-governmental organisation that aims to achieve better international networking of emergency call handling agencies in Europe in order to increase people's safety. The audience of the EENA conference consists of representatives from control centers, policy makers, disaster management organisations (fire brigades, police, rescue services, aid organisations) as well as technology providers and researchers across the field of public safety. The different groups are united by the common goal of innovative benefit solutions in the field of SMCS (e.g. the integration of social media data into decision-making in control centers). For this goal, we offer different approaches and support with the respective libraries, which have been critically validated with regard to their benefits. The need for the libraries and its successful implementation within the LCC received positive evaluations, reinforcing the recognition of the work accomplished thus far as a valuable and indispensable resource. Furthermore, there were some requests from different stakeholders to present their technical solutions or practical applications in our library. For example, the discussion arose to include social media components from control center software in our libraries. Accessibility, however, offers a contrary argument. Further discussions are needed here.

Also, discussions arose with representatives of the app LastQuake<sup>22</sup>, which was developed by seismologists and is the official app of the Euro-Mediterranean Seismological Center (EMSC) and is using participatory action of its users to estimate earthquake effects and notify the population. LastQuake serves as a good example of crowdsourcing platforms to increase the security of citizens and provides a good starting point for LINKS to describe and analyse crowdsourcing.

#### 4.7.3 Annual Conference 2023 of the Association for the Promotion of German Fire Protection

In May 2023, we discussed the SMCS Technologies Library at the 69th annual conference of the vfdb (Association for the Promotion of German Fire Protection e.V.) in Münster. In the joint expert session "Social media in crisis prevention", moderated by our project partner FEU (Federation of European fire officers), the topic was considered from different perspectives. First, FEU presented a procedure for setting up a social media team in a municipal fire brigade. Then we presented the SMCS Technologies Library within the LCC. This was followed by a presentation on VOST Germany and its work. By involving the audience, it was possible to gather the opinions of practitioners in Germany. For example, we asked if the organisations in the audience are utilizing information from social media to assess the situation in emergencies or disaster situation (cf. Figure 13) or if technologies are used to this end.

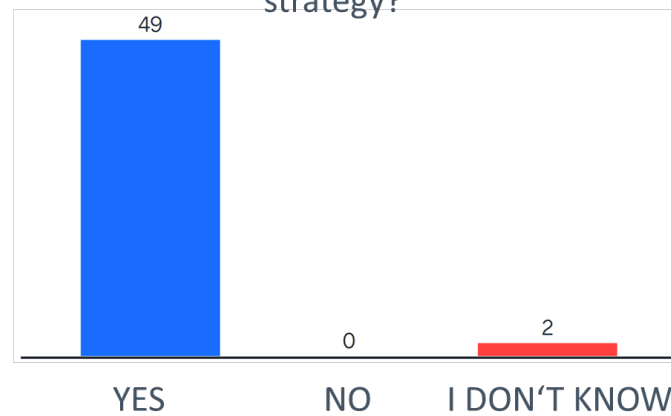
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<sup>21</sup> <https://eena.org/events/eena-events/eena-conference-exhibition-2023/>

<sup>22</sup> <https://m.emsc.eu>

**Figure 13:** Question about the Attitude towards Social Media as Part of Crisis Communication

Do you think social media should be incorporated into disaster management organizations' communications strategy?



Source: WP4

The clear agreement from the audience confirms that social media is understood as an integral part of modern crisis communication. This confirms the need for the products developed in LINKS to support organisations in the introduction and implementation of social media. Namely, the Use Cases Library provides inspiring examples of the benefits of an effective social media strategy while the Guidelines Library sets the strategic framework. The Technology Library then helps in the next step to select a suitable technology.

#### 4.7.4 KI-CoP ENGAGE

In December 2022, we participated in the second Knowledge & Innovation - Community of Practice (KI-CoP<sup>23</sup>) workshop organised by the sister project ENGAGE. The workshop aimed to strengthen the collaboration established during the first workshop, which took place at the EENA conference in 2022. ENGAGE, like LINKS, focuses on building knowledge through the collection and analysis of information related to broader solutions in disaster risk management. ENGAGE is also developing a knowledge management platform<sup>24</sup> (“catalogue of solutions”) to present the gathered solutions and information about it. The workshop had a significant impact on understanding the disparities and commonalities between the catalogue of solutions and the LCC, by differentiating their respective libraries and exploring opportunities for further cooperation. The workshop also generated ideas

<sup>23</sup> The Knowledge & Innovation - Community of Practice (KI-CoP) is a collaborative network comprising practitioners, NGOs, Virtual Operations Support Teams, scientists, researchers, and representatives of citizens. These stakeholders actively participate in ENGAGE as users and co-owners of its solutions. The involvement of KI-CoP in ENGAGE's activities guarantees the validation and transferability of solutions, guidelines, and methods across various risk and disaster scenarios. By bringing together diverse expertise and perspectives, the KI-CoP strengthens the reliability and applicability of ENGAGE's offerings, ensuring they can effectively address different challenges and contexts.

<sup>24</sup> <https://engageknowledgeplatform.eu/>

for conceptual planning and demarcation, such as linking similar solutions e.g. on a profile page of a technology.

Overall, the participation in the KI-COP serves as a major contribution to enhancing collaboration between ENGAGE and the LCC. It facilitated a deeper understanding of each platform's strengths and opportunities for synergy, enabling the exploration of potential joint initiatives and knowledge sharing. The insights gained from the workshop will inform the development and improvement of both projects, ultimately enhancing their effectiveness in supporting disaster risk management.

#### 4.8 3rd LINKS Advisory Committee

In February 2023, the third LAC was organised by VU and the product owners. The LAC consists of selected experts from different type of stakeholder who are familiar with the project. Most members have already participated in the second LAC meeting in February 2022 (reported in D8.5), which was about receiving feedback on the usefulness of the categorisation of the Technologies Library, the Guidelines Library and the structure and layout of the LCC including the area “Networks”.

Based on the progress of the different products, a concept for the third LAC was developed together with VU and FEU. For WP4, the focus was on validating the Technologies Library and testing and providing feedback on the Use Cases Library. In preparatory workshops, key areas for the LAC were identified and participants, their competencies and the comments already made at the second LAC meeting were analysed. Drawing on this, a questionnaire was developed in an interactive process, which contained 2 or 3 questions for each of the participating products as well as for the LCC itself. The overall goal was to validate the products and the LCC, which specifically means:

- Evaluate the overall design of the libraries and the LCC,
- perform a practitioner-oriented task by searching for relevant information in the libraries,
- define expectations for the libraries that go beyond the current state,
- deliver ideas to enrich the content with similar knowledge resources or initiatives,
- enrich the strategy with ideas to make the LCC and its products sustainable beyond the finalization of LINKS,
- and assess the applicability of the products in different contexts.

The challenge in developing the questionnaire and defining the objectives was, of course, to keep the time required by the participants for answering and preparing the questions within acceptable limits. However, the formulation in predefined questions enabled a structured collection and processing of the feedback for an effective further development of the project.

Based on the answers provided by the participants in advance and their prior knowledge of the products, it was possible to steer an in-depth discussion during the meeting. 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. The detailed report on the 3rd LAC Meeting Committee will be available in D8.6 (Final LINKS Community Workshops and LINKS Advisory Committee report, November 2023). The following statements are worth highlighting in relation to the Technologies and Use Cases Library:

- “Would be great, if there can be included some evidence (e.g. practice reports) where the tools, which are flagged by “used by practitioner”, have been used.”
- “I'd like to have a more granular filtering option (some sections don't have filtering option for their sub-topics).”
- “Add more information about the concrete usage of the technology (e.g. if the technology can be used online, downloaded and in case what is required (basic requirements).”
- “Advice on learning and limitation: Try to create some sort of success criteria of the Use Case.”
- “An information about how many resources were needed for the activities in the use case would be helpful.”

The individual statements offer exciting starting points for further work in the project and beyond. Some of the suggestions have already been directly taken into account and have contributed to an improvement of the products, as described in Section 3. For example, an extension of the category “used by practitioners” was designed to provide evidence. Information on how the technology can be used operationally was also included in the data model of the Technologies Library (cf. Section 3.1).

## 5. FUTURE PLANS OF THE KNOWLEDGE BASE

The future plans of the knowledge base of WP4 encompass the continuation of the strategic roadmap and goals set in the past deliverables (D2.7, D4.2, D4.1). These plans outline the objectives that will guide the knowledge base's quality, completeness, and relevance in the area of disaster management in Europe.

Until the end of the project, efforts will be focused on validation and distribution of the SMCS Technologies Library and Use Cases Library, enriching its content, and improving its user experience. This includes further cooperation with practitioner organisations, further testing and incorporating user feedback to improve accessibility and usefulness. The aim is to ensure that the knowledge base with its products remains a valuable resource for practitioners, researchers, businesses, and individuals seeking reliable and comprehensive information about SMCS in disasters.

Looking ahead, the long-term vision for the knowledge base involves the sustained growth of the libraries, adaptability, and continued relevance in an ever-evolving landscape. This approach is possible by building and maintaining an online community that uses the LINKS Community Center (LCC) as a platform for exchange and communication. Furthermore, the content and structure of the libraries should be preserved after the end of the project, which can be made possible through cooperation with other knowledge platforms or continuation in targeted research projects. With the long-term vision in mind, the knowledge base seeks to stay as a dynamic resource that empowers stakeholders and fosters collaboration.

### 5.1 Until the End of the Project

In the following, we describe the activities that are currently considered to be promising for advancing the WP4 Knowledge Base (and thus also the SMCS Technologies and Use Cases Library) within the scope of the project duration.

As stated already in D2.7 and confirmed in the second case assessment, SMCS technologies are currently often underused in DMOs and many practitioners have little to no experience on how to apply these technologies in an efficient way in disaster management processes. This suggests the necessity to enhance the interconnectivity among the libraries, as all three libraries play a crucial role in addressing the knowledge gaps identified and serving as a suitable entry point to the application of SMCS. To achieve this goal, **further cooperation** with practitioner organisations within the consortium and existing contacts with DMOs, including those established and continued during the case assessments, will be used. This entails ongoing enhancements to the contribution form, as well as active engagement in dissemination and exploitation activities within the LINKS community. Our aim is to persuade interested individuals and organisations to share their valuable experiences, thereby enriching the repository of knowledge and fostering a collaborative environment. Further

dissemination of the Technologies and Use Cases Library will also increase the visibility and awareness and expand the community.

Further cooperation with practitioner organisations will also be developed and deepened at the next LINKS Advisory Committee (**LAC**) **meeting** in Rotterdam. In June 2023, a two-day joint advisory board meeting will be held together with the advisory board of the sister project ENGAGE<sup>24</sup>, where, among other things, the LINKS Libraries will be further discussed and validated.

Another planned opportunity for the validation and further development of the LINKS Libraries and the presentation within the LCC is the **annual meeting** of the project, which will take place in July in Osnabrück in Germany. Within the two-day consortium meeting we are planning a workshop to collaborate intensively on the user-friendliness and accessibility of the libraries. The idea is to co-design useful highlights from the respective libraries to embed them as entry points in the LCC. Overall, this will help users quickly assess whether the content is relevant to their needs before clicking through to the platform.

**Businesses** have the motivation to present their product convincingly with up-to-date and accurate information in the Technologies Library. The incentive to present their product in a practical way through a use case has also been confirmed several times. This initiative also supports our efforts to expand the links between the libraries. For this reason, business providers developing SMCS technologies will also be continued to be directly engaged (i.e., through bilateral workshops). Furthermore, the current idea is to offer the possibility of becoming a “Premium Contributor” once the businesses have validated the description of their solutions in the Technologies Library. This will serve to highlight the proofed content and topicality of the profile page. This also includes giving the user more insight into the described solution within the LCC by adding meaningful images to the profile page, e.g. of the user interface (in terms of copyright issues). Moreover, we also identified the added value in identifying which technologies offer free or reduced versions for e.g. non-profit organisations, authorities, or research organisation. The possible integration in the schema will be further elaborated.

In order to maximize the impact and value of the research efforts, we will continue to work on effectively disseminating the SMCS Technologies and Use Cases Library. Ensuring that our findings and innovations reach the relevant stakeholders, we continuously work closely with WP9 on the dissemination strategy of LINKS.

Validation of the Technologies and Use Cases Library is equally important as it involves assessing the credibility, reliability, and applicability of the research outcomes. Through validation by experts in the field, the trustworthiness and acceptance of the findings will increase, and thus, the potential for implementation and integration into existing disaster management.



## 5.2 Long-term Vision

The challenge of implementing research outcomes in practice after a project ends is common in many fields, including disaster management. Despite producing valuable insights, innovative solutions, and evidence-based recommendations, research outcomes often struggle to be effectively translated into practice. In this section, we describe briefly the long-term vision of keeping the SMCS Technologies and Use Cases Library available as a valuable resource and sustainable beyond the project.

**Community building** is a fundamental component of our long-term strategy. We aim to cultivate an engaged community of practitioners, researchers, businesses, and other stakeholders who actively keep the information updated, contribute to and benefit from our products. By fostering a sense of belonging and collaboration within this community, we can evolve our LCC to serve as a one-stop-shop for SMCS in disaster management. In parallel to engaging an active contributing community, the aim is also to further expand the passive consuming community through promotion and dissemination of the LCC in cooperation with WP9 (Dissemination and Sustainability). At this point it must be made clear that we are not leading the community building from WP4, but rather it is a goal of the whole project, to which WP4 contributes.

By establishing **mutual connections** between entries of the LINKS Libraries through further analysis, we enable interested stakeholders to have easy access to knowledge. Technologies, guidelines, and use cases should not be treated as isolated sources of information but should be available as a flexible and interconnected resource through intelligent linking of information. This interconnectedness ensures that stakeholders can navigate seamlessly between different entries, gaining a comprehensive understanding of SMCS and leveraging the collective knowledge available within the libraries. These mutual connections enhance the usability and effectiveness of the LINKS Libraries, providing a rich and interconnected resource.

As we continue to refine and enhance our libraries within the LINKS project, we recognize their potential to serve as valuable input for upcoming **research projects** in the field. The accumulated knowledge, resources, and insights gathered through our project can contribute to the foundation of future research endeavors, providing a valuable repository of knowledge. Researchers are invited to draw upon the real-world experiences from the Use Cases Library to gain a deeper understanding of the potential benefits, limitations, and good practices associated with utilizing technologies.

Furthermore, we assess mutual connection or integration within other **knowledge platforms** (e.g. CMINE<sup>25</sup>, DRMKC<sup>26</sup>). Recognizing that our products are part of a broader landscape of knowledge resources within the European disaster research, we already work on synergistic relationships with

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<sup>25</sup> Crisis Management Innovation Network Europe, <https://www.cmine.eu>

<sup>26</sup> Disaster Risk Management Knowledge Centre, <https://drmkc.jrc.ec.europa.eu>

other platforms (e.g. cooperations via CERIS<sup>27</sup>). This approach ensures that the project results are widely known, understood, and utilized by relevant stakeholders. It facilitates knowledge transfer, fosters collaboration, and encourages the adoption of evidence-based approaches in disaster management.

The second case assessment confirmed what has been also found as a result in the Europe wide online survey (D2.7): Across practitioners there is less knowledge and awareness about **crowdsourcing initiatives** than social media usage. Therefore, further research into crowdsourcing would be helpful. Such an investigation will not only provide valuable insights into the similarities and differences between social media usage and crowdsourcing initiatives but also contribute to a deeper understanding of their respective roles and potential support in disaster management.

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<sup>27</sup> Community for European Research and Innovation for Security, [https://home-affairs.ec.europa.eu/networks/ceris-community-european-research-and-innovation-security\\_en](https://home-affairs.ec.europa.eu/networks/ceris-community-european-research-and-innovation-security_en)

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