

LINKS

Strengthening links between technologies and society
for European disaster resilience

D4.5 REPORT ON THE MONITORING OF DCT-RELATED BROADER CONTEXT APPLICATION

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, due to 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)

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

About this deliverable

This final report from WP4 concludes the knowledge base on Social Media and Crowdsourcing (SMCS) Technologies¹ established during the project's runtime. Alongside the complementary knowledge bases from WP2 (DRPV: Disaster Risk Perception and Vulnerability) and WP3 (DMP: Disaster Management Processes), it explores the impact of SMCS on European disaster resilience and contributes to the development of LINKS products.

¹ The original name at the start of the project was “Disaster Community Technologies (DCT)”

Over 3.5 years, WP4 focused on identifying, collecting, and structuring information about SMCS technologies and their application in disaster management, making this knowledge accessible in four distinct SMCS Libraries:

- The **SMCS Technologies Library** gathers and structures information about existing technologies to provide an up-to-date overview and thus support the selection of suitable technologies. The goal is to face the growing heterogeneous use of technologies in disasters and the overwhelming number of technologies on the market.
- The **SMCS Guidelines Library** (co-development with UCPH and FEU): gathers and structures existing guiding documents (guidelines, legal documents, Standard Operation Procedures) that support the implementation and use of social media and crowdsourcing in disaster management organisations.
- The **SMCS Use Cases Library** collects experiences and use cases of how SMCS have been used or can be used in real world. This enables the opportunity to give disaster management organisations a concrete indication of how they can use SMCS in practice.
- The **SMCS Crisis Communication Library** (development led by FEU) collects recommendations, apps, and websites with predefined social media messages to ease communication and increase risk awareness, preparedness and appropriate behaviour during and after a disaster to mitigate its effects on people.

The SMCS Libraries are publicly accessible via the LINKS Community Center (LCC):

<https://links.communitycenter.eu/>

This deliverable is structured to achieve two goals:

1. Monitor the knowledge base, providing an overview of the latest developments of the knowledge base within LINKS, specifically the improvements in the SMCS Libraries, their evaluation, and integration into the LINKS Framework's User Guidance. This includes ongoing analysis of market trends and SMCS applications.
2. Offer a comprehensive report on the broader application of the SMCS Libraries within and beyond LINKS, including their use in LINKS cases, engagement with the Advisory Board, and presentations at conferences and events, as well as dissemination activities in the Disaster Risk Reduction (DRR) environment.

WP4's overall strategy involves systematically capturing and structuring complex data, categorizing SMCS-related entities, and providing overviews for comparability. This is implemented through SMCS Libraries in the LCC, featuring intuitive filtering systems for easy access and tailored solutions for practical and research needs. The report details the establishment and public availability of various libraries, each serving specific functions in disaster management and communication. The report concludes with updates on the latest advancements in SMCS technologies, their implications for the libraries, and future research, along with a vision for their long-term sustainability.

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LIST OF ACRONYMS

Acronym / Abbreviation	Description
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
EENA	European Emergency Number Association
KI-CoP	Knowledge & Innovation – Community of Practice
LAC	LINKS Advisory Committee
LCC	LINKS Community Center
NGO	Non-governmental organisation
SMCS	Social Media and Crowdsourcing
vfdb	Association for the Promotion of German Fire Protection
WP	Work Package

DEFINITION OF KEY TERMS²

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.
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'.

² Definitions are retrieved from the LINKS Glossary

<p>Disaster Community Technology (DCT*)</p>	<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><i>* 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.</i></p>
<p>Disaster Risk Management</p>	<p>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.</p>
<p>LINKS Advisory Committee (LAC)</p>	<p>Invited professionals and experts from relevant organisations (representing practitioners, researchers, and citizens) that advise, inform, and validate developments and results in the project.</p>
<p>LINKS Community Center (LCC)</p>	<p>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.</p>
<p>LINKS Framework</p>	<p>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.</p>
<p>LINKS Knowledge Bases</p>	<p>The outputs and knowledge obtained from the assessment of the three knowledge domains. The knowledge is used to develop the LINKS Framework.</p>
<p>LINKS Knowledge Domains</p>	<p>The three crucial domains of analysis for studying European disaster resilience and SMCS. These include: Disaster Risk Perception and 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</p>

	Community Technologies (DCT), for assessing SMCS related technologies used by practitioners (and citizens) in disasters.
Scenarios	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
Social media	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.

1. INTRODUCTION

This deliverable is the final report from WP4 and concludes the knowledge base about Social Media and Crowdsourcing (SMCS) technologies³ established during the runtime of the project. Together with the other two complementary knowledge bases (WP2: Disaster Risk Perception and Vulnerability (DRPV) and WP3: Disaster Management Processes (DMP)) the impact of SMCS on disaster resilience in Europe was investigated and the knowledge gained led to the development of different LINKS products. Over the last 3.5 years, WP4 has pursued the goal of identifying, collecting, and structuring existing information primarily about SMCS technologies and their application in disaster management. This knowledge then was made available to various stakeholders in the user-friendly web-platform of the project, the LINKS Community Center (LCC).

To reflect that process, this deliverable is structured to accomplish two objectives:

- 1) Monitor the knowledge base by providing an overview of the latest developments of the knowledge base within LINKS, specifically the latest improvements of the SMCS Libraries, evaluation by the cases and the integration into the User Guidance from the LINKS Framework. Additionally, the ongoing advancement of the knowledge base is fundamentally reliant on the persistent monitoring and analysis of market trends and the application of SMCS from a technological perspective.
- 2) Provide a comprehensive report on the broader context application of the SMCS Libraries both within and beyond LINKS. This encompasses their utilization in the LINKS cases and their associated networks, engagement with the LINKS Advisory Board, and presentation and discussions in conferences and events. Additionally, it involves dissemination activities aimed at establishing the prominence of the SMCS Libraries in the Disaster Risk Reduction (DRR) environment.

The overall strategy pursued by WP4 focuses on systematically capturing complex data and overwhelming information in a structured way, describe SMCS related entities (e.g. technologies) with categories and therefore, provide an overview and enable comparability. This approach is technically implemented through so-called SMCS Libraries. These libraries, featuring an intuitive filtering system within the LINKS Community Center, facilitate easy access and provide tailored solutions for various practical and research needs, such as navigating a complex market or finding relevant examples about innovative SMCS applications. The LINKS Library model is overarching, fostering connections (LINKS) between individual entries and categories through a uniform structure. By the conclusion of the LINKS project, the following libraries have been established, populated with information, and made available to the public via the LCC (cf. Figure 1).

³ The original name at the start of the project was “Disaster Community Technologies (DCT)”

Figure 1: SMCS Libraries implemented in the LCC

Social Media and Crowdsourcing Libraries



Source: LCC

- **SMCS Technologies Library:** The SMCS Technologies Library gathers and structures information about existing technologies to provide an up-to-date overview and thus support the selection of suitable technologies. The goal is to face the face the growing heterogeneous use of technologies in disasters and the overwhelming number of technologies on the market.
- **SMCS Guidelines Library** (co-development with UCPH and FEU): The SMCS Guidelines Library offers a collection of action recommendations, such as guidelines, policies, or Standard Operating Procedures (SOPs), for integrating and utilizing social media within organizations. These recommendations are designed to assist in various aspects, including setting up a social media team, developing strategies for social media monitoring during crises, and focusing on vulnerable groups in social media usage.
- **SMCS Use Cases Library:** The SMCS Use Cases Library gathers real-world instances and experiences of social media use, narrated by practitioners for their peers. This library highlights the measures adopted by disaster management organizations at various stages—before, during, and after disasters—and encourages the practical implementation of social media strategies.
- **SMCS Crisis Communication Library⁴** (development led by FEU): The SMCS Crisis Communication Library compiles advice for improving communication with the public via social media during all phases of a disaster. It focuses on raising risk awareness, preparedness, and promoting suitable actions during and after a disaster to lessen its impact on individuals. This library's aim is to facilitate public communication through reliable social media text messages. It provides practitioners with access to websites and applications tailored for crisis communication.

⁴ The Crisis Communication Library is a rather new library, launched by FEU in August 2023.

A filtering system is available to users across all libraries, which allows them to customize searches according to their specific needs. This system enables users to e.g. select technologies based on functionality or social media platform compatibility, find relevant guidelines by considering the target audience or disaster management stages, identify pertinent use cases by hazard type or theme, and refine searches for different types and scenarios in crisis communication, facilitating the use or sharing of content on social media.

The SMCS Libraries were created through a collaborative and iterative process involving multiple partners and work packages. This deliverable finalizes the process by providing an update about the latest advancements in the field of SMCS technologies and their implications for the SMCS Libraries and future research (**Section 2**). **Section 3** begins with a summary of the development process of the SMCS Libraries and how these have been further developed from June to November 2023 and integrated into the LINKS Framework (User Guidance). **Section 4** discusses the application in a broader context, while **Section 5** concludes the deliverable including the vision for their long-term sustainability.

2. UPDATED STATE-OF-THE-ART AND IMPLICATIONS FOR THE KNOWLEDGE BASE

Complementary to the introduction, **Section 2.1** provides a concise summary of the driving forces behind the LINKS knowledge base, linking it to the research questions. The development of the knowledge base is continually shaped by prevailing technological trends, such as widespread AI capabilities or the interface limitations of platforms like the former Twitter, as well as by global political upheavals, disasters and conflicts, including the COVID-19 pandemic and the Ukraine war. Consequently, **Section 2.2** therefore provides a brief overview of the relevant developments about technological demands and potentials.

2.1 Motivation of the Knowledge Base

The integration of SMCS technologies in disaster management is hindered by a variety of factors as identified in LINKS. One challenge relates to the absence of a comprehensive understanding of existing SMCS technologies. This deficiency extends to possible application scenarios and functional capabilities of them. Another aspect revolves around the questions of legal implications and possible liability that disaster management organizations may face in responding to help requests posted on social media. Additionally, there exists a lack of organized and structured data regarding the specific use of SMCS technology in disaster situations and which disaster management organizations have successfully integrated it into their operations. Consequently, disaster management organizations, lack clarity regarding advantages, disadvantages, and benefits of SMCS in disaster situations. Having this information in a consolidated and well-structured format could offer valuable insights for disaster management organizations looking to effectively incorporate SMCS technology. Furthermore, organizations report challenges in connection concerning the integration of SMCS: there exists a lack of financial resources, clarity of legal and privacy issues, guidelines and policies, and there is a need for trained employees, practical examples, technical knowledge, an overview of existing software/ technologies, and an exchange of experiences and dialogue with other organizations. The challenges are tackled by interrelating research questions between the three knowledge domains, of which the following are related to WP4:

- RQ1: How do DMOs apply SMCS technologies?
- RQ2: What are the limits and potentials of the application of SMCS technologies?
- RQ3: How can the implementation and application of SMCS technologies be further facilitated?

These questions are elaborated in D2.7 (Lüke, et al., 2022) and D4.4 (Lüke & Habig, 2023) based on a literature review and ongoing business market analysis and the results of the extensive work done in five LINKS cases (see D4.1 (Habig, Lüke, Sauerland, & Tappe, 2021), D6.4 (Clark, et al., 2022) and D6.5 (Larruina, et al., 2023)).

Disaster management and response could be crucially enhanced by integrating SMCS technologies to access, analyze, and utilize disaster-related information from social media platforms. With the help of the gathered information from processing social media posts that deal with the disaster-event, the disaster management team receives the chance to assess situations more efficiently and comprehensively which allows a quick and prioritized coordination of relief supplies and emergency forces. Likewise, a well-organized social media presence of disaster management organizations offers valuable benefits in combating consequences of disaster events. From providing information and guidelines on what to do in various emergency scenarios (e.g. drought, flood, etc.), to sharing credible information and combating fake news, to offering direct and instant communication with the public in case of a disaster event to provide real-time updates and vital information, a social media channel has the potential to significantly improve public safety, engage communities, and create reliable communication channels. Yet, these potentials can only be met by maintaining an active social media presence as trustworthiness and credibility are created, which fosters trust in government and the organization's capabilities.

2.2 Recent Trends and Implications for the Knowledge Base

Since the rise of Web 2.0, which enabled individuals to transform from passive spectators to active content creators, there has been a notable increase in the exchange of accessible and rapid information. This development offers immediate access to a vast amount of information through social media and other communal platforms (Aboualola, Abualsaud, Khattab, Zorba, & Hassanein, 2023). Although European countries have increasingly worked on the integration of SMCS into disaster and crises management, the effectiveness of the same on European disaster resilience remains insufficient as the diversity in disaster risk perception and emerging technologies is overwhelming (Aboualola, Abualsaud, Khattab, Zorba, & Hassanein, 2023) (Ghadge, 2023). A crucial element of this advancement is the integration of technology to gather catastrophe-related data from SMCS, amplifying the effectiveness and range of these groups during crises. For example, in the event of a disaster, promptly collecting, sorting, and analyzing social media content that shows or describes the harm can lead to faster and broader situational awareness. The Technologies Library attempts to fill the gap of knowledge about existing SMCS technologies while the Guidelines Library pursues to aid with applying these technologies in disaster situations. In this process, the Use Cases Library can be accessed to find real scenario examples that exemplify benefits and challenges connected to the application of SMCS technologies in disaster management.

Consequently, emergency responders and assistance can be dispatched more efficiently. Moreover, a well-planned social media presence for disaster management organizations is priceless. Immediate and direct communication with the public is facilitated, promoting transparency and timely updates during crises. Consistent online engagement enhances the organization's reputation and strengthens trust with the public. Additionally, social media plays a crucial role in combating misinformation by promptly disseminating verified facts and correcting false information.

Particularly, the Crisis Communication Library and the Guidelines Library provide advice for a well-made social media-presence as well as the exchange of vital information before, during, and after disasters. By effectively utilizing social media and technological resources, organizations responsible for disaster management can enhance public safety, encourage community involvement, and establish reliable communication channels in times of crisis.

Nevertheless, the potential of social media platforms across a huge variety of possibilities is still unexplored and unused (Chon & Kim, 2022). As already elaborated in D4.4, the rapid evolution of technology and social media platforms has highlighted the need for advanced social media data analysis to harness potential benefits (Lüke & Habig, 2023). This is particularly relevant in light of recent global events such as the climate emergency, the COVID-19 pandemic, and the Ukraine conflict. Social media has become increasingly important for maintaining social connections, especially during pandemic-induced isolation, but it also presents challenges, such as the rise of radical influencers and decentralized communication that complicates authorities' response efforts. In Germany, groups like the lateral thinkers (Querdenker) emerged who are characterized by their opposition to pandemic-related regulations, including lockdowns and vaccination mandates. While some participants in the movement may have genuine concerns about civil liberties and government overreach, the Querdenker movement has also been criticized for attracting a diverse range of individuals, including conspiracy theorists and those spreading misinformation. Some of the protests associated with the movement have faced controversies, such as non-compliance with public health guidelines and the presence of extremist elements. This also reflects on their activity on social media, as they have utilized social media to organize and spread dissent against COVID-19 measures, demonstrating the importance of data analysis in managing such movements (Jarynowski, 2020). The LINKS products are beneficial in the combat with radicalization as they provide DMOs with information on SMCS technologies which can be helpful communication with the public to spread awareness about sensible topics.

Similarly, social media posts have played a crucial role in political awareness, particularly with the Ukraine conflict, where they have been used for everything from spreading personal narratives to conducting information warfare. The spread of fake news on social media is not to be underestimated and was repeatedly cited in LINKS as (cf. D6.4) one of the obstacles to working with social media. Likewise, to the beginning of the Russia/ Ukraine war, one can observe a massive spread of fake news with the beginning of the Israel/ Gaza war (Hoffmann, 2023). False information either in support of Hamas or Israel are spread on social media in form of images and video material taken out of context from a different time or place or even taken from a video game circulate on social media and have to be checked on correctness by the users themselves (Strahm & Schlauri, 2023). To fact-check images and videos, one can use a reverse image search which helps to identify the source of an image (Grigonis, 2023). When using SMCS technologies, DMOs are faced with the challenge of ensuring information quality as there exists an overwhelming amount of redundant, outdated, and false data provided on social media. To tackle this, an early detection of anomalous

events and trends is necessary as disaster events are associated with a disproportionate increase of keywords used on social media as soon as the public notices the disaster. Additionally, sentiment analysis provides valuable insights into the public's emotional state as citizens cope with uncertainty using social media which is more present during disaster events. Anyhow, the use of filtered SMCS data offers a variety of possibilities, such as a more efficient search for missing people, internal communication within or between DMOs, and engaging volunteer helpers by enabling the coordination of most activities, meeting points and task allocation. Thus, crowdsourcing activities can be supported and spurred if DMOs integrate SMCS technologies in their disaster management process.

Moreover, social media has become a vital tool during crises: it facilitates communication, is used to coordinate aid efforts, and addresses the challenges posed by global events such as the Covid-19 pandemic, natural catastrophes, and war-conflicts. For example, during and after the Covid-Crisis many people, especially the younger generation, experience severe consequences in their mental health (Peroziello, Sousa, Aubriot, & Masson, 2023). With the rise of climate change, a rise in the frequency of natural catastrophes and disaster events can be observed. Accordingly, risks and challenges for affected areas and people become higher and more serious, as can be seen at the example of the 2021 floods where volunteers coordinated aid through online platforms. Recent Developments as the wars in the Gaza-Strip and the Ukraine put millions of people in catastrophic situations. The West experiences consequences from the conflicts in the form of an energy crisis and inflation which do not only lower the living standard for most citizens but also strain financially weak groups on the verge of living costs. Disaster management organizations need new and improved ways to face these challenges in order to prepare and protect the society. The LCC and the LINKS products equip DMOs with a set of current SMCS technology to recognize sentiments and pressing issues within the society. With the help of the Crisis Communication and the Guidelines Library, DMOs are able to best use the gained knowledge about trends in social media and the society's sentiment to improve the well-being of the individual and the society as an entirety.

The developments described underscore the untapped potential of technological advancements in disaster preparedness and response. The vast data generated by these platforms needs effective collection, processing, and analysis to understand community dynamics in disasters and provide timely updates and information dissemination. This situation calls for continued research in technologies to enhance SMCS data analysis for optimal utilization. Furthermore, the implementation of SMCS technology in disaster management has to be further pressed as most DMOs are still unaware of possibilities, or do not have yet the capacity to introduce new technologies in their DMP. The LINKS products present innovative solutions for this problem and can be used as a helpful guide to spur the integration of SMCS technology in disaster management.

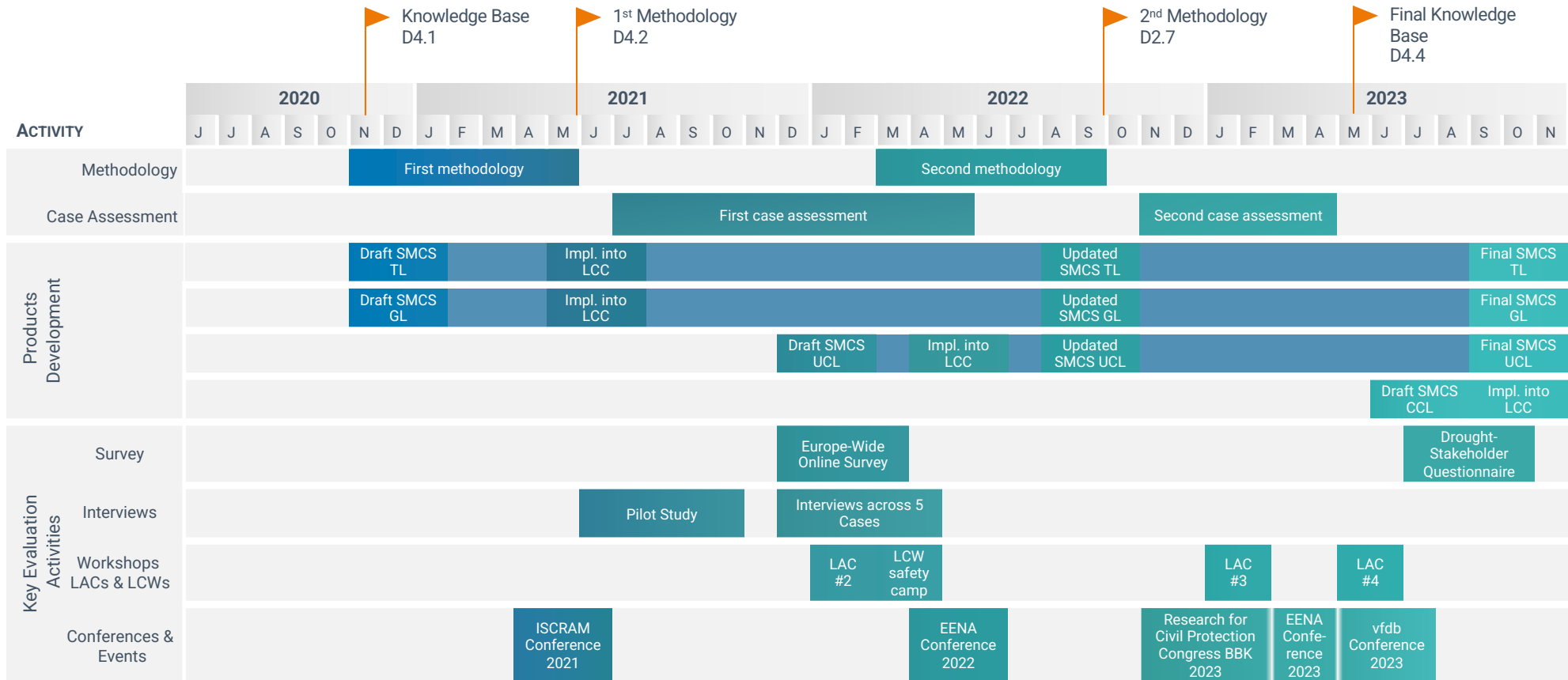
A further important aspect to be taken into account in future research is the emerge and wide utilisation of AI software in 2022, disaster management has seen revolutionary approaches to improve disaster response and early warning systems. One example of that is the development of

an AI-model that is able to detect landslides by analyzing images from social media in real time (Ofli, et al., 2023). Similarly, researchers have created an AI-model to support the monitoring and identifying of emergency messages on social media platforms in context with hurricanes, while following the ambition to extend the use of the AI-model to other disaster situations (Huang, Khallouli, Rabadi, & Seck, 2023). As X (former Twitter) is one of the leading social media platforms, a “semi-automated AI-based disaster response system for Twitter data” has been proposed to spur situational awareness during disaster events (Lamsal & Kumar, 2023). But AI-models cannot only be used in disaster management during natural catastrophes. In recent research, AI has been integrated in decision-making processes in context with opioid overdoses to improve the survival rate by distributing and managing resources in areas with lower survival rates (Johnson, Albizri, Harfouche, & Tutun, 2021). Thus, AI poses great potential for disaster management and early warning systems. In connection with SMCS, disaster situations can be tackled more efficiently. This is where social media platforms come in and further research has to be done building up on the results from LINKS.

3. DEVELOPMENT OF THE SMCS LIBRARIES

This section summarises the development of the WP4 Knowledge Base and the associated creation and latest improvements of the SMCS Libraries. Firstly, an overview of the methodological approach and building blocks in LINKS is given (**Section 3.1**). Then the latest improvements to the 4 libraries (**Section 3.2**) and the integration into the user guidance of the LINKS Framework (**Section 3.3**) are described. Figure 2 provides an overview of the WP4 project activities over the entire duration of the project.

Figure 2: Overview WP4 Activities



Source: WP4, template from WP3

3.1 Methodological Pathway

Establishment of the Knowledge Base

The overall goal, to gain a comprehensive understanding of SMCS technologies in disasters was established through an iterative process, starting with laying down the foundations in D4.1 (Habig, Lüke, Sauerland, & Tappe, 2021). D4.1's primary purpose is to provide a state-of-the-art overview of SMCS technologies that facilitate the use of SMCS across different disasters and phases. The gaps and needs in practice as well as research needs in the field of crisis informatics were also identified, analysed and transferred into concrete solutions (e.i., SMCS Libraries). The approach to building this knowledge base was twofold: firstly, conducting a focused literature review on the technological aspects of SMCS in disaster scenarios (top-down approach), and secondly, performing a business market analysis of existing relevant technologies (bottom-up approach).

Interrelating with the two other knowledge domains (Disaster Risk Perception and Vulnerability (DRPV) and Disaster Management Processes (DMP)), this comprehensive approach is crucial for understanding the three dimensions of disaster resilience: social, institutional, and technological. It recognizes diversity at individual, institutional, and systems levels, investigating interactions among these dimensions (Fonio & Tzavella, 2022).

Knowledge Base Methodologies

To bridge the knowledge gaps identified in D4.1, the first knowledge base methodology is developed, as detailed in D4.2 (Gehlhar, Habig, Lüke, & Marterer, 2021). This methodology is designed to support the development of guidance and facilitation of the first case assessment of the LINKS Framework (WP5 & 6). It addresses various research gaps and questions by introducing a suite of research tools. This involves adapting qualitative interviews, a Europe-wide online survey, and various workshops to the specific needs of enhancing the SMCS Technologies Library. A critical need identified during this first case assessment is the exchange of experiences and practical examples. To address this, the SMCS Use Cases Library is established, compiling structured and helpful examples (both positive and negative experiences, key facts, etc.) of innovative SMCS applications in disasters. The library aims to provide organizations and individuals with concrete examples and inspiration, thereby enriching their understanding and application of SMCS in disaster scenarios.

D2.7 (Lüke, et al., 2022) introduces the second DCT-methodology, with a primary focus on further evaluate and improve the SMCS Libraries. This methodology serves a dual purpose: firstly, to analyze the initial case assessments and illustrate their impact on the LINKS products current status, including the development of its Framework and products; and secondly, to provide an updated methodology for directing the second case assessments (Clark, et al., 2022). This approach marks a shift from a research-centric to a practitioner-focused strategy, emphasizing the role of practitioners in the development and application of the LINKS Framework and its products (cf. D5.5 (Fonio & Larruina, 2023)). The document outlines two main phases of the methodology: the knowledge

expansion phase, driven by research methods like desk research and interviews, and the application and assessment phase, which is practitioner-driven and focuses on evaluating and applying the LINKS products and Framework.

Significant contributions to the LINKS Framework are also detailed in D2.7. It summarizes the Framework's status and its products, explaining how the initial assessment phases influence their development. The document also notes how the LINKS Community Center (LCC) is expanded and how the SMCS Libraries are improved consistently.

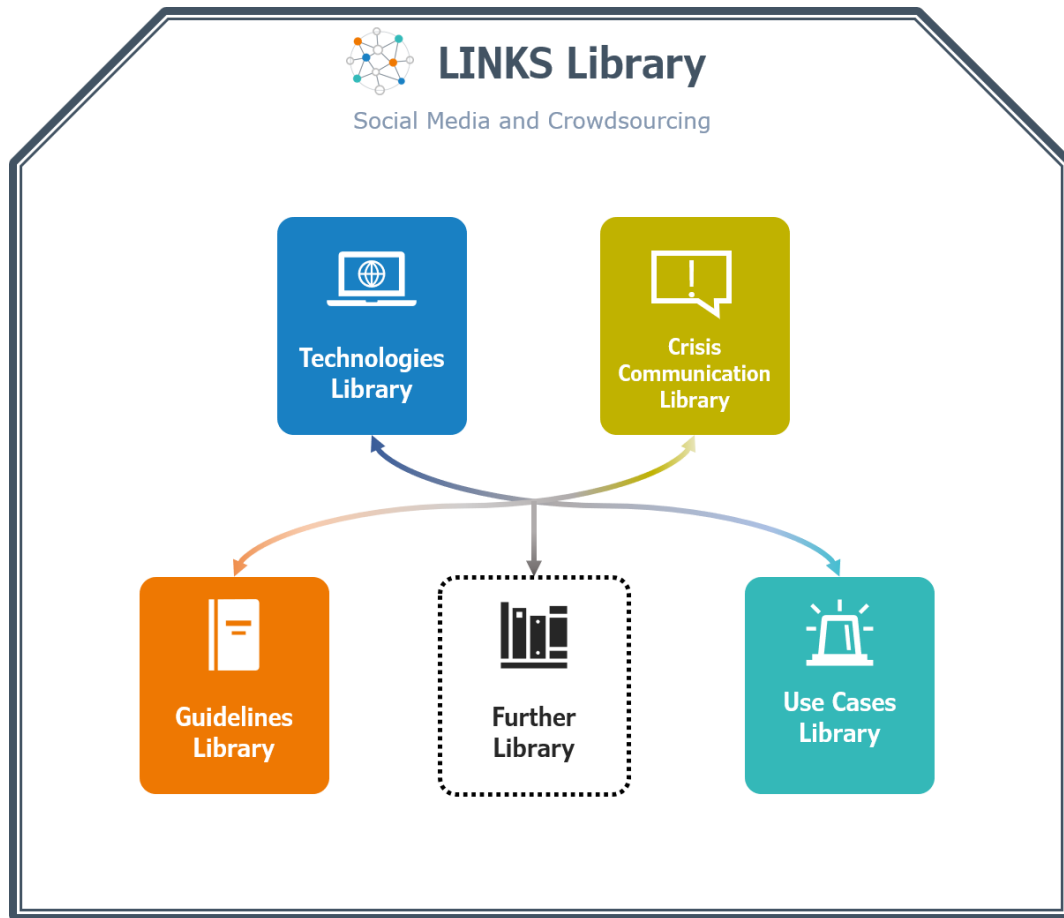
Evaluation by the Cases through the LINKS Framework

The knowledge bases are supported by the practitioner-orientated cases (earthquake in Italy, industrial hazards in the Netherlands, drought and terrorism in Germany and flooding in Denmark) during the course of the project when developing the outputs. In the beginning of the project, the needs of the cases are collected, evaluated and incorporated into the design of the outcomes. The results are evaluated both through integration into the LINKS Framework and separately with the cases in the early development stage. The case assessment teams involve diverse stakeholders like fire departments, police forces, and technology providers, using multiple research methods to understand DMOs' experiences, practices, and challenges in using SMCS for disaster management. These methods include expert interviews, Europe-wide surveys, workshops, desk research, and technology testing. Key findings from these methods significantly influence the development of the SMCS Libraries. The cross-case interviews provide insights into SMCS technologies, shaping the Technologies Library's updates, and validating its existing sections. The Europe-wide Online Survey gathers data from various stakeholders on SMCS usage in disaster management, revealing new technologies and leading to updates in the Technologies Library, including a new "Used by Practitioner" category. Workshops during the first case assessment, including the LINKS Advisory Committee meeting and LINKS Community Workshops, lead to further significant improvements in the Technologies and Use Cases Library. The LINKS Framework, developed within WP5, provides a User Guidance to prospective users within the LCC. Its objective is to facilitate the process of navigating the available products and identifying the most pertinent ones to meet specific needs. The integration of the SMCS Libraries in the User Guidance is described in Section 3.3. The results from the case assessments are presented in D6.4 and D6.5 as well as D2.7 and D4.4.

3.2 Improvement of the SMCS Libraries

As introduced in D5.3, the knowledge gathered within the LINKS project is organised in four libraries at the end of the LINKS project (Fonio, et al., 2022). The four SMCS Libraries serve the purpose of providing structured, accessible, and searchable overviews of information of technologies, guidelines, use cases, and crisis communication recommendations. Figure 3 illustrates the LINKS Library approach. The "blank" library at the bottom of the diagram represents any further potential libraries that might emerge in the future as the project develops.

Figure 3: Final LINKS Library Model



Source: SIC

To facilitate systematic organization and navigation within a library, each element is tagged with specific attributes like “target group” or “disaster phase.” These attributes, which can be filtered, also create links to other libraries. For example, in the SMCS Guidelines Library, a guideline might have a “covers” attribute linking it to the SMCS Technologies Library. In contrast, a technology might have a “covered in” attribute pointing to pertinent guidelines. This structured approach forms a network of interconnected information, illustrated by arrows in the figure. Each library begins with a foundational model (schema) outlining possible properties for its entries. These schemata share a universal base, akin to a “Meta Library,” encompassing common properties like “disaster phase”. Every specific library builds upon this shared foundation, adding unique properties as necessary. This structure not only links the libraries through shared attributes but also paves the way for integrating additional libraries in the future. Such integration ensures they remain interconnected through this shared foundational core.

The accuracy and timeliness of information in online knowledge repositories, particularly in the context of SMCS Technologies, are crucial due to the volatile and rapidly evolving nature of this market. Ensuring the reliability of entries of the libraries is paramount, as users depend on this

information for making informed decisions. Moreover, the reputation of a knowledge repository hinges on its ability to provide accurate and timely content, which in turn attracts more users and contributors. As described in detail D7.6, the foundation of this reliable **quality assurance** system is based on the concept of "**approvers**" (Schmidt, Habig, & Marterer, 2023). These approvers are a unique category of users granted extra privileges. Essentially, they have the power to review alterations made to the content within the LCC and assess if these changes adhere to established quality standards. However, unlike typical reviewers found in processes like journal or book editing, approvers are not required to immediately propose improvements to the suggested changes. Their role is primarily to either approve or reject these changes. This approach is adopted to make the quality control process more efficient and to avoid overloading the approvers with tasks.

Changes that receive approval are integrated into the LCC, while those that are rejected are discarded. A key aspect of this system is that any changes awaiting an approver's decision remain invisible to the public and are only revealed once they have been approved or rejected.

Besides the implementation of the "approver"-system, a process was initiated to sustain and improve the quality of entries with the support of Artificial Intelligence. **Incorporating Artificial Intelligence (AI)**: This process leverages AI tools for internal scanning and of the library's entries but also extends its capabilities to include scanning of freely accessible websites from e.g. the technology providers. AI can efficiently handle the vast and dynamic nature of SMCS technologies, ensuring that the information remains current and accurate. Through an AI analysis of the information from the websites and aligned prompting and processing of the results in a structured manner, the results allow to control the entries and assure the quality. Further work can steer the involvement of AI to create draft of Use Cases or as already happen, provide Crisis Communication Advice for the Crisis Communication Library.

In addition to the quality assurance process described above, various technology providers (e.g. Ubermetrics or PublicSonar) were also included in WP4 to improve quality. Firstly, the structure and categorisation of the SMCS Technologies Library was validated in interviews and workshops, in the next step, the entries for the solutions of the technology provider were approved. This process is described in more detail in D2.7.


The assurance of the quality is achieved not just by reviewing existing entries, but also by consistently identifying and incorporating new, pertinent entries, enriching them with detailed information. The community members for example, can contribute by sharing real-world experiences and insights, providing updates on new technologies, and offering feedback on existing entries. This collaborative approach ensures the library remains relevant, accurate, and reflective of the latest trends and practices in disaster management technology, fostering a dynamic and informed community-driven place of knowledge. These methods complementing the ongoing business market analysis that has been active since the project's inception, as detailed in D4.1.

3.2.1 SMCS Technologies Library

Since the start of the project, the SMCS Technologies Library has evolved from a concrete idea through continuous improvement to a comprehensive repository of SMCS technologies, complete with explanations of their functionality, providing practitioners with essential knowledge and skills. This library presents in-depth information on a range of technologies specifically designed for managing social media in disaster scenarios, as can be seen in Figure 4 using an example. Its objective is to provide a detailed and broad overview, recognizing the growing diversity and sheer volume of technologies available in the market. This resource aims to assist users in selecting appropriate technologies for each phase of a disaster event, tailored to their specific needs. The library includes a user-friendly filtering system, allowing users to narrow down their choices based on various criteria, such as the desired functional scope or compatibility with particular social media platforms. This feature enhances the library's utility, making it easier for stakeholder to find the most suitable technologies for effective disaster management and response. A detailed illustration of a profile page is shown in Figure 5.



Figure 4: Overview Page of the SMCS Technologies Library



Technologies

Social Media and Crowdsourcing Library

The overall goal of the Social Media and Crowdsourcing (SMCS) Technologies Library is to face the growing heterogeneous use of technologies in disasters and the overwhelming number of technologies on the market. It gathers and structures information about existing technologies to provide an up-to-date overview and thus support the selection of suitable technologies.

You can use the filters to identify relevant technologies according to your needs and then click on the name of the technology to get further information.

Selected Filters

No filter. Showing all results.

OPEN FILTERS


Results: 73

ADD NEW TECHNOLOGY

Name	Functions	Supported Platforms
<p style="color: #007bff; font-weight: bold;">Agorapulse</p> <p style="font-size: x-small; border: 1px solid #ccc; padding: 2px; display: inline-block; margin-top: 5px;">Free & Paid</p>	<p>📄 🗨️ 📊 📈 📍 🔄 >>></p>	<p>📘 📺 📷 📺 📺 📺 📺</p>
<p style="color: #007bff; font-weight: bold;">ArcGIS</p> <p style="font-size: x-small; border: 1px solid #ccc; padding: 2px; display: inline-block; margin-top: 5px;">Used by practitioners</p>	<p>📄 🗨️</p>	<p>📘 📺 ..</p>

Source: LCC

Figure 5: Profile Page of the SMCS Technologies Library


[VIEW ALL TECHNOLOGIES](#)

Created: 28 January 2022
Last edited: 31 July 2023

Ubermetrics


Used by practitioners

Website ↗

Ubermetrics's monitoring technology integrates information analysis across sources and media channels to identify emerging risks, potentials, and trends to help companies optimize their business responses. The amount of new information created daily is truly immense. Every minute, hundreds of thousands of documents, tweets, blogs, and news are published – public information that is often ignored by companies as they are simply overwhelmed by this flood of input and thusly fail to systematically evaluate these amounts of equally valuable information from external sources. As a result, they fail to react to powerful information about their customers, their products, their competition, and suppliers.


Note: This description is based on content provided by the technology's website.

Launch Year
2011

Provider
Ubermetrics Technologies
 Germany

Pricing
Paid

User Interface Languages
English, French, German, Spanish, Russian

Supported Platforms


Crisis Communication Matrix (explanation)
Citizens to Authorities

Disaster Management Phase

Functions

Search & Monitor

- ✓ Advanced search features
- ✓ Event monitoring
- ✓ Event notification
- ✓ Hashtag monitoring
- ✓ Hashtag search
- ✓ Keyword monitoring
- ✓ Keyword search

Post & Schedule

- ✗ Content library
- ✗ Post time optimization
- ✗ Posting content
- ✗ Scheduling content

Analysis

- ✗ Image analysis
- ✓ Sentiment analysis
- ✓ Text analysis
- ✓ Topic analysis
- ✗ Trend analysis
- ✗ Video analysis

Metrics

- ✓ Audience metrics
- ✗ Competitor metrics
- ✓ Follower metrics

Report

- ✓ Clustering/Aggregation
- ✓ Customizable reports
- ✓ Filtering, sorting & searching

Collaboration

- ✗ Approval workflows
- ✗ Inbox workflow
- ✓ Multiuser

Source: LCC

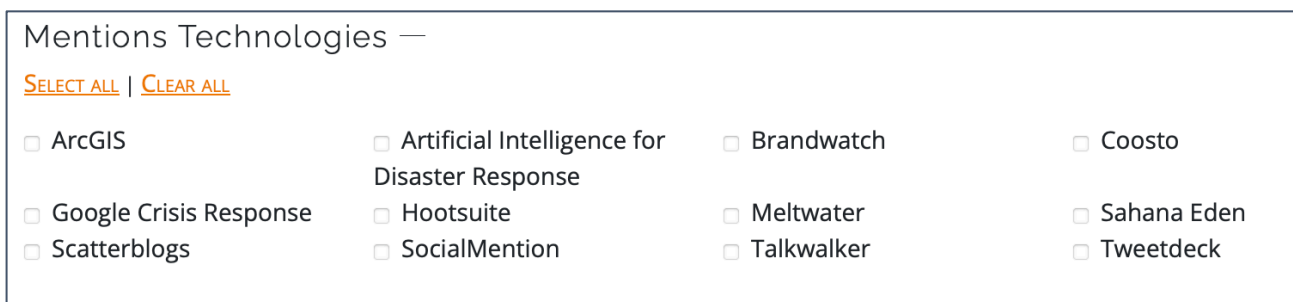
3.2.2 SMCS Guidelines Library

The Guidelines Library provides guidelines for the usage of SMCS in disasters which support practitioners in applying SMCS. Figure 7 shows an example of the Guidelines Library. Within the SMCS Guidelines Library recommendations for action (e.g. guidelines, policies, or SOPs) are made available for the implementation and use of social media in organizations. These suggestions aim to help in several areas, like establishing a social media team, devising strategies for monitoring social media during crises, and giving special attention to vulnerable groups when using social media. The filtering system assists users in locating the most appropriate guidelines by allowing them to filter based on criteria such as target audience or a specific disaster management stage. The development process and the broader context application of the Guidelines Library, in which WP4 was significantly contributing, is documented in D3.5 (Bach Nielsen, Landwehr, Nicolai, & Raju, 2023).

WP4's primary emphasis in documenting and evaluating guidelines revolves around the technological aspect. Within the Guidelines Library, a specific category named "Mentions Technologies" exists as shown in Figure 6. This category serves to identify if a particular SMCS

technology is referenced or elaborated upon within a guideline. This categorization establishes a connection between the two libraries, allowing for a comprehensive understanding of how a technology is applied within the guidelines. The connection is also displayed on the profile page of the guideline. The depth and breadth of this information vary, offering insights into the practical use and implementation of these technologies as outlined in the guidelines. This approach not only enhances the utility of the library but also provides a clearer, more structured way of assessing the integration of technology in various guidelines.

Figure 6: Filter “Mentions Technologies” of the SMCS Guidelines Library




Source: LCC

In a subsequent adjustment, the "Mentions Platforms" category was removed after receiving the feedback from the LAC. Similar to the "Mentions Technologies" category, "Mentions Platforms" was intended to highlight instances where specific platforms, like Facebook or Instagram, were discussed in a guideline. However, it became apparent that the context and extent of these platform mentions were frequently too narrow to offer any significant value to users. This lack of substantial relevance led to the decision to remove this category.



Figure 7: Profile Page of the SMCS Guidelines Library


[VIEW ALL GUIDELINES](#)

Created: 5 June 2023
Last edited: 14 August 2023

Building a Social-Media-Team in a local fire brigade

Source ↗

Quick Facts

Publishing Organisation: Max Nüßler, FEU	Year: 2023	Primary Target Country: Germany	Languages: English	Status: Published
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Synopsis

In the document, suggestions from various guidelines available in the LINKS Guidelines library have been used

The document is also available in German https://links.communitycenter.eu/index.php/Einrichtung_eines_Social-Media-Teams_bei_einer_städtischen_Feuerwehr

User Story

A social media team is to be set up and established in a medium-sized public fire brigade with around 400 to 600 emergency personnel.

A variety of questions need to be addressed, such as:

- What are the fire brigade's goals in entering the social media world?
- Which of the numerous platforms should a fire brigade use?
- How can one monitor if objectives have been achieved?
- How much staff is needed for implementation of the Social Media strategy?
- Are there technologies that are required and/or desirable to ease the use?
- What regulations, standards, or rules should have to be followed?
- Are there examples of successful social media use, or templates, tools, and documents that are useful for setup, operation, and various scenarios when using social media in emergency response?

Implementation

The following steps are suggested for implementation:

- Definition of objectives
- Definition of target audience
- Definition of content types and categories
- Determination of type of content
- Definition of community management rules

Covers Thematic

- Community management
- Content creation
- Crisis communication
- Social Media Strategy
- Social Media Team

Target audience

- Practitioners

Audience experience level

- Intermediate

Disaster Management Phase

- Before

Source: LCC

3.2.3 SMCS Use Cases Library

The establishment of the Use Cases Library (cf. Figure 8) in summer 2022 is driven by the recognition, during the cross-case analysis, of a pressing need for more guidance and illustrative examples on the implementation of SMCS (Clark, et al., 2022). This library provides practitioners with tangible, real-life examples and actionable insights for the effective utilization of SMCS. Its incorporation into the existing LINKS Library framework not only allows for a systematic approach but also opens avenues for potential connections with upcoming libraries. An extensive analysis of these research methodologies and their influence on the development and effectiveness of the libraries and their offerings is thoroughly documented in D2.7. Particularly within the second case assessment, the Use Cases Library has shown significant development. Since October 2022, the Use Cases Library has grown to 30 developed use cases. This expansion is not just in terms of quantity

but also in the diversity of topics and the range of hazardous scenarios addressed. To encourage its ongoing enhancement and growth, a digital form for contributing new use cases has been created for the LINKS Community Center (LCC).

In collaboration with the Federation of European Fire Officers (FEU), several developmental steps are undertaken to enhance the Use Cases Library. Initially, an iterative analysis process is conducted in August 2023 to evaluate the current state of the Use Cases Library from the LCC. This involves comparing the library with various assessment standards. For instance, the analysis identifies categories with limited or no information and explored potential reasons for these gaps. Additionally, the varying lengths of text across different fields are examined, leading to the establishment of new benchmarks for each text field. The quality of entries was also rated on a three-tier scale to determine the need for revisions.

Based on this analysis, significant improvements were made to the library:

- The **content was restructured** for better user-friendliness, particularly in the “Description” section. Long texts were revised and categorized into three distinct themes: the overall goal of the Use Case, what aspects worked well and could be recommended to others, and the limitations identified. This restructuring allows users to quickly grasp the core messages of each Use Case and assess its relevance to their needs.
- Where feasible, relevant **images** were added to the Use Cases to enhance visual appeal and effectively convey key messages. More abstract or challenging-to-assess categories, such as scalability, were removed, and their pertinent information was integrated into other categories.
- **Categories** that were more challenging to grasp or evaluate, such as scaling, were **removed** and their relevant information components were integrated into other categories.
- Many Use Cases underwent content revisions to ensure a **consistent style** of information presentation. This included concise and clear text, language and spelling checks, and uniform tense usage. For Use Cases that required quality improvements, the respective partners (in the case of internal project Use Cases) were contacted for necessary revisions.
- Additionally, efforts were made to **document the organizations** responsible for authoring each Use Case and those involved in its development. This not only facilitates contact for interested LCC visitors with inquiries but also holds great potential for future developments of the Use Cases Library.

Beyond these changes, specific feedback from LAC Meetings #3 (February 2023) and #4 (June 2023) is also incorporated into this process. Following the fourth LAC Meeting, LAC members contribute high-quality Use Cases, further enriching the library.



Figure 8: Profile Page of the SMCS Use Cases Library

[VIEW ALL USE CASES](#)

Created: 4 September 2023
Last edited: 17 October 2023

Citizens Drought Reporting

The Crowdsourcing project #unserWasser investigates the impact of drought on Germany's water bodies by collecting public observations on drying rivers, lakes and streams.

Hazard: Drought Year: 2022 Location: Germany Scale: Country Involved Organisations: ARD, SWR

Description

The #unserWasser Crowdsourcing project by ARD and SWR (Public service television channels in Germany) investigates the impact of drought on Germany's water bodies. Since March 2022, it has collected nearly 2,400 public observations on drying rivers, lakes, and streams. The data is mapped and analyzed by experts to understand the extent of drought conditions. The initiative highlights that 60% of rivers globally are at least temporarily dry, a condition also affecting Germany. Collected data is displayed on an interactive map until September 2022, allowing citizens to report on depleting water bodies.

What was the overall goal of the Use Case?

The project aims to serve as an early warning system and fill the knowledge gap about Germany's increasingly dry landscape.

What worked well and could be recommended to others?

The gathered data shows a lack of consistent national data on water conditions. The project emphasises that no one really knows what the state of the waters in Germany is and therefore asks for the help of the population. The inclusion of reports from the citizens enables a data collection that can lead to a comprehensive picture of the drought in Germany.

What limitations were identified?

Specific challenges are not reported. However, two challenges are obvious:

1. the population must be encouraged to participate (which has worked well here through the public television channels (ARD & SWR))
2. the evaluation of the reports must be very time-consuming and demanding due to free-text answers.

Publishing Organisation
Safety Innovation Center gGmbH (SIC)

Category
Real-world

Theme
Crowdsourcing

Thematic

- Collecting and Analysing Information from SMCS
- Ensuring Credible Information
- Mobilising Citizens

Disaster Management Phase
After, Before, During

Source: LCC


3.2.4 SMCS Crisis Communication Library

The youngest member of SMCS Libraries is the Crisis Communication Library, launched by FEU in August 2023. D7.6 describes the Crisis Communication Library in more detail. The profile page is shown in Figure 9. It presents recommendations for efficient risk communication in disasters in the form of providing websites and Apps concerned with crisis communication. Within the Crisis

Communication Library, recommendations to enhance efficient communication with the public through social media at all stages of a disaster are collected. Risk awareness, preparedness, and appropriate behavior during and after a disaster is key to mitigate its effects on people. The purpose of this library is to ease communication with the public via social media text messages taken from trustful resources. The library equips practitioners with websites and apps for crisis communication. Users can refine searches using filters based on type and scenario, and either utilize or share the content through their social media accounts.



Figure 9: Overview Page of the SMCS Crisis Communication Library



Crisis Communication

Social Media and Crowdsourcing Library

The best way to cope with a disaster is an efficient crisis communication before, during and after such situation. Risk awareness, preparedness and appropriate behaviour during and after a disaster is key to mitigate its effects on people. The purpose of this library is to ease communication with the public via Social Media text messages taken from trustful resources.

The user can narrow down the results via filters and may either use (part of) the content and/or provide the link to the source via the own Social Media account. The use of the translation tools available in the various browsers allow for easy transfer of the texts into own messages.

Selected Filters

No filter. Showing all results.

Results: 60

Title	Scenario	Language
112NL - Emergency Call app for the Netherlands	Emergency Call	English, German, French, Italian, Spanish, Dutch, Danish, Hungarian, Arabic, Portuguese, Polish
AARDBEVING		Dutch
Akuthjælp til Døve		Danish
AllertaLOM - Allerta Regione Lombardia	Public Warning	Italian
Alluvione - Cosa fare	Flooding	Italian

Filters
✕

CLEAR FILTERS

Type —

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

App
 Text
 Website

Scenario +

Disaster Management Phase +

Language +

Source: LCC

3.3 Integration of the SMCS Libraries within the User Guidance

The LINKS Framework, developed over three years within WP5, integrates knowledge from the three knowledge domains - disaster risk perception, disaster management processes, and disaster community technologies - into a comprehensive resource. It focuses on two key themes: engaging with citizens and improving communication. The LINKS Framework consolidates expertise and insights on the use of SMCS in disaster situations, transforming this knowledge into accessible products for stakeholders. The User Guidance (cf. Figure 10) directs users in the LCC to the most pertinent resources for their needs through targeted questions, enhancing their decision-making and resource utilization in various scenarios. The final iteration of the development focused on refining the User Guidance into a more streamlined User Guidance approach, detailed in D5.5. Via thematic areas, the LINKS products are connected to the thematic questions of the User Guidance to help users navigate in the LCC. A navigation compass serves as a starting point from which the user can select either the theme “Improving Communication” or the theme “Engaging with Citizens” (Fonio & Larruina, 2023) (Larruina R. C., 2023). Throughout these stages, the SMCS Libraries played a crucial role, especially in the last two phases, where multiple matching exercises were conducted. These exercises aimed to align the content of the Technologies and Use Cases Library with the relevant themes and questions of the User Guidance.

Figure 10: SMCS Libraries within the User Guidance

User Guidance

The LINKS User Guidance, like a compass, aims to support navigation and orientation within and across two main themes – Engaging with Citizens and Improving Communication – so that disaster management organizations and relevant stakeholders can take more informed decisions on the uses of Social Media and Crowdsourcing through the LINKS products. Orientation is supported by pre-defined questions that guide users towards the LINKS products.

Please select the themes you are interested in below.

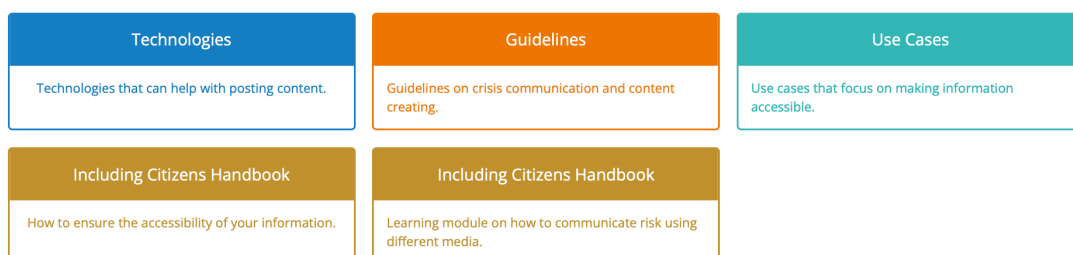
— Improving Communication

+ Targeting Communication

+ Ensuring Credible Information

— Making Information Accessible

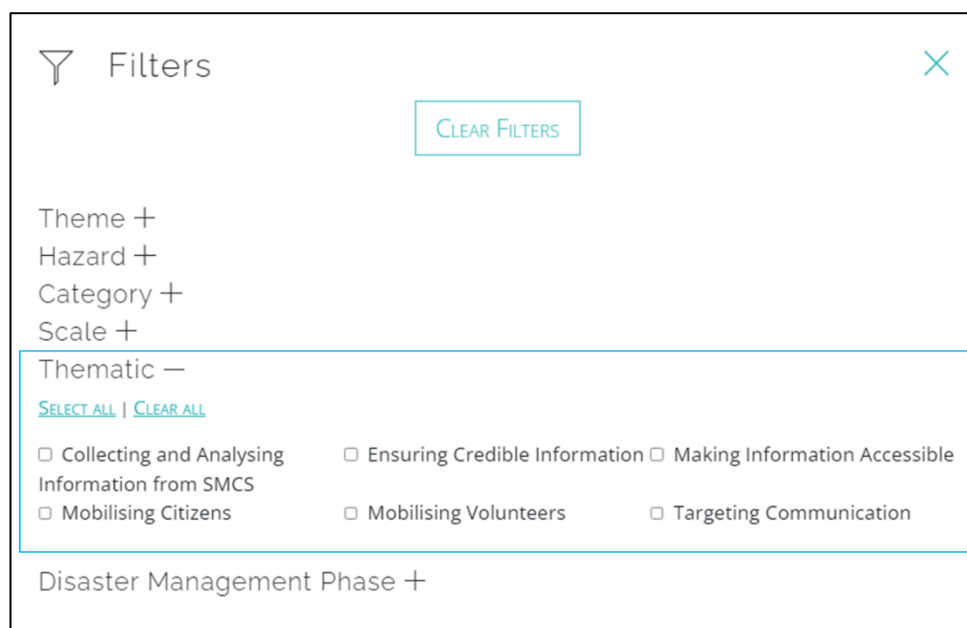
— How can you make your information accessible?



Source: LCC

The assignment of library content to the LINKS Framework's questions is a meticulous process, achieved through the careful selection of relevant categories, facilitated by preselected filter criteria within the LCC. For instance, the Technologies Library offers a range of technologies specifically designed to meet functions like "Search & Monitor" or "Analysis." These are in direct response to user queries such as "How can you search and monitor information?" or "How can you carry out content analysis?" This approach ensures that users are seamlessly directed to technologies that align with their specific needs. In terms of integrating the Use Cases Library into the User Guidance system, a more comprehensive strategy was employed (cf. Figure 11). The Use Cases Library, enriched by contributions from users' experiences with SMCS in disaster scenarios, can encompass all aspects of User Guidance. Contributors can select one or more thematic areas when submitting a use case, thereby aligning it with a specific sub-theme of the User Guidance. Consequently, when a sub-theme is chosen in the User Guidance, all use cases relevant to that sub-theme become accessible to the user, thanks to the content's thematic alignment. This holistic approach not only enhances the usability of the Use Cases Library but also ensures that users have access to a wide array of relevant and practical scenarios.

Figure 11: Thematic Criteria for the Use Cases Library



Filters ×

[CLEAR FILTERS](#)

Theme +
Hazard +
Category +
Scale +

Thematic —

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

Collecting and Analysing Information from SMCS Ensuring Credible Information Making Information Accessible

Mobilising Citizens Mobilising Volunteers Targeting Communication

Disaster Management Phase +

Source: LCC

4. BROADER CONTEXT APPLICATION AND SUSTAINABILITY THE SMCS LIBRARIES

Incorporating and understanding the importance of both sustainability and broader context application of the SMCS Libraries was crucial already after concrete plans for the SMCS Libraries have been developed. A **broader context application** refers to the practice of extending the impact and relevance of the SMCS Libraries within but also beyond LINKS. This approach is about exploring how the findings and solutions of a project can be applicable and beneficial in various scenarios, across different fields, and for a diverse range of stakeholders.

This section details the various activities undertaken to guarantee not only a broader context application of the SMCS Libraries but also their sustainable usage well beyond the project's lifespan. The case activities summarised in **Section 4.1** in LINKS form a crucial foundation for broader context application. Practitioner organizations can directly assess and implement these results in real-world scenarios, further extending their reach through network dissemination. A key instrument in this process were the LINKS Community Workshops. These workshops, organized within the cases alongside network stakeholders, focused on evaluating and applying the products developed. **Section 4.2** presents an example on the implementation of a SMCS technology in the Municipality of Frederiksberg, showcasing the outcomes of collaboration with the Cases.

The LINKS Advisory Committee (**Section 4.3**) meetings also played a central role in the broader context application. In these gatherings, experienced consultants from the project first reviewed the SMCS Libraries and the LCC, subsequently promoting them across their respective networks and organizations. Additionally, showcasing the SMCS Libraries at select events and conferences (**Section 4.4**) proved to be an effective strategy for bringing the results closer to practical application, thereby generating a significant multiplier effect.

Acknowledging the critical role of application-oriented science in the broader context application, the project placed a strong emphasis on scientific publications (**Section 4.5**). This focus ensured that the research findings were not only academically robust but also readily accessible for practical implementation in relevant fields. These efforts were complemented by targeted dissemination activities related to the LINKS results, which saw a notable increase as the project neared completion (**Section 4.6**).

4.1 Summary Case Assessments

The case assessment was instrumental in refining and enhancing LINKS products, as well as in identifying interconnections across the three knowledge bases and fostering interdisciplinarity among the three libraries, encompassing both research-driven and practitioner-driven activities. In addition to a constant iterative evaluation and validation process in close cooperation with the

cases, the following activities for the broader context application of the products should be emphasised:

- **Interviews across Cases:** In total, 54 expert interviews were conducted across various cases, focusing on SMCS. These interviews were crucial for analyzing and enhancing the Technologies Library. Key codes like “Descriptions of SMCS technologies” and “Future potential of SMCS technologies” were thoroughly examined. The discussions were categorized into “Needs”, “Plans”, “Concerns”, and “Insights”, leading to the identification of over 30 topics. Some of these topics were pivotal in updating the library, while others reinforced existing sections. Particularly, the insights significantly improved the “Functions” category, addressing aspects like the need for broader reach and legal concerns. The interviews also shed light on SMCS technologies currently in use or previously used by practitioners, resulting in the addition of three new technologies to the library. The insights from these interviews provided crucial information for adapting the Technologies Library to broader contexts, ensuring its relevance across diverse scenarios and user needs. A more detailed overview of the results can be found in D6.4 (Clark, et al., 2022) and D2.7 (Lüke, et al., 2022).
- **Europe-Wide Online Survey:** This survey was designed to investigate the current and future use of SMCS in disaster management, drawing responses from authorities, disaster management organizations, practitioners, and NGOs. It offered valuable insights into practical experiences, attitudes, and challenges associated with SMCS use. The survey also revealed new technologies not previously featured in the SMCS Technologies Library, leading to their inclusion. Moreover, it prompted updates to the library, such as adding the “Used by Practitioner” category and confirming the significance of various functions. The survey's findings highlighted the Technologies Library's applicability in a wide range of real-world situations, enhancing its broader context utility. A more detailed overview of the results can be found in D6.4 and D2.7.
- **Diverse Workshops:** A series of workshops, including three LINKS Community Workshops, and workshops during the first and second LINKS annual meetings (June 2022, July 2023), were instrumental in the development of the Technologies and Use Cases Library. Participant feedback from these workshops led to substantial modifications and enhancements, such as simplifying disaster phases, focusing on individual platforms rather than data types, and introducing new categories like "License Model." Feedback from these workshops directly influenced the Technologies Library's evolution, making it more adaptable and relevant for broader context applications. A more detailed overview of the results can be found in D6.4. and D8.5 (Reeson, Giacinti, & Nüssler, 2022).
- **Engagement with Civil Society Networks:** In February 2023, an expert interview with the leader of VOST Europe and VOST Portugal provided crucial insights into their use of innovative technologies for crowd-based operations and social media analysis. This interaction enriched the product development process, particularly highlighting how VOST Portugal effectively used crowdsourcing during the 2019 national fuel crisis. Their approach in disseminating information and coordinating volunteer efforts showcased the practical application and impact of these

technologies in managing real-world challenges. This case not only contributed a valuable use case to the SMCS Libraries but also underscored the importance of such collaborations for broadening the context in which these libraries can be applied, demonstrating their versatility and effectiveness in diverse situations.

- **Cooperation with local practitioners:** SIC engaged with local practitioners in Paderborn, including the fire department, which uses the Ubermetrics social media monitoring tool. Their feedback on using this technology provided crucial practical insights for refining the SMCS Libraries, emphasizing the need for application examples and the integration of technologies across the libraries. Additionally, a workshop with the Paderborn Police Department highlighted the value of having a structured overview of technologies to support the formation of a social media monitoring team. These interactions were vital for enhancing the usability and filter options of the libraries, making them more relevant and effective for broader context applications in various emergency management scenarios.
- **Cooperation with business providers:** In WP4, the collaboration with SMCS technology providers like Ubermetrics and PublicSonar is a key research activity. These partnerships, which include expert validations, offer insights into a range of technical features crucial for social media data management during crises. By focusing on identification, filtering, and analysis of public social media data, these technologies provide valuable information for disaster management organizations. Detailed discussions and live demonstrations of functions, particularly in the "Search & Monitor" and "Analysis" categories, not only enhanced the technical understanding but also helped refine these categories within the SCMS Technologies Library. This collaboration is vital for the broader context application of the SMCS Libraries, as it ensures that the technologies included are both relevant and effective for real-world crisis management and allows for the continuous updating and validation of the library's content based on expert insights and practical applications.
- **Cooperation with ENGAGE:** SIC participated the second Knowledge & Innovation - Community of Practice (KI-CoP) workshop hosted by ENGAGE, a sister project focusing on disaster risk management solutions. This workshop, building on the collaboration initiated at the 2022 EENA conference, aimed to deepen the understanding of the differences and similarities between ENGAGE's catalogue of solutions and the LCC. Insights for conceptual planning and integration, such as linking similar technology solutions, were gained through the examination of each platform's unique features and potential for cooperation. The participation was crucial for the broader context application of the SMCS Libraries, as it fostered collaborative opportunities and knowledge exchange between ENGAGE and LCC, enhancing the ability to develop more comprehensive and effective disaster risk management tools and strategies. The cooperation with ENGAGE was continued in the joint organisation of the fourth LINKS Advisory Board.
- **Site Visits:** During a two-day meeting in Paderborn, project partners from the Danish and Dutch cases, including Copenhagen Fire Brigade, Frederiksberg Municipality, University College Copenhagen, University of Copenhagen, Sitech Services, and the Zuid-Limburg Security Region,

discussed the progress of the LINKS Libraries with the Paderborn fire brigade. This collaboration, part of the INSPIRE project, involves collecting, filtering, and analysing social media data for operational use, a process demonstrated to the partners. This interaction sparked new ideas and led to revisions in the Technologies, Guidelines, and Use Cases Libraries, tailoring them more closely to practitioner organizations' needs and potential applications. The workshop also focused on enhancing the usability and relevance of the libraries. Adjustments were made to the Technologies Library's filter logic for more intuitive use, and the Use Cases Library was refined for better clarity and applicability.

- **Questionnaire:** Key stakeholders in drought situations like BBK, UBA, DWD, and UFZ shared their use of social media in managing droughts and heat waves, also learning about project outcomes and the LCC. Three organizations responded, detailing their SMCS strategies in such scenarios. These organizations use social media as a quick, effective way to convey important information, especially during extended droughts, including promoting water conservation. They collaborate, sharing content and strategies to increase effectiveness. For instance, DWD disseminates real-time weather updates and directs users to BBK's resources, integrating health information from the Ministry of Health for comprehensive public guidance. While all organizations distribute information via social media, only one actively collects data from it during droughts, tracking hashtags and trends for more focused communication. The absence of automated social media monitoring tools highlights the SMCS Libraries' significance in the LCC, with the survey underscoring the LCC's value and applicability.

4.2 Practitioner's Viewpoint on the Application of SMCS

As part of the site visit (cf. Section 4.1), an initiative was launched with the Municipality of Frederiksberg to select a technology with the help of the SMCS Technologies Library. The aim was to advance the social media monitoring, being aware what the public opinion is. The following narrative from FRB describes the application of SMCS technologies, their experiences and benefits achieved due LINKS.

Practitioner's Viewpoint

The municipality of Frederiksberg (FRB) wishes to engage with citizens when adapting Frederiksberg to more frequent cloudburst. When asking citizens about risk perception there is a clear pattern that they want to take initiatives to secure their homes, but they do not always know what to do. When inviting to meetings concerning cloudburst management the attendance is often low and consisting of senior people. Overall, the citizens are active on social medias and try to help each other with information concerning different topics.

To get more knowledge about how the citizens use social medias when looking for information the municipality decided to try social listening.

Applying the filter system of the SMCS Technologies Library and talking to the communication department of the municipality it was decided to try Retriever (a selection process within the SMCS Technologies Library for a suitable technology is detailed in the user stories in D5.4). First it was very promising as retriever said that they would also be able to look in closed groups, this however was not the case, due to meta restrictions. Not being able to search in closed groups is a problem as several of the local groups used by the citizens to communicate is closed groups.

Therefore, we also decided to do a manual monitoring of the closed groups to get additional information.

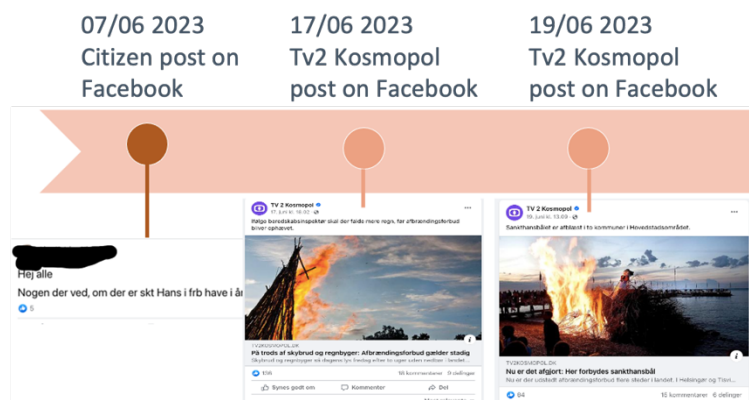
Another problem has been that there has been no cloudburst this year and therefore the topic has not been interesting, however we had a drought in the early summer, we therefore in lack of water followed the communication of that topic.

When looking at direct results about citizens use of social media it is scares. However, a good thing that has come out of this is that collaboration with the communication department at the municipality which previously has been very limited now is good as the communication department has shown interest and there has been several meetings discussing the use of social listening now and in the future.

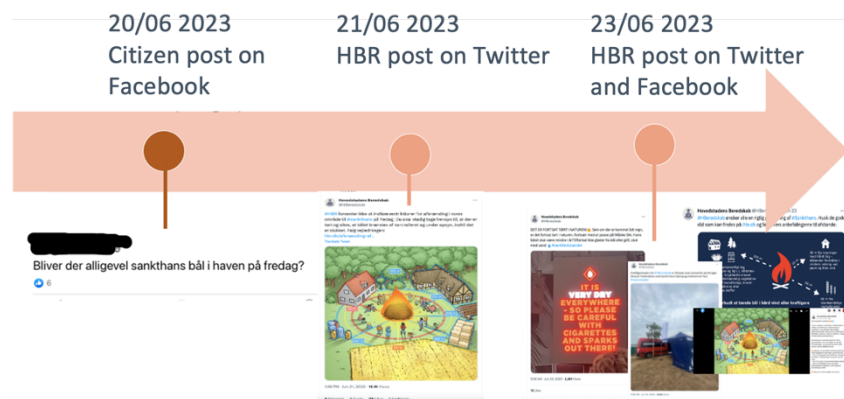
Example bonfire case:

In the early summer in Denmark there was a long period of drought leading to the authorities requesting not to use drinking water to water the garden. It was around the time were there I Denmark is a national bonfire day which a lot of Danes celebrates. The citizens were afraid that it would not be permitted to have the fires. The case here shows that the citizens take up the topic on the social medias and try to come with information and give explanations before there is information from authorities about the situation. The following timeline in Figure 12 shows the relevant events monitored with Retriever during the bonfire case:

Figure 12: Timeline Bonfire Example



Source: LCC



Source: FRB

4.3 LINKS Advisory Committee Meetings

The LINKS Advisory Committee (LAC) is composed of selected experts from various stakeholder organizations across different disciplines from the field. They are well acquainted with the projects results, connected with a wide network of practitioners and researchers and an excellent opportunity to increase the impact in the broader context.

In February 2022, the **second LAC meeting**, organized by SIC and detailed in Deliverable 8.4 (Bianchi, Giacinti, Vieilleigne, & Nuessler, 2022), focused on evaluating the SMCS Technologies Library, the Guidelines Library, and the LINKS Community Center (LCC) structure. Comprising experts familiar with the project, the LAC provided in-depth feedback, particularly on selecting appropriate technologies for various tasks and the overall utility of the Libraries and LCC. Key outcomes included the introduction of a "Verification" filter in the SMCS Technologies Library to address trust issues in social media information and the addition of a "Media" category to cater to specific user groups like media professionals and social media teams within Disaster Management Organizations (DMOs). These enhancements, driven by expert feedback, significantly contributed to refining the LINKS project's outputs, ensuring their practical applicability and relevance in diverse disaster management scenarios.

In February 2023, the **third LAC meeting**, led by VU and product owners, focused on validating the Technologies Library and reviewing the Use Cases Library. Building on the second LAC meeting's feedback, this session aimed to refine the libraries and the LINKS Community Center (LCC), including evaluating design, searching for relevant information, setting future expectations, and exploring sustainability strategies. A structured questionnaire, developed through interactive workshops, guided the discussion, ensuring efficient feedback processing for the project's advancement. Participants, familiar with the LINKS outcomes, offered constructive suggestions for improvement, many of which have already been integrated into the project, enhancing its practicality and relevance. Key feedback included requests for more detailed usage evidence of technologies,

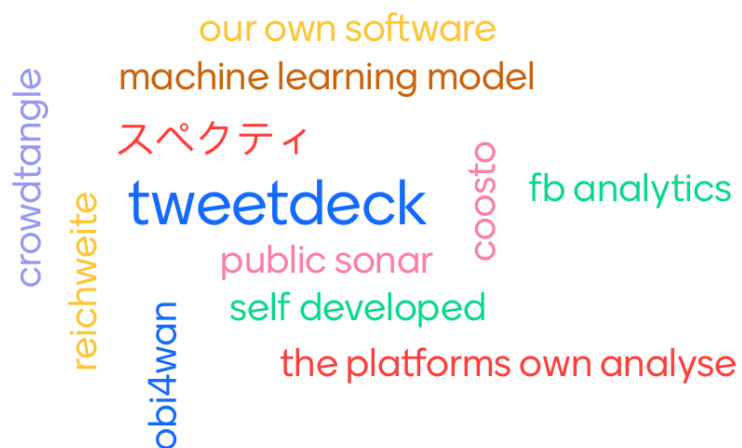
granular filtering options, operational usage information, success criteria for use cases, and resource requirements for activities.

The **fourth LAC meeting**, held in Rotterdam from June 20-22, 2023, coincided with the ENGAGE project's Advisory Committee meeting, forming a joint ENGAGE/LINKS workshop. This convergence offered a unique platform for the LINKS product owners to receive feedback from an external expert group, enhancing the development of LINKS products and fostering community growth through synergies with the ENGAGE project. The workshop began with an exhibition where participants explored the results of LINKS and ENGAGE. The LINKS sessions, moderated by SIC and FEU, initiated a comprehensive discussion on the advantages of incorporating social media into the operational structure of disaster management, particularly from the perspective of public safety answering points. This conversation continued into an in-depth exploration of the processes involved in establishing a dedicated social media team within emergency service organizations. Central to this discussion was a set of guidelines, meticulously developed within the LINKS project, which served as the foundational blueprint for this process. Following this, the session transitioned into a practical, hands-on exploration of the SMCS Technologies and Use Cases Libraries. This segment provided valuable insights into how these resources can be effectively applied in real-world disaster scenarios, demonstrating their practical utility and relevance. To enrich the interactive experience, the workshop leveraged the Mentimeter platform, which played a crucial role in fostering a dynamic and engaging environment (cf. Figure 13). This tool enabled a seamless flow of real-time feedback and queries between the audience and the presenters, ensuring an interactive and responsive dialogue that enhanced the overall effectiveness and impact of the session.

Figure 13: Example Question of the LAC Meeting

If yes, which social media analysis or crowdsourcing technologies?

13 responses



Source: LINKS

The second day focused on identifying synergies and exploitation routes between LINKS and ENGAGE, recognizing their common goals in enhancing disaster resilience, bridging communities with authorities, and leveraging social media for real-time communication. Proposed synergies included sharing results, joint participation in events, synchronizing glossaries, and potentially merging platforms and results, highlighting the workshop's significance in broadening the application and ensure sustainability of the SMCS Libraries in a wider context. The presence of a diverse group of stakeholders raised awareness about the project's objectives, likely leading to broader adoption. Overall, the LAC meeting was instrumental in aligning the LINKS project with the evolving needs of its users and stakeholders, enhancing its relevance and impact in disaster management.

4.4 Events and Conferences

In January 2023, the Technologies Library at the LCC during the "**Research for Civil Protection**" expert congress, organized by the Federal Office of Civil Protection and Disaster Assistance (BBK), was presented. This event aimed to validate the library by collecting feedback from a diverse group of civil protection scientists. The presentation led to valuable insights and fostered connections with other national projects, notably initiating a collaboration with a project focused on social media monitoring and analysis technologies. This partnership offered immediate benefits, such as enhancing the Technologies Library's entries and improving technology profiles, making it a more useful resource. Strategically, the congress provided new avenues for promoting the LCC and sparked discussions on integrating SMCS into the daily routines of organizations, highlighting the congress's role in both immediate and long-term development of the library.

At the **EENA Conference 2023**, all SMCS libraries within the LINKS Community Center were showcased to stakeholders at a dedicated booth throughout the event, building upon the theoretical concept of the SMCS Technologies Library initially introduced in a panel discussion at the EENA Conference 2022. At the EENA21 Conference 2023, the LINKS Libraries and their role in the LCC were highlighted, showcasing their significance to a diverse audience from the European Emergency Number Association (EENA). This gathering, aimed at enhancing safety through improved emergency response networking in Europe, brought together professionals from various public safety sectors. The presentation of the libraries, which have undergone thorough validation for their effectiveness, received positive feedback, underscoring their essential role as comprehensive resources in public safety. The interest from stakeholders in showcasing their solutions within the libraries, such as integrating social media elements from control center software, although challenged by accessibility concerns, demonstrates the growing need for such collaborative platforms in enhancing crisis management. Furthermore, the interaction with LastQuake representatives, from the Euro-Mediterranean Seismological Center (EMSC), emphasized the value of crowdsourcing in public safety, offering a new dimension for LINKS to

analyze and incorporate into broader context applications, thereby enriching the understanding and approach to public safety and crisis management.

At the 69th **Annual vfdb Conference** in May 2023 (Association for the Promotion of German Fire Protection), a multifaceted discussion about the SMCS Technologies Library was engaged. Hosted in Münster, the session, led by the partner FEU (Federation of European fire officers), explored social media's role in crisis prevention. FEU initiated the session by outlining the process of establishing a social media team within municipal fire brigades. Following this, the audience was introduced to the SMCS Technologies Library within the LCC. The session also included insights from VOST Germany about their operations. Interactive participation from the audience, comprising German practitioners, allowed us to gauge their use of social media for emergency situation assessments and their reliance on related technologies. This discussion was crucial for understanding the practical application and effectiveness of the SMCS Technologies Library in real-world crisis management, providing valuable insights for its further development and broader context application in emergency response strategies.

A key event was the **Disaster Prevention Day 2023** in North Rhine-Westphalia, which provided a platform to deepen collaboration with various local and regional stakeholders, including the Fire Department and Municipality of Paderborn, the Federal Office for Civil Protection and Disaster Assistance, German Weather Services, and other aid organizations. This event showcased the potential of the LINKS Community Center (LCC) and its libraries to diverse groups, gathering direct feedback. Discussions focused on specific use cases, such as the 2022 Paderborn tornado, exploring the applications of social media and supporting technologies in crisis situations. These discussions led to the identification of new requirements for the use cases library. Overall, the Disaster Prevention Day highlighted the significance of disseminating scientific information to the public, strengthening ties with local practitioners and stakeholders, and building connections with policymakers, thereby underlining the pivotal role of the SMCS Libraries in enhancing disaster management and communication strategies.

At the **Final Event of LINKS** in Rome in October 2023, the final versions of LINKS solutions within the LCC were showcased and discussed with LAC members, as shown in Figure 14. A key topic that emerged post-presentation was the management of first responders. One LAC member emphasized the importance of accurately understanding who first responders are. The discussion highlighted the varied use of terms like 'First Responder', 'Lay Responder', and 'Spontaneous Responder' across Europe, often with vague or interchangeable definitions. The LCC's specific filters aid in delivering structured results, but there's a need to standardize these terms to avoid confusion and enhance incident management, reducing risks to and from responders. Additionally, the latest updates to the Technologies Library, Guidelines Library, Use Case Library, and the new Crisis Communication Library were presented and examined. LAC members acknowledged the LCC's comprehensive approach, covering scenarios, emergency phases, use cases, and technologies, as beneficial for first responders, regardless of the terminology used. They emphasized the significance of the LCC's

integrated search functions and selective filters for efficiently accessing relevant information. The LAC concluded that, with continuous updates and integration into future projects, the LCC is poised to become a vital tool for first responders aiming to incorporate social media into their operations sustainably. In closing, LAC members were encouraged to promote the LCC within their respective organizations and networks, leveraging the knowledge gained throughout their project involvement and particularly from the final event in Rome.

Figure 14: LAC Members discussing the SMCS Libraries



Source: FEU

4.5 Scientific Publications

Scientific publications in practice-oriented research networks are essential for the effective application of project results in disaster management. They play a key role in disseminating knowledge, linking the latest research with practical strategies. These publications are instrumental in bridging the theoretical and practical aspects, fostering collaboration between researchers and practitioners. This ensures that project outcomes are based on solid scientific principles, leading to informed decision-making and strategy development across multiple fields, ultimately bridging the gap between research and its practical implementation.

After the concept for the SMCS Technologies Library was developed, a work in progress paper was published at the ISCRAM Conference 2021. The ISCRAM community is an international community of researchers, policy makers and practitioners involved in the development and use of information systems in crisis management. The presentation and publication of the paper within this community established a basis for deeper collaboration with the ISCRAM network. This partnership is instrumental in broadening the dissemination of LINK's project results, both during and beyond the

project's lifespan. Through this network, a wider audience can be effectively reached, ensuring that the findings have a lasting impact in the field of crisis management.

The second scientific publication provided a practical guide on the utilization and contribution of knowledge within the SMCS Libraries, detailing their applications and the ways in which the community can engage with and enhance this knowledge. The presentation at the annual vfdb conference 2023 (cf. Section 4.3.) led to a technical article within the vfdb journal, which is a key medium for disseminating research, technology, and management in the field of fire protection. It includes article series that present research findings and practice-oriented projects in fire protection. The vfdb journal reaches a wide audience in German-speaking countries, particularly in the fire brigade, emergency services, and aid organizations sector. The journal, which is shown in Figure 15, has a strong online presence with a large number of followers and unique users on various social media platforms and websites, highlighting its importance and reach.

Figure 15: Scientific Contributions about the SMCS Libraries



Source: SIC

4.6 Increase of Reach (Dissemination of the SMCS Libraries)

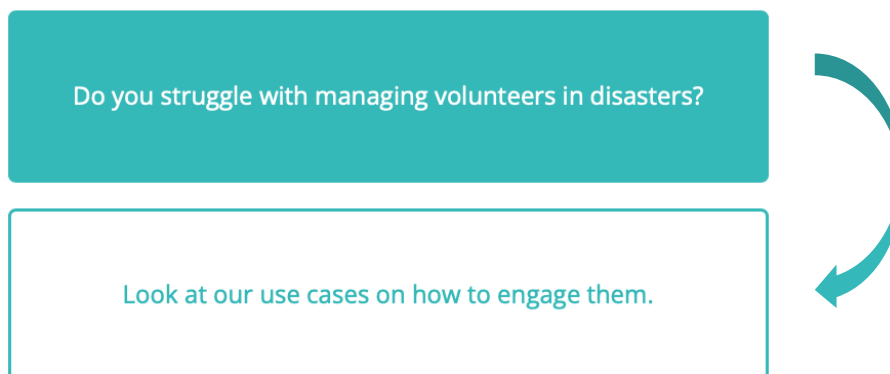
Disseminating information about the SMCS Libraries is vital for raising awareness and ensuring accessibility among emergency responders, policymakers, and researchers. It promotes the application of shared knowledge in crisis management, enhancing global disaster response effectiveness. Ultimately, this dissemination contributes to building community resilience, preparing stakeholders to effectively use social media in disaster situations.

From the standpoint of Work Package 4 (WP4), the **LINKS Newsletters** served as an effective tool for updating the project's extensive network on the progressive development stages of the SMCS Libraries. They also played a key role in inviting stakeholders to explore and utilize these resources. Newsletter 1 (January 2021) introduced the Knowledge Base, focusing on the challenges it aims to address and the methodology for evaluating technologies. This edition laid the groundwork for understanding the project's scope and its approach to technological exploration. Newsletter 2 (May 2021) highlighted the launch of the LINKS Community Center, which was online from that moment and features the SMCS Libraries. This marked a significant step in making these resources accessible to a broader audience and initiated measures to support broader context application and ensure long-term sustainability. In Newsletter 3 (August 2022), the enhanced second version of the SMCS Technologies Library was showcased, offering deeper insights into its revised visual and functional aspects. It also provided detailed explanations of its approach, the ease of accessing and utilizing information, and the intricacies of its filtering system. The final edition, Newsletter 4 (November 2023), presented the four fully developed SMCS Libraries, providing a comprehensive and user-friendly guide to their diverse applications, functionalities, and unique characteristics, culminating the project's efforts in a consolidated resource.

In collaboration with WP7, **snippets**⁵ were developed and integrated into the dissemination strategy to enhance the accessibility and visibility of the SMCS libraries, an example is shown in Figure 16. These snippets effectively spotlight key features, such as specific functions in the technologies library that are highly relevant to Disaster Management Organizations. These snippets effectively highlight key features, such as specific functions in the SMCS Technologies library, which are highly relevant to disaster management organizations. E.g. research indicates a significant demand among organizations for automated social media monitoring tools. To meet this need, a selection of relevant filters has been prominently featured on the LCC's homepage through these snippets. This strategy is also applied across other libraries, emphasizing particularly useful or exemplary use cases. Additionally, a specialized workshop dedicated to the creation of these snippets was conducted at the LINKS Annual Meeting in Osnabrück in July 2023, further enhancing the user-friendliness and accessibility of the libraries. The development process and concept behind the snippets is described in more detail in D7.6.

⁵ Snippets in websites are short excerpts or previews of content that provide a quick overview or summary of what the page or article is about. They are typically displayed in search engine results or on web pages to give users an idea of the content before they click through to the full page. Snippets are useful for improving user experience by helping users determine the relevance of a page to their search query or interest. They also play a role in search engine optimization (SEO), as well-crafted snippets can increase the likelihood of a user clicking on a link, thereby driving more traffic to the website.

Figure 16: Example of a Snippet for the Use Cases Library



Source: LCC

Furthermore, a short promotional video was produced in collaboration with partners FEU and UCL to engage stakeholders with the SMCS Libraries. Videos allow for the dynamic presentation of the libraries, using visual storytelling to capture the audience's interest and convey key messages succinctly. In the video, shown in Figure 17, a fire officer from FEU discusses the needs of his fire brigade regarding improvements in working with social media. The primary focus is on enhancing situational awareness during major incidents, particularly forest and moorland fires caused by prolonged droughts in the region, as well as advancing communication with the public. To address these needs, the LCC is presented as a key resource with its important libraries, making it accessible to a wide audience.

Figure 17: Promotional Video of the SMCS Libraries

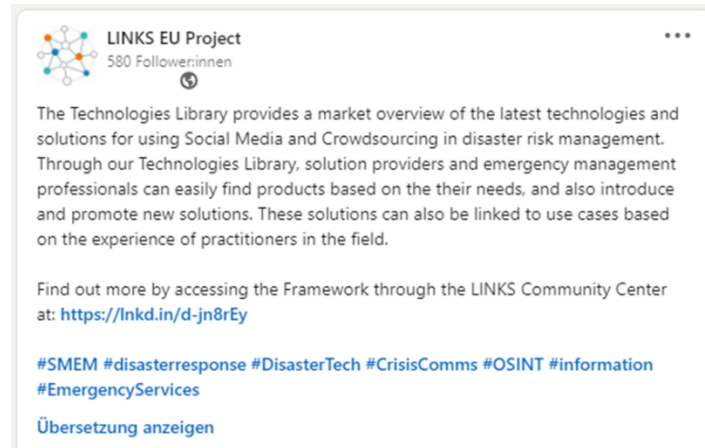


Source: FEU and SIC

Throughout the project's duration, the reach of the LINKS account on social media, has consistently expanded in terms of both the number and diversity of stakeholders. Naturally, in a project about social media, social media channels are leveraged to promote the SMCS Libraries. Consequently,

tailored texts were crafted for the libraries, catering to the specific needs of different target groups. The social media campaign, shown in Figure 18, was led by the partner LCU, aimed at highlighting the most relevant aspects for each group, thereby enhancing engagement and attention.

Figure 18: Promotion of the SMCS Libraries over Social Media



Source: LINKS

5. CONCLUSION AND LONG-TERM VISION BEYOND LINKS

Deliverable 4.5 is the final deliverable from Work Package (WP) 4 on SMCS technologies and their application in disaster management and thus concludes the activities carried out as part of this knowledge base. The work done within WP4 is focused on achieving a comprehensive understanding of how SMCS technologies can be used and integrated within disaster management.

To support disaster management organisations utilizing SMCS, WP4 pursued the strategy to methodically organizing and structuring complex data and extensive information into an accessible, user-friendly environment. Technologies, guidelines, use cases and communication recommendations were meticulously gathered, compared and analysed. The information were then incorporated into the relevant libraries within the LCC, making them accessible to a diverse array of stakeholders including practitioners, researchers, policy makers, and the wider DRR community. Equipped with a user-friendly filter system, these libraries offer uncomplicated access to structured knowledge on various aspects of the application of SMCS. Incorporated in an overarching LINKS Library model the following libraries were designed to strengthen the use of SMCS in European disaster management:

- The **SMCS Technologies Library** gathers and structures information about existing technologies to provide an up-to-date overview and thus support the selection of suitable technologies. The goal is to face the growing heterogeneous use of technologies in disasters and the overwhelming number of technologies on the market.
- The **SMCS Guidelines Library** (co-development with UCPH and FEU): gathers and structures existing guiding documents (guidelines, legal documents, Standard Operation Procedures) that support the implementation and use of social media and crowdsourcing in disaster management organisations.
- The **SMCS Use Cases Library** collects experiences and use cases of how SMCS have been used or can be used in real world. This enables the opportunity to give disaster management organisations a concrete indication of how they can use SMCS in practice.
- The **SMCS Crisis Communication Library** (development led by FEU) collects recommendations, apps, and websites with predefined social media messages to ease communication and increase risk awareness, preparedness and appropriate behaviour during and after a disaster to mitigate its effects on people.

This deliverable presents the monitoring and the assessment of the application of the knowledge base within the LINKS cases and in the broader context. This document thus describes the finalization of the work from WP4 by:

- Monitoring the knowledge base by summarizing the latest updates, focusing on enhancements to the SMCS Libraries, their evaluation in various cases, and integration into the LINKS Framework's User Guidance. This involves continuous tracking and analysis of market trends and technological applications of SMCS in disaster management.

- Providing a concise report on the broader application of the SMCS Libraries within and outside LINKS. This includes their use in LINKS cases and networks, interactions with the LINKS Advisory Board, participation in conferences and events, and dissemination efforts to highlight the SMCS Libraries' role in Disaster Risk Reduction (DRR).

A recognized challenge in disaster management and other fields is ensuring the **sustainability** and practical application of research findings after the completion of a project. Despite generating valuable insights and recommendations, these outcomes often fail to translate effectively into practice. SIC's vision includes keeping the SMCS Libraries as a sustainable, accessible resource beyond the project's lifespan. The long-term vision for WP4 beyond the project is focused on its continuous growth, adaptability, and relevance in an evolving environment. Central to this vision is the creation and nurturing of an online community centered around the LCC, serving as a web platform for interaction and communication. It's crucial to maintain the content and structure of the libraries beyond the project's end, achieved through collaborations with other knowledge platforms and extending into specific research areas, ensuring the knowledge base remains a dynamic and empowering. To ensure this, SIC will keep the LCC including the SMCS Libraries for at least 1 year after the project ends alive. Further information about the sustainability of LINKS and the products can be found in D9.6 (Sciarretta, E., Sposato, M., 2023).

Community engagement is considered essential in the strategy. In the LINKS project, a community of practitioners, researchers, and stakeholders was established, who actively update, contribute to, and benefit from the available resources. Besides that, at this point, it is evident that the SMCS Libraries will serve as valuable input for the Horizon Europe **project SYNERGIES**⁶, which is set to commence in December. Further, a deeper collaboration with other knowledge platforms will also be handled via the SYNERGIES project. Hence, there exists a strong link with CMINE⁷ and other possible platforms through the involvement of the partner RAN (Resilience Advisory Network⁸).

As Sections 2 shows, relevant technological trends, as well as by global political upheavals, disasters and conflicts have taken place over the course of the project that have influenced the work of the knowledge base and should be addressed by **further research**. The integration of Artificial Intelligence (AI) into disaster management, particularly in the use of SMCS, presents a promising area for future research. This field explores how AI can enhance the analysis and utilization of data from social media platforms during crises. Potential research could focus on developing AI-driven tools for real-time monitoring, data sorting, and analysis to achieve quicker situational awareness.

⁶ The aim of SYNERGIES (Horizon Europe, 2023-2026, Grant Agreement Nr. 101121172) is to enhance disaster preparedness by engaging various stakeholders, including responders, communities, and businesses. It addresses five key needs: involving all actors, improving education and communication, managing volunteers, and ensuring sustainable solutions. Leveraging insights from six projects, it integrates best practices, fills gaps through targeted research, and evaluates progress via three real-life cases.

⁷ <https://www.cmine.eu/>

⁸ <https://www.resilienceadvisors.eu/>

Another key area is the use of AI for sentiment analysis and the identification of emerging trends, which could lead to more effective coordination of disaster response efforts. AI could also be utilized to address the challenges posed by the spread of misinformation, disinformation, and the rise of radicalization through social media, especially during the recent pandemic. Future research in this area could concentrate on devising strategies and technologies for identifying and neutralizing online misinformation and radical influences. This research might involve the development of sophisticated algorithms and AI tools aimed at the early detection of false information and the analysis of social media trends. The objective should be to understand and lessen the influence of radical groups.

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