

LINKS

Strengthening links between technologies and society
for European disaster resilience

D2.2 DISASTER RISK PERCEPTION KNOWLEDGE BASE

*A CONSOLIDATED UNDERSTANDING OF DISASTER RISK PERCEPTION IN SOCIAL
MEDIA AND CROWDSOURCING*

Research Report

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EXECUTIVE SUMMARY

About the project

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

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

Bringing together 15 partners and 2 associated partners across Europe (Belgium, Denmark, Germany, Italy, Luxembourg, the Netherlands) and beyond (Bosnia & Herzegovina, Japan), the project will develop a framework to understand, measure and govern SMCS for disasters. The LINKS Framework consists of learning materials, such as scientific methods, practical tools, and guidelines, addressing different groups of stakeholders (e.g., researchers, practitioners, and policy makers). It will be developed and evaluated through five practitioner-driven European cases, representing different disaster scenarios (earthquake, flooding, industrial disaster, 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

Disaster risk perception (DRP) can be seen as the ways in which individuals and groups appropriate, subjectivize, and perceive risks. In a changing technological landscape, this deliverable aims to provide the state-of-the-art of the existing scientific literature linking SMCS with DRP. It contributes to the overall objective in LINKS of producing sustainable advanced learning, through the development of the Disaster Risk Perception and Vulnerability (DRPV) knowledge base (KB) in the project. This document (D2.2) is a research deliverable that will support the construction of a methodology for the case-based assessments of the LINKS Framework accessible through the LINKS Community Center (LCC). It is a research deliverable, but one which is useful for a wide variety of

stakeholders involved in the LINKS community (e.g., both researchers and practitioners) as well as of interest for the wider scientific research community working on DRP and SMCS.

Methodologically, this deliverable is the result of a structured literature review of secondary empirical sources, that are published scientific papers and European project deliverables, that discuss the role of SMCS in all the phases of Disaster Management Cycle (DMC) in relation to the risk perception. Conceptually, the definition of both DRP and the factors that influence it are the theoretical foundations and the key concepts at the basis of the analysis of the role of SMCS in the assessment of DRP. A multi-level approach to classify these factors is used as the foundation to conduct this review.

To build the knowledge on SMCS in relation to DRP, an overview is created of risk perception studies that take into account SMCS in connection with multiple hazards, multiple ages, and diversity. This deliverable is closely linked to the vulnerability knowledge domain presented in the Deliverable 2.1: Disaster Vulnerability Knowledge Base. These two deliverables are indeed part of the same knowledge domain of DRPV. Moreover, this knowledge domain is also clearly connected to the other two Disaster Management Processes (DMP) and Disaster Communication Technologies (DCT), respectively presented in the Deliverables 3.1 (D3.1): DMP Knowledge Base (Nielsen & Raju, 2020) and 4.1 (D4.1): DCT Knowledge Base (Habig et al., 2020). The three domains are emblematic for three crucial dimensions of disaster resilience insofar as they investigate interactions among social, institutional, and technological dimensions while recognizing diversity at the individual, institutional, and systems levels.

The key findings of this deliverable can be summarised as follows:

- Even though the use of SMCS in disasters is widespread, there are very few works that take into account their role in relation to DRP;
- Media and SMCS are often believed to be very important for DRP, and trust in the source of information is one of the main factors in DRP studies;
- There are still some open questions: How and to what extent the media shape subjective DRP? What is really known about the media and SMCS influence on DRP;
- One of the main points that has to be addressed is the development of a SMCS culture that can be a useful tool for DRP, and not just a mechanism for the spread of false information;
- Very few studies have been dedicated to understanding risk perception in relation to vulnerable groups. Indeed, a specific focus is needed on these groups when assessing and evaluating the use of SMCS in DRP, also by employing a 'targeted' communication strategy.

There is a need to address the role of DRP in DMP and DCT, especially due to the lack of attention to this topic in European studies. The aim must be to understand how DRP is shaped by technologies, and how SMCS can be governed to ingrain them into systems that can help to improve knowledge and reduce the role of uninformed perceptions. In the coming years, the project will work towards

developing the LINKS Framework encompassing the knowledge gained from the studies across the three domains of DRPV, DMP, and DCT.

To conclude, this deliverable provides three key outputs feeding into D2.3, on the DRPV Methodology:

- An overview of existing knowledge on the role of SMCS in DRP and research gaps that LINKS project can address in this regard;
- The first draft of the DRP multilevel-approach for DMPs in the digital environment that will help to improve the role of SMCS in DM taking into consideration the role of disaster risk perception;
- Registries of existing knowledge (Annexes), summarized in Section 7, which will be translated from the KB into learning materials within the LINKS Framework, accessible to different stakeholders through the LCC.

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LIST OF ACRONYMS

Abbreviation / Acronym	Description
CLT	Construal Level Theory
DCT	Disaster Community Technologies
DMC	Disaster Management Cycle
DMP	Disaster Management Processes
DRM	Disaster Risk Management
DRP	Disaster Risk Perception
DRPV	Disaster Risk Perception and Vulnerability
DRR	Disaster Risk Reduction
ICT	Information and Communication Technology
KB	Knowledge Base
LCC	LINKS Community Center
SMCS	Social Media and Crowdsourcing
WP	Work Package

DEFINITION OF KEY TERMS¹

Term	Definition
Community	Local community – the people living in, serving or responsible for a particular small area, especially of a country (adapted from Cambridge University Press 2019). Besides geographical aspects, the community may also share common values, interests, and needs (UNDP, 2009).
Crisis Communication	Crisis communication includes the collection and processing of information for crisis team decision making along with the creation and dissemination of crisis messages to people outside of the team (Coombs and Holladay, 2010: 20).
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' (definition builds on Howe, 2006; see also LINKS Glossary).
Disaster	A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts (UNDRR, 2016).
Disaster Community Technology (DCT)	A DCT is a software(-function) for interaction with, within or among groups of people who have similar interests or have common attributes (communities) in case of a disaster as well as performing analysis of these interactions (LINKS Glossary and D4.1).
Disaster management cycle	Set of phases related to disasters and their management (UNDRR, 2016).
Disaster Management Processes (DMP)	A collective term encompassing a systematic series of actions or steps taken to reduce and manage disaster risk. Disaster management processes are often associated directly with the phases of the DMC. In the context of LINKS, we specifically refer to DMP as the policy frameworks, tools and guidelines developed to govern disasters across all phases of the DMC (LINKS Glossary).
Disaster risk management	Disaster risk management is the application of disaster risk reduction policies and strategies to prevent new disaster risk, reduce existing disaster risk and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses (UNDRR, 2016).
(Disaster) risk perception	Risk perception is the way individuals and groups appropriate, subjectivise and perceive risks that might or might not be calculated in an objective

¹ All definitions are retrieved from the LINKS Glossary (forthcoming).

	<p>manner during risk assessments. The importance of studying risk perception more seriously is obvious: risk perception directly influences people's ability and level of preparedness. Risk perception covers what is also referred to as "risk awareness" (UNDRR, 2016).</p>
Diversity	<p>Recognize diversity, the difference between people, including (but not limited to) gender, age, sexual orientation, economic status, religion, race, culture, ethnic background, political position and all the characteristics that make an individual unique. Beyond tolerance; demystifying, understanding and supporting.</p> <p>However, the LINKS project conceptualizes diversity in a broader manner, as the diverse processes, hazards and technologies that are involved in the disaster risk management cycle (LINKS Glossary and D2.1).</p>
Institutions	<p>Institutions are social structures that are composed of regulative, normative and cultural-cognitive elements that provide stability and meaning to social life. Institutions provide the 'rules of the game' and define the available ways to operate by discouraging, constraining or encouraging given behavioural patterns (Scott, 2001).</p>
LINKS Community Center (LCC)	<p>A flexible and user-friendly web-based platform for online sharing and integrating lessons learned and ongoing experiences and knowledge within the LINKS Community, as well as broader EU and international network (LINKS Glossary).</p>
LINKS Framework	<p>A set of learning materials, such as methods, tools and guidelines for enhancing the governance of diversity among the understanding of SMCS in disasters for relevant stakeholders. Methods in LINKS refer to approaches that will enable researchers and practitioners to assess the effects of SMCS for disaster resilience under diverse conditions. Tools are practical instruments supporting first-responders, public authorities and citizens with the implementation of SMCS in disaster and security contexts. Guidelines are recommendations for improving national and regional governance strategies on SMCS as well as introductions and explanations of how to apply the methods and tools under diverse conditions (LINKS Glossary).</p>
LINKS Knowledge Bases	<p>The outputs and knowledge obtained from the assessment of three knowledge domains. This knowledge is used to develop the LINKS Framework (LINKS Glossary).</p>
LINKS Knowledge Domains	<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</p>

	disaster risks induced by SMCS, as well as assessing the changes in the vulnerability of practitioners and citizens. Disaster Management Processes (DMP) for analysis of how SMCS changes the procedures and processes within the crisis and disaster management. Disaster Community Technologies (DCT), for assessing SMCS related technologies used by practitioners (and citizens) in disasters (LINKS Glossary).
Natural hazard	Natural hazards are naturally occurring physical phenomena caused either by rapid or slow onset events which can be geophysical (earthquakes, landslides, tsunamis and volcanic activity), hydrological (avalanches and floods), climatological (extreme temperatures, drought and wildfires), meteorological (cyclones and storms/wave surges) or biological (disease epidemics and insect/animal plagues) (IFRCC).
Resilience	The ability of individuals, institutions, and systems to recover from disturbance and to develop and adopt alternative strategies in response to changing conditions (definition builds on Tyler & Moench, 2012; see also LINKS Glossary).
Risk communication	Risk communication is the process of exchanging or sharing risk-related data, information and knowledge between and among different groups such as scientists, regulators, industry, consumers or the general public (IRGC, 2017:27).
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 (definition builds on Kaplan & Haenlein, 2010).
Sustainable Advanced Learning	A maintainable and evolving collection of knowledge and best practices produced for and by relevant stakeholders. Sustainable advanced learning entails a cognitive dimension (the capability to gain in-depth knowledge of crises and crisis response) and a social dimension (the ability to implement the knowledge into new practices) (LINKS Glossary).
Vulnerability	The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards. The LINKS project focuses on social vulnerability, which is interpreted as a

function of exposure, susceptibility and resilience. It is a pre-existing and dynamic condition, result of processes built over time (e.g., social power relations at national and international levels) and all the environmental and social circumstances that allow or limit community's capacity to deal with risks (UNISDR 2004 and D2.1).

1. INTRODUCTION

The terms 'crisis', 'disaster', 'catastrophe', and 'emergency' are sometimes used by scholars and practitioners alike as synonyms and with negligible differences (Hiltz et al., 2011a, b; Kaufhold et al., 2019). They describe a situation that cannot be overcome by normal structural and process organization (Reuter & Kaufhold, 2018) and, although there are still academic discussions on their definitions, it is accepted that they are not specific to any one hazard (whether from natural causes or human actions, such as terrorist attacks), nor completely uncontrollable. What is more, they have a significant impact on society (Hiltz et al., 2011a; Perry, 2018). While some authors use the concept of *natural disaster* (e.g., Mehta et al., 2017; Lai et al., 2018; Reuter & Kaufhold, 2018; Kankanamge et al., 2019), the most appropriate and nowadays accepted concept is *natural hazard* (Castro et al., 2017; Kaufhold et al., 2019), which underlines how disasters are no longer seen as natural, but as socially constructed events since natural phenomena interact with social risk construction (Reilly, 2009; Birkmann et al., 2014). Cardona (2008) has upheld that risk itself is the fundamental problem, while crisis/disaster/catastrophe/emergency is a derivative issue. This is why, according to Cardona, in the 1980s a transition occurred from *disaster* to *risk* management.

Risks, however, are not only physical phenomena. As already mentioned for disasters, they also reflect relationships with the environment and are culturally, socially, and psychologically constructed (Eiser et al., 2012). Thus, it is very important to take a multidisciplinary research approach to study disaster risk perception (DRP) as the social, cultural, and psychological dimension of risk interpretation. In fact, DRP could be directly influenced by people's competences and preparedness. Accordingly, the literature has shown how risk perception has a significant impact on individual and group behaviour (Hagen et al., 2016). The resilience of local communities can be improved if local risk perception is understood (Gregory et al., 1997). In the same way, risk communication strategies need to have a good knowledge of the local awareness of risks (Kellens et al., 2011). Thus, studies on DRP aim to understand the interconnections between perception and coping capacity and to provide communication tools that can improve communities' risk knowledge (Slovic, 1987; Fischhoff et al., 1982; Gough, 2000).

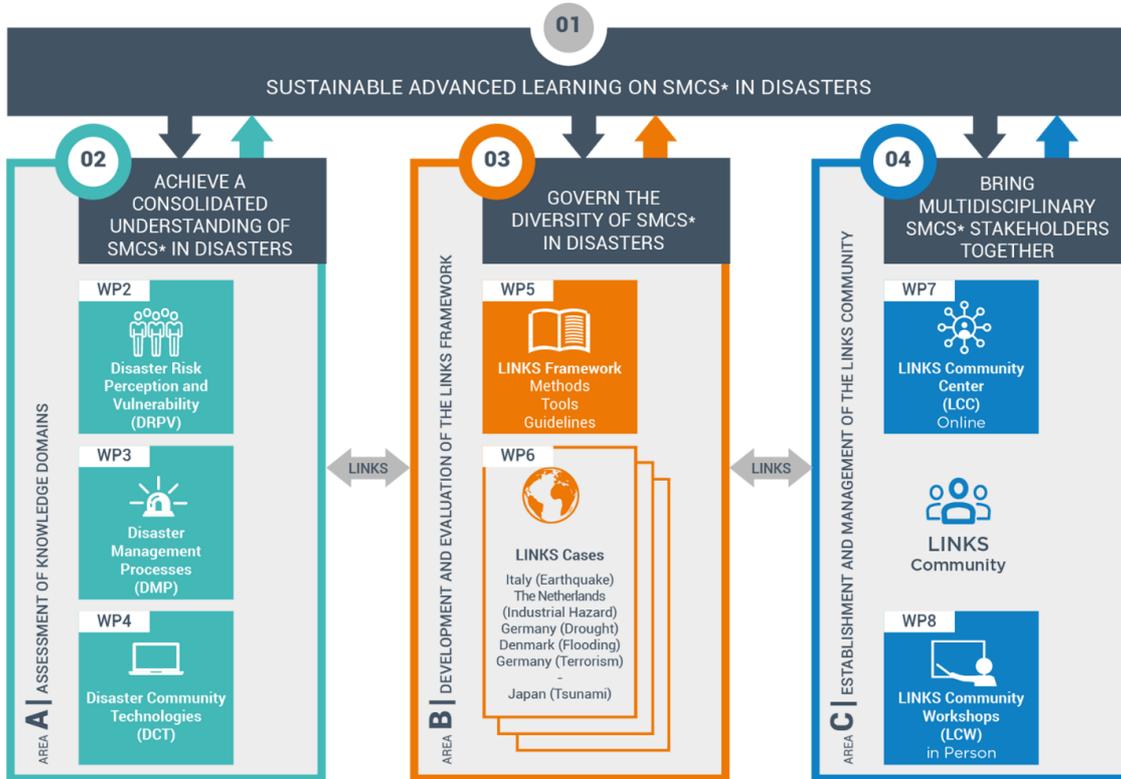
Despite the many efforts to pinpoint generic reasons for diversity in risk perception, it seems inevitable that individuals and communities base their risk perception on a multitude of factors, including their own experiences, past memories and, of course, expert risk assessments. It is crucial to understand and acknowledge that risk perceptions are deeply interwoven within local cultural practices and world views, and that local knowledge on disasters and risks therefore needs to be an integral part in disaster management processes. Thus, DRP can be seen as the way individuals and groups appropriate, subjectivize and perceive risks that might or might not be calculated in an objective manner during risk assessments.

In order to contribute to sustainable advanced learning on social media and crowdsourcing (SMCS) in disasters, three central themes have been identified in the LINKS project: Disaster Risk Perception and Vulnerability (DRPV), Disaster Management Processes (DMP), and Disaster Community Technologies (DCT). Accordingly, this deliverable is a research report which has the aim to contribute to the larger knowledge base (KB) on DRPV with a specific focus on risk perception (DRP), also understood as 'risk awareness', with particular attention to the role of SMCS and connections with vulnerability (analysed mainly in terms of 'diversity', see Deliverable 2.1 (D2.1) (Bonati, 2020). The dialogue between the two concepts is addressed in this deliverable at an introductory level, and will be discussed in depth in Deliverable 2.3 (D2.3): First DRPV – Methodology for the LINKS Framework and case assessments, to be submitted in May 2021.

In the LINKS project the knowledge base (KB) is defined as the state of the art, theoretical foundations, key concepts, or data available at a given time (i.e., the D2.1, D2.2, D3.1, and D4.1 submission time) within the three knowledge domains of DRPV, DMP, and DCT, and their role with SMCS. To build the KBs, a structured review of secondary empirical sources (e.g., published scientific papers and European project reports) has been carried out, as well as a scientific analysis of available data (e.g., DCTs in DMP). Building on this, within the LINKS project, it is important to make the collected knowledge applicable to various stakeholders. Thus, the results obtained with these four deliverables will form the foundational KBs which feed into the LINKS Framework.

The KBs provide the first assumptions and gaps which will be validated in five cases-based assessments of the Framework in different phases of the project (see Fonio & Clark, 2021a: D5.1 and Fonio & Clark 2021b: D6.1). Accordingly, the LINKS Framework is defined as “**a set of learning materials**, such as methods, tools and guidelines for enhancing the governance of diversity among the understanding of SMCS in disasters for relevant stakeholders” that contributes to learning at different levels and in different phases of the project. At its core, the Framework enables sustainable advanced learning through the learning materials by providing a dynamic structured way of accessing and contributing to varied amounts of knowledge on SMCS in disasters. These processes are supported by the LINKS Community Center (LCC), which will be the online environment for stakeholders in the LINKS Community (see Philpot & Reuge, 2020: D8.1) for accessing and contributing to the LINKS Framework and other project outputs (see Kiehl et al., 2021: D7.1) (see Figure 1)

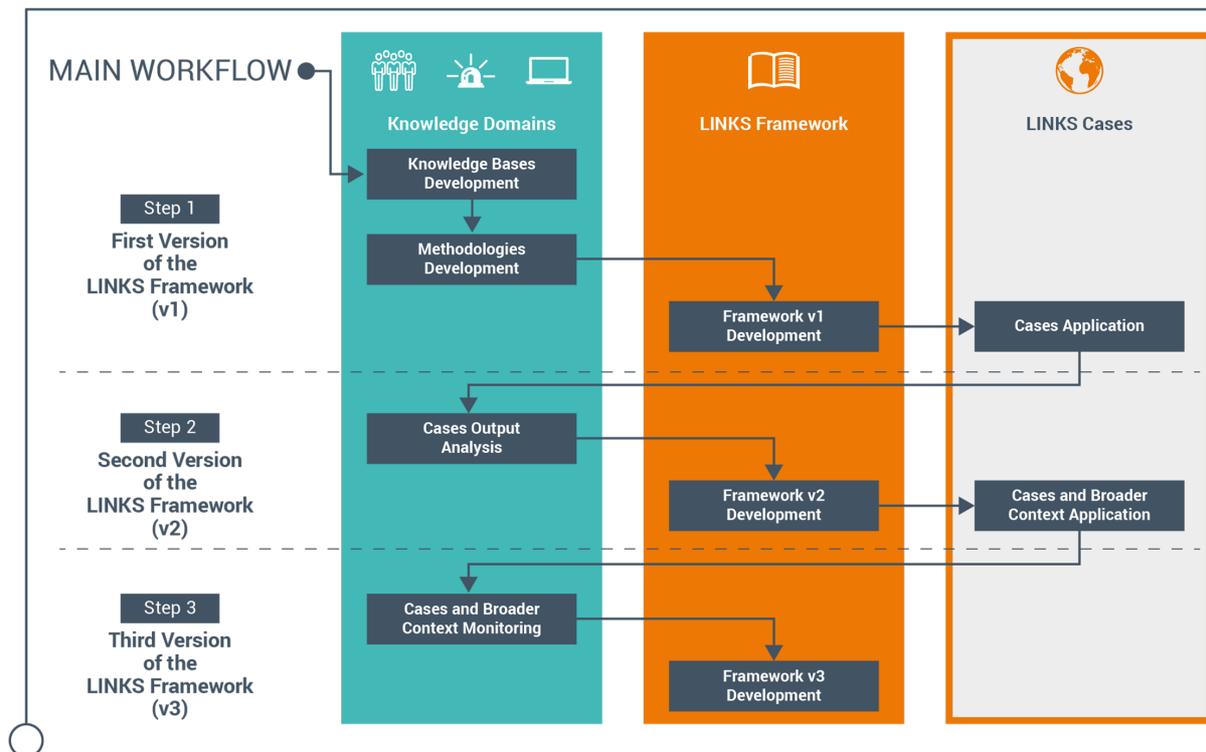
Figure 1: Concept of LINKS



Source: LINKS

This deliverable provides the first inputs from the DRPV KB for the development and evaluation of the Framework learning materials. The outputs of this deliverable will be integrated with those on the vulnerability domain from D2.1, in order to develop the first version of the DRPV methodology (D2.3). This DRPV methodology will guide and support the development of the LINKS Framework (WP5) and the five case-based assessments of the Framework (WP6). In particular, the purpose of this deliverable is to provide the results of an in-depth review on the concept of disaster risk perception with the aim of expanding the perception analysis to the digital environment. The DRPV multilevel-approach suggested in this KB will be improved and translated into the DRPV methodology in iterations in the project, and through the different phases of the Framework development and evaluation (Figure 2).

Figure 2: Workflow of LINKS



Source: LINKS

To construct the DRP aspects of the DRPV KB within the LINKS project, the following four research questions were formulated:

- How can DRP be defined and what main variables play an important role in its assessment?
- How is the diversity issue addressed in the literature on DRP and what main lessons can we draw?
- Since the implementation of SMCS in relation to DRP is a new and challenging research topic, what is the role of SMCS in DRP?
- How are SMCS implemented in DRP in order to boost the role of diversity in disaster risk management (DRM) and the capacity resilience of vulnerable groups?

To answer these questions, a literature review has been carried out to highlight the existing gaps in the knowledge domain. Section 2 provides information on the selection and analysis of the academic papers and European projects for the structured literature review. Section 3 illustrates a conceptual framework of DRP and explains the main variables, grouped into three main categories ('individual factors', 'interpersonal factors', and 'background factors'). Starting from these categories and variables, Section 4 sets out to draw the state-of-the-art of the role that SMCS play in the assessment of DRP, highlighting that few works are available on this topic, and thus that there are some gaps that need to be addressed. Section 5 discusses the main methods employed in the

literature to assess DRP and SMCS and their role in implementing knowledge. Section 6 illustrates the main conclusions, consideration and outputs feeding into the next steps in the project in relation to this deliverable and WP2.

This deliverable is first of all a product for the scientific community, to stimulate further studies on the role of SMCS in DRP, to understand possible future directions for discussions, for the LINKS partners involved in the methodology developments, and for WP5 that has the responsibility to design the LINKS Framework. However, this deliverable is useful for a wide variety of stakeholders involved in the LINKS community, and the results here produced are able to dialogue with different users, like practitioners and policymakers. The information provided aims to be a resource for those stakeholders responsible for DMPs. In this regard, the assumptions and findings from the deliverable have already been discussed, contextualized, and validated through meetings and workshops with LINKS practitioner partners which will be part of the case-based assessment of the Framework (see Section 2). These practical considerations are highlighted in boxes titled “Practitioners’ Viewpoint” in relevant sections throughout this document.

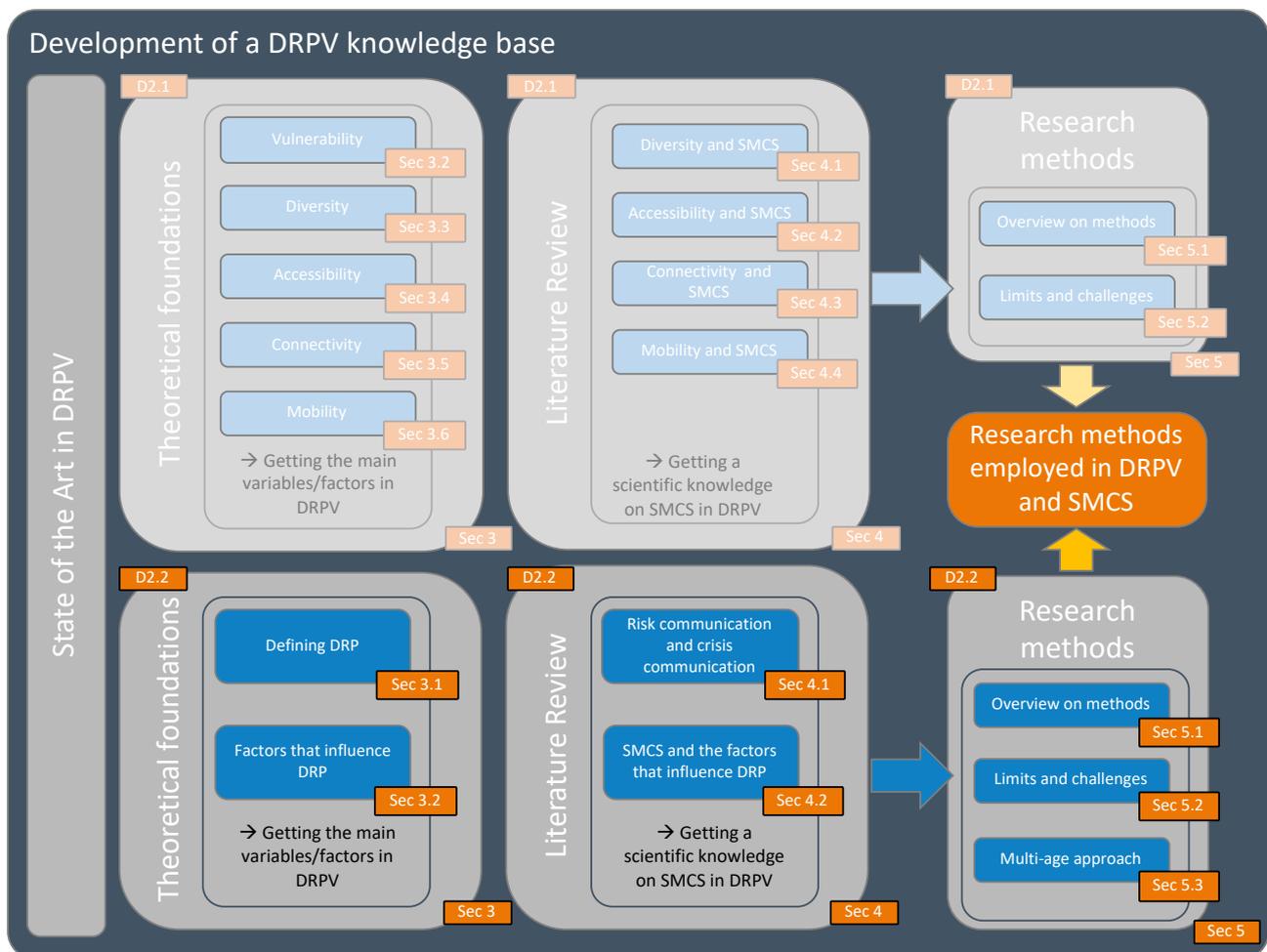
One example of the applicability of the knowledge produced in this deliverable, in line with a scenario provided in all the KB deliverables, is considerations for a heatwave and long-lasting drought in Europe where many communities face water shortages and consequent restrictions on water consumption. This scenario is characterized by a top-down and authoritative approach with lack of citizens inclusion in DMP. In past emergencies this has resulted in the lack of trust in the authorities and high public criticism. Thus, in the current crisis authorities think to use social media as a communication channel to better inform and reach citizens’ needs. The DRP multilevel-approach described in this deliverable will help to improve the communication process and thus to reduce the risk of peoples exposure, helping to structure a targeted information flow.

To conclude, the relevance of this deliverable is linked with its ability to provide an interpretative lens for the Framework on the role of risk perception in disaster risk management. The main variables identified in this deliverable are the conceptual basis for the LINKS Framework on the disaster risk perception, that will be used in defining the research questions and assumptions, and ultimately learning materials of the Framework such as methods, tools, and contents in the context of the overall DRPV KB. As the findings of this deliverable are critical for the progress of other processes and tasks, the work has been carried out in close consultation with the other deliverables on DMP in Deliverable 3.1 (D3.1) (Nielsen & Raju, 2020) and DCT in Deliverable 4.1 (D4.1) (Habig et al., 2020).

2. RESEARCH DESIGN AND METHODS

This section contains information about the type of research conducted, the data sources and collection methods, and how the data were analysed and used in the research. Moreover, this section justifies the methodological choices. The literature review has been carried out to lay the foundations for a DRPV methodology, which will be set out in D2.3 in Month 12 (June 2021). The research design is visualised in Figure 3.

Figure 3: D2.2 Research Design



Source: Authors' adaptation from D4.1

The main steps, presented in the following sections, consisted of:

- Establishing the kind of data sources to consider (scientific papers and reports) (details in Section 2.1);
- Establishing the criteria for collecting and selecting the data (details in Section 2.2);
- Making an in-depth reading and analysis of the selected papers (Section 2.3);

- Identifying the main variables of DRP (Section 3);
- Building the conceptual framework (Section 3);
- Applying the conceptual framework to SMCS in disasters and consulting local practitioners (Section 4);
- Identifying the gaps, the main research questions, and methods (Section 4 and 5).

2.1 Data Sources

The literature review about DRP and the role of SMCS in disaster studies was carried out between June and October 2020. The literature review entailed the analysis of worldwide scientific papers and European project reports, taking into consideration conceptual, theoretical, and empirical works in particular. The research was not limited to specific kinds of hazard but examined all three categories considered in the project: natural hazards, industrial/technological hazards, and terror attacks. Considering the amount of studies that discuss DRP, during the first literature review on the concept (covered in Section 3) it was decided to limit the studies on climate change and diseases to those texts deemed particularly relevant and innovative (according to the principle of saturation), as hazards not specifically addressed by the project (see Section 2.4). No primary data or data coming from datasets were collected or used in this phase. These research methods are expected to be used in the next steps of the project.

2.2 Data Selection and Collection

Papers/works have been identified, in accordance with vom Brocke et al. (2015), by searching Google Scholar, ScienceDirect, and Scopus websites for the following combined keywords: 'risk perception', 'multi-age', 'multi-hazard', 'multi-cultural' and 'cross-cultural', 'Europe', 'social media', 'disaster management', 'disaster community technologies', and 'vulnerability', in the singular and plural (Table 1), and with no restrictions concerning the time frame. Thus, only papers from the last ten years were considered in order to identify those most important and relevant to complete the KB. This is because this work is based on an existing literature review on risk perception (Bonati, 2014) that covered papers until 2014 and because several literature reviews on the topic already cover the period before 2010 (e.g., Rohrman & Renn, 2000; Visschers & Siegrist, 2008; Lechowska, 2018; Siegrist, 2019). The papers were first selected according to their abstract, and, if considered relevant, downloaded and read in depth. The references quoted in the selected studies were checked in a snowball fashion in order to be sure not to miss out any relevant works. Following the principle of saturation, the papers considered most relevant for the purposes of the project were included in the literature review process, in this case without temporal limits based on the year of publication. On the other hand, projects were found both by reading the scientific literature and searching on Google for keywords like 'risk perception (European) project', 'risk perception social media', and 'disaster management project'.

Table 1. The Most Relevant Keyword Combinations Used for the Literature Review

Section no.	Main keyword combinations used	Time frame of selected papers
Section 3	Disaster, risk, natural hazard(s), industrial/chemical hazard(s), terrorism/terror attack(s), earthquake(s), flood(s), drought(s), (disaster) risk perception, risk perception framework, conceptual framework	2010-2020
Section 4 and 5	disaster, risk, social media, crowdsourcing, (new) technology(ies), big data, natural hazard(s), industrial/chemical hazard(s), terrorism/terror attack(s), earthquake(s), flood(s), drought(s), (disaster) risk perception, (social) vulnerability, children, the elderly, immigrants/refugees, temporarily vulnerable people, people with disability(ies), Facebook, Twitter, gender, women, (mobile/smart) phones, European project, disaster management project, multi-age, multi-cultural, multi-hazard, disaster community technologies	2010-2020

The combined list of papers consisted of a large number of entries, hence the following selection criteria were applied:

- Temporal limits (as already explained above): The first research step only considered papers published in the last 10 years. However, papers identified through ‘snowballing’ were collected according to their relevance and without temporal limits on their publication;
- Spatial limits: When possible, the research was limited to European empirical works. This limit was applied in particular to project reports and methodological works;
- Methodological limits: In the first phase, review papers or papers with the highest number of citations were preferred. However, as said, empirical works were also analysed, selected because of their innovative approach and linkage with the purposes of the project;
- Hazard limits (as already mentioned): The literature review was not limited to some specific kind of hazards, but when possible, owing to the large number of publications, it was preferred to focus on the risks covered by the LINKS project, that are, earthquakes, tsunamis, floods, drought, terror attacks, and technological/industrial hazards. Moreover, works on climate change and diseases were considered on the basis of the limits already mentioned above;

2.3 Data Analysis

Two grids were developed to analyse the selected works. The first grid (see Annex I) is a spreadsheet document listing the works used for the literature review on the role of SMCS in DRP. It was the result of the discussions carried out with WP 3 and 4 leaders. The aim of this first exercise was to identify the following information:

- Type of document;
- If the paper is the outcome of a project;
- If the paper presents an empirical work;
- Main stakeholders analysed;
- Phases of the disaster risk management cycle discussed in the paper (prevention/mitigation, preparedness, emergency/response, recovery);
- Adoption of a multi-age approach;
- Adoption of a comparative approach;
- Geographical area of the research
- Kinds of hazards discussed;
- Adoption of a multi-hazard approach;
- Technologies discussed in the research;
- If specific materials used for the empirical analysis are attached.

Then, a table (not included in this document) in a Word document was filled in for each selected paper, providing the following information:

- Name of the paper;
- Case study (main characteristics);
- Method employed;
- Contents of the paper that fit with the purposes of the research;
- Critical aspects identified;
- Main definition provided for DRP;
- Main references used to provide the definition of DRP.

The third phase was to identify the main variables that affect DRP and to provide a conceptual framework. The construction of the conceptual framework started from a proper understanding of DRP as it is presented and discussed in the literature. The second step in the construction of the conceptual framework was the identification of the variables that go to define DRP itself (see Section 3.2). Accordingly, the main definitions of DRP provided in the literature were analysed (see Annex II) and the main variables were extrapolated. The analysis was then applied to DRP and SMCS (see results in Section 4).

As per Jabareen's suggestion (2009) on how to build a conceptual framework, our work followed the next steps of:

- Mapping the selected data sources;
- Reading and extensively categorizing the selected data;
- Identifying and naming the concepts;
- Deconstructing and categorizing the concepts;
- Integrating the concepts;
- Summing up and making sense of everything;
- Validating the conceptual analysis;
- Rethinking the conceptual analysis (if necessary).

The drivers that (implicitly or explicitly) occurred more frequently in the papers were depicted and discussed in broad categories, as can be seen in Section 3 (see also Wachinger et al., 2013).

To conclude, the validation phase has also seen the participation of the local practitioners, that have been consulted in two phases: in a preliminary phase with the aim of collecting existing knowledge about the cases (see also multi-level mapping results in D3.1: Section 5.3), and in a second phase with the aim of collecting their perspective on the results provided by this deliverable. Then, practitioners have been asked to contribute with their considerations on the issues emerging in the deliverable. The main results of the validation process have been collected and integrated in the practitioners' viewpoint boxes in Section 4 of this deliverable.

2.4 Limitations

The main limits that appeared in the literature review process were:

- The deliverable was due in M6 (November 2020). Owing to the limited available time, it was necessary to focus the literature selection and collection phase on more specific aspects of the research;
- The huge number of works that discuss DRP and that contribute to providing different (and sometimes contradictory) definitions;
- The limited number of works that discuss DRP and SMCS, which made it difficult to build a base of work;
- Differences in the number of works on the different types of hazard: natural hazards, technological/industrial hazards, and terror attacks.

PRACTITIONERS' VIEWPOINT

Throughout the first step of the analysis, (Section 4) boxes like this will provide a practitioner's viewpoint to supplement the findings from the research literature.

These boxes contain subjective reflections on how research findings match the everyday policy and practice of LINKS consortium partners and how these partners have approached the identified problems with concrete solutions.

3. THEORETICAL FOUNDATIONS AND CONCEPTUAL FRAMEWORK

This section is dedicated to laying the theoretical foundations for the DRPV Methodology in relation to SMCS. It provides the KB aspects on DRP that will be integrated in D2.3 (forthcoming in Month 12, June 2021) with the vulnerability analysis provided in D2.1. As mentioned in the Introduction (Section 1), four research questions have been formulated to construct the DRP aspects of the DRPV KB within the LINKS Project. This section specifically addresses the first and second questions, namely:

- How can we define DRP (Section 3.1) and what main variables play an important role in its assessment (Section 3.2)?
- How is 'diversity' addressed in the DRP literature and what main lessons can we draw (Section 3.2.4)?

For this second question, 'diversity' is addressed starting from the findings of the vulnerability knowledge base (see D2.1) and the definition provided in the LINKS Diversity Awareness Strategy (internal document). Thus, this deliverable considers diversity as one of the main variables to consider in the evaluation of the DRP.

3.1 Defining Disaster Risk Perception (DRP)

The steps to construct the DRP conceptual framework are briefly presented and discussed below. In particular, Section 3.1.1 provides a definition of the *disaster risk* concept (Section 3.1.1) as the first fundamental step to understand what we perceive and how we perceive it. Then, Section 3.1.2 briefly presents the scientific debate on a multi-level approach to *disaster risk perception*, with the aim of laying the foundations to build a multi-level framework to reading DRP in relation to SMCS.

3.1.1 The *Disaster Risk* Concept

Disaster risk is a complex concept since it refers to a disaster that has not yet happened. Hence, it is related to probability and possibility. The scientific literature provides various notions of disaster risk, but nowadays it is widely accepted that disaster risks are not only due to the entity of the phenomena, but mainly to the vulnerability of the exposed elements. Disaster risk is the potential loss of exposed subjects or an exposed system (i.e., the expected number of lives lost, injured persons, damage to property, or disruption of economic activities) expressed as the probability of surpassing a determined level of economic, social, or environmental consequence in a certain place and during a certain period of time (see Pazzi et al., 2016 and references within). Considering that disaster risk is an objective quantifiable variable, mathematical approaches have been established that link two or more of the following variables: damage, probability, intensity, hazard, vulnerability, and exposed elements. From the point of view of physical science, disaster risk is mainly related to hazard, vulnerability, and exposed elements.

On the other hand, it is useful to consider that from a social sciences point of view (see Douglas & Wildavsky, 1982), disaster risk is a social construction, which is the consequence of differences in lifestyle, power structure, ethical values, and linguistic uses. In this way, it is less easy to objectivize and quantify disaster risk, as it includes the dimension of perception.

Thus, in order to define/quantify disaster risk, interactions must be established between subjective risk perception and the scientific need for objective measurement. Therefore, risk assessment is defined as an objective evaluation of the actual risk to which a person is subjected based on past occurrences and the probabilities of new occurrences, mortality, and damage (Gierlach et al., 2010; Yong & Lemyre, 2019). On the contrary, the public evaluates risks based on 'subjective' dimensions such as negativity, familiarity, and controllability (Yong & Lemyre, 2019).

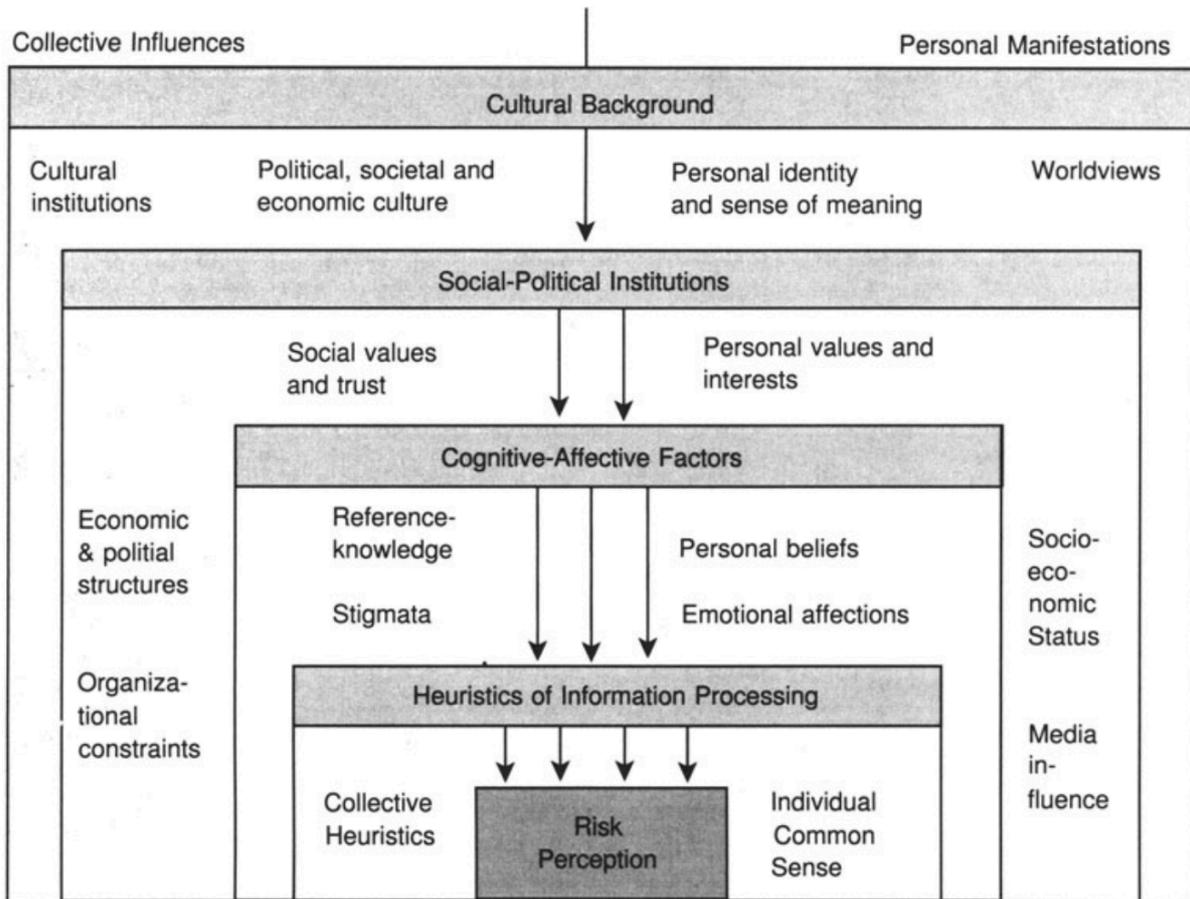
3.1.2 Towards a Multi-level Approach to Disaster Risk Perception

Since the end of the 1980s, DRP has referred to an inherently psychological construct. It has been defined as the individual risk judgment and appraisal that people make when characterizing and evaluating hazards, as well as the perceived likelihood of encountering a hazard (Slovic, 1987; Gierlach et al., 2010; Yong & Lemyre, 2019). Among others, Peters et al. (2004) have defined perception as a mainly emotional knowledge process that depends on the way in which people interpret reality and their level of knowledge.

Recently, the scientific literature has recognized that a variety of both internal (i.e., linked to the person) and external (i.e., linked to the environment) information sources (the factors discussed in Section 3.2), which often appear discrepant from the objective risk, influence disaster risk perception (Gierlach et al., 2010). There are two main approaches to define DRP that are taken into consideration here. The first one considers which factors influence people's disaster risk perception and tries to classify them; the second one defines perception on the basis of the response that individuals give in the face of hazards.

In general, the authors that use the first approach have tended to group and classify the factors according to a multi-level classification. For example, Beck (1992) adopted a two-level classification, based on subjective and objective perception. Subjective perception is mainly the result of experience, culture, emotions, and feelings, while objective perception is given by the interpretation of reality provided by the scientific methods that are used to identify and measure risk. On the other hand, Renn & Rohrman (2000) have affirmed that DRP is influenced by four context levels: i) cultural background, ii) social-political environment, iii) cognitive-affective factors, and iv) general heuristics. Each level links individual, social, and cultural variables to each other and is thus embedded in the next, higher level. A visual summary is presented in Figure 4.

Figure 4: The Four Context Levels of Risk Perception



Source: Renn & Rohrman (2000)

A description of each level is provided below:

- **First level:** This includes political, social, and economic culture; cultural institutions; personal identity and sense of meaning; and world views, that is, the collective and individual heuristics that individuals/groups use to formulate judgments about risks;
- **Second level:** The role of the social-political environment in DRP, that is, the social and political framework in which individuals and groups operate. Therefore, it comprises organizational constraints, economic and political structures, social values and trust, personal values and interests, socio-economic status, and media influence;
- **Third level:** The context level that comprises 'cognitive and affective factors that influence the perception process directly and also indirectly through the assignment of special weights to universal heuristics' (Renn & Rohrman, 2000, p.222). Therefore, this level includes reference-knowledge, stigmata, personal beliefs, individual skills, and emotional affections (Renn & Rohrman, 2000; Loewenstein et al., 2001; Peters et al., 2004);

- **Fourth level:** Collective heuristics and individual common sense, namely how citizens act in large-scale collective actions (i.e., society's repertoire of heuristics or collective action strategies).

The second aforementioned approach to define DRP assumes that DRP plays a major role in motivating individuals to take action to avoid, mitigate, adapt to, or even ignore risks. Therefore, this completely different way to classify DRP is based on the kind of response individuals give in the face of hazards. Khan (2012) has identified three forms of perception, which are acceptance, domain, and adaptation. The first corresponds to the resignation that makes individuals unable to deal with risk/reduces the will to deal with risks, the second usually activates 'domination of nature' processes, favouring the adoption of engineering solutions, and the third asks for solutions of adaptation to the environmental conditions.

Given the purposes of the LINKS project and the wider literature, to evaluate DRP in relation to SMCS, we decided to follow a multi-level approach that accounts for factors linked to the person and the environment. Therefore, Section 3.2 presents those factors that the literature review showed to be the most important.

3.1.3 The Risk Perception Paradox

Before discussing the multi-level approach, another point needs to be addressed: the connection between DRP, willingness to act, and risk preparedness, which is still not clear. When analysing the influence of experience and trust factors on risk perception and the likeliness of individuals to take preparedness action, the review by Wachinger et al. (2013) discovered the existence of a risk perception paradox. It is assumed that high risk perception will lead to personal preparedness and, in the next step, to risk mitigation behaviour (or the other way round, that individuals with a low level of DRP will be less likely to respond to warnings and undertake preparedness measures than individuals with a higher risk perception). However, this is not necessarily true. In fact, the opposite can occur if individuals with a high risk perception still personally choose not to prepare themselves in the face of a natural hazard. Based on the results of the review, and taking into account experience and motivation, trust and responsibility, and personal ability (economic and personal conditions), the authors have offered three explanations suggesting why this paradox might occur:

- The first possible reason is linked to the expectations of people who live or stay in hazardous areas despite the risk. In other words, individuals understand the risk of the area, but choose to accept it because the perceived benefits of living in that area appear to outweigh the potential negative impacts;
- The second possible reason for the paradox is linked to trust in the authorities. In other words, individuals understand the risk but think that the governance measures will keep them safe (they transfer the responsibility for action to someone else), so they do not act;

- The third reason justifying the paradox is linked to confusion or ignorance about the appropriate action to take as well as to personal resources (a lack of the capacity/resources to help oneself). Therefore, individuals understand the risk, but they have few resources to face the situation.

These findings have implications for future risk governance and communication as well as for individuals' willingness to invest in risk preparedness or risk mitigation actions.

3.2 The Factors that Influence DRP

As presented in Section 3.1, a huge part of the literature about DRP has maintained that perception might be shaped by factors such as (a lack of) hazard experience (individual and possibly that of family, friends and colleagues) and/or exposure to information about the objective risk, with consequences on the level of people's awareness (Knuth et al., 2014). Other studies have shown that disaster risk perception, identification, and management are connected and filtered by local cultures and social structures (Dressel, 2015). In this connection, Kaspersen et al. (2000) have affirmed that public risk perception is usually the result of cultural values, economic interests, and intuitive biases. Thus, individuals have different perceptions according to the expected benefits they can receive, their capacity to deal with and understanding of hazards, and their cultural values. Furthermore, Lee et al. (2015) have stated that national, cultural, and geographic factors play an important role in defining individual-level risk perceptions. Going in the same direction is the work by Wachinger et al. (2013), according to which perceptions may differ depending on the type of risk, the risk context, the personality of the individual, and the social context. In addition, the authors have identified further factors such as knowledge, experience, values, attitudes, and emotions that influence individuals' thinking and judgment about the seriousness and acceptability of risks. In Annex II the main factors that influence DRP and the definitions of DRP arising from the literature are summarized.

As mentioned in Section 3.1.2, given the purposes of the LINKS project and the wider literature, it has been decided to use a multi-level framework which takes into account factors linked to the person and the environment, in order to evaluate DRP in relation to SMCS. In particular, here we propose a three-level approach to classify the factors that will be considered in discussing the role of SMCS in DRP (Section 4). This classification has been selected among those available in the literature while bearing in mind the three-level 'ecological view of digital disparities and vulnerability in relation to disaster preparedness' presented in the work by Lai et al. (2018) on digital disparities and vulnerability, mobile phone use, information behaviour, and disaster preparedness in South East Asia. Therefore, the three levels proposed here are: 'Background' factors, 'Interpersonal' factors, and 'Individual' factors. As depicted in Figure 5, the lower levels are embedded in the next higher one, meaning that they are closely interconnected, and that the different levels interact with each other. The levels will be discussed in detail in the following

sections. What emerges from the multi-level framework is that diversity has an intra-level capacity, in that it works both as a potential amplifier factor in and over all the levels, and as a linking component (for a more detailed explanation of diversity see Section 3.2.4).

Figure 5: The Main Factors in DRP

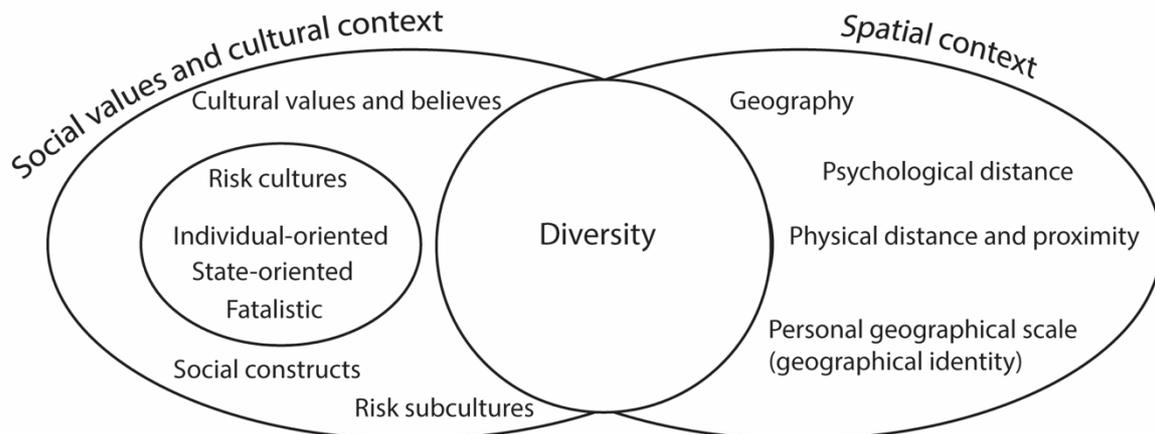


Source: Authors' contribution based on Lai et al. (2018) and Renn & Rohrmann (2000), adapted to include the 'diversity' concept

3.2.1 'Background' Factors

The higher level of the proposed classification comprises factors that are linked to the geographical and socio-cultural environments (Figure 6). In particular, these are social values and cultural context (Section 3.2.1.1), and spatial context (Section 3.2.1.2).

Figure 6: The 'Background' Factors



Source: Authors' contribution based on the literature

3.2.1.1 Social Values and Cultural Context

According to Dressel (2015), culture is defined as an interpretative framework shared by a group in a particular region, the common way in which a community (see LINKS Glossary forthcoming on the website) makes sense of the world. In this perspective, what might have been perceived as risky in a given historical moment and in a certain local area may no longer be deemed as such later, or in a different geographical area. Therefore, DRP is connected to and filtered by the specific cultural values and beliefs, and social constructs of various actors in society, at a level that goes beyond national borders (see e.g., Douglas & Wildavsky, 1982; Dressel, 2015) with consequences on the way people respond to the different situations. In such a fluid context, 'culture' means a constantly evolving set of behaviours and understanding incorporating knowledge from both within and outside a community (Mercer et al., 2012). Thus, disaster scholars have talked about risk cultures and risk subcultures as the sum of cultural practices that communities develop in response to frequent hazards/disasters (see, e.g., Wenger & Weller, 1973; Gaillard et al., 2008; Bankoff, 2003). For these reasons, in the absence of other factors, the cultural context can increase or reduce risk awareness (Wildavsky & Dake, 1990; Palm, 1998).

The discourse on *risk culture* in the humanities and social science emerged as a topic during the 1980s and 90s (see e.g., Douglas & Wildavsky, 1982). Risk culture defines which risks are considered to be acceptable or tolerable and which are not, helping individuals to create meaning, coherence

and social order (Dressel, 2015). According to Cornia et al. (2016), risk cultures are characterized by three interrelated discriminatory dimensions:

- The way people perceive and interpret risks and disasters (disaster framing);
- The level of trust people have in the responsible authorities' disaster risk management capabilities, and the credibility they give to media information;
- People's attribution of responsibility for disasters (disaster blaming).

In Dressel & Pfeil (2017), Pfeil & Dressel (2017), and Dressel (2015), three specific risk culture ideal types emerge that are briefly described here below and summarized in Table 2:

- **State-oriented risk culture:** Here the dominant frame is that, at least in principle, disasters can be avoided, and this task is the responsibility of the respective authorities, in whom there is a high level of trust. The fault if a disaster occurs is therefore attributed to the state authorities who did not impose any or sufficient disaster prevention measures;
- **Individual-oriented risk culture:** People living in this second type of risk culture think that disasters could be prevented, at least in the majority of cases, and that the responsibility for prevention lies with the individual person (everyone should be prepared and have implemented prevention measures) together with the authorities. The fault if a disaster occurs can be to a large extent attributed to the failure of individuals, their weak sense of self-efficacy and unpreparedness;
- **Fatalistic risk culture:** In this third type of risk culture, disasters occur owing to a punishment from God, fate, or are simply attributed to nature. As a result, they are perceived as unpredictable and unavoidable, and thus prevention is not a shared concept. Trust in the crisis management capabilities of the responsible authorities is weak.

Table 2. The Three 'Risk Cultures'

Risk culture	How people perceive and interpret risks and disasters	How much people trust in disaster management capabilities	Who or what is judged responsible for the disaster
State-oriented	Disasters can be avoided	High level	State authorities
Individual-oriented	Disasters can be prevented	High level (but everyone should be prepared)	The individual
Fatalistic	Disasters are unpredictable and unavoidable	Weak	God's punishment, fate or nature

Source: Dressel & Pfeil (2017), Pfeil & Dressel (2017), and Dressel (2015)

3.2.1.2 Spatial Context

The spatial context is used here to define all the levels of spatial perception that influence the way we relate to reality. Thus, four dimensions are considered:

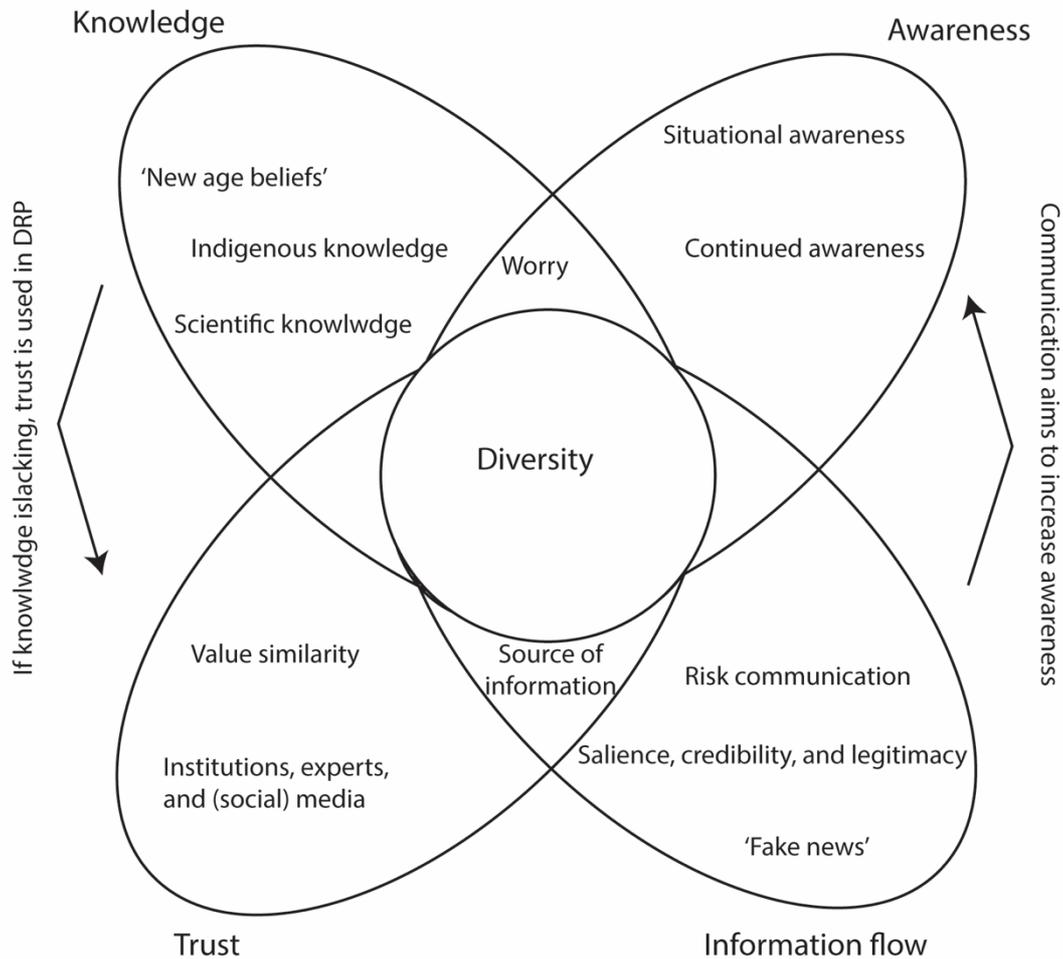
- **Physical distance and proximity:** Both refer to the real and measurable distances that exist between a person and the risk area. Thus, the upshot is the further people are from the risk, the lower their level of knowledge and the more significance they attribute to perceptions in interpreting it (Beck, 1992). However, the debate is more open in the literature. Some works, like Perry et al. (1982), have not found any significant relationship between real distance and perception to hazard, while other works, like Peacock et al. (2005) and O'Neill et al. (2016) have maintained that it has a real impact;
- **Geography:** The sum of a place's social, cultural, political, economic, and physical characteristics. Many hazards are more or less common in given environmental contexts (climatic areas) or socio-cultural contexts, regardless of political boundaries or shared historic development (see Khan, 2012);
- **Personal geographical scale or geographical identity:** This refers to the geographical contexts in which people grow up and are formed, or have relevant life experiences, and their fundamental role in conditioning the degree of individual perceptions (Bonati, 2014). Geographical identity links the population to the territory and, therefore, contributes to the construction of individual and community perceptions;
- **Psychological distance:** This refers to the cognitive separation between the self and other persons, objects or events. It is directly linked to the way people mentally represent their surrounding world, including distances from potential criticalities (Liberman & Trope, 2008). Psychological distance from an object or event depends on the way people represent it in their mind (Mir et al., 2016; Spence et al., 2012). Furthermore, psychological distance from events may be an important factor in judging causal impact because distance shapes individuals' focus in perceiving causal events (Hansen et al., 2013; Rim et al., 2009). These different types of psychological distance are strongly and systematically correlated and the total distance increases as each element grows (Huang et al., 2019).

Both geographical identity and psychological distance are the sum of several dimensions: temporal, spatial, geographical, social, hypothetical, informational, experiential, and affective (for psychological distance see Liberman & Trope, 2008; Trope & Liberman, 2010).

3.2.2 'Interpersonal' Factors

The intermediate level includes factors that involve interaction between people and the geographical and socio-cultural environments, such as knowledge, information flows, awareness, and trust (Figure 7).

Figure 7: The 'Interpersonal Factors



Source: Authors' contribution based on the literature

3.2.2.1 Knowledge

Individuals with greater scientific reasoning ability have been found to be more likely to perceive risk in a manner that is consistent with the scientific evidence regarding those risks, although knowledge of risks may be acquired unevenly, reflecting existing social and structural inequalities (Lai et al., 2018). On the other hand, for new and relatively unknown hazards, a high scientific reasoning ability can lead to dampened risk perceptions. Following the reasoning of Siegrist & Árvai (2020), people may feel there is insufficient scientific reason to be worried. Moreover, individuals with high scientific reasoning abilities may nevertheless demonstrate a low ability or willingness to deploy it based on their prior beliefs. Along similar lines, some individuals tend to be sceptical of science and may hold beliefs that lack a scientific basis; hence they have inappropriate levels of perception. For Sjöberg & Wahlberg (2002), some subcultural movements, like 'new age beliefs', are examples of this phenomenon, and they tend to be related to higher levels of risk perception. There is also evidence that certain judgments, which may inform risk perceptions, are influenced by

the style of reasoning. It is also proven that knowledge-based risk perception plays a fundamental role in the life of indigenous peoples who learn to survive events and changes in their own area by carefully transmitting to subsequent generations the most useful information coming from their direct experience. For a long time, this perception was (and partly still is) higher among the indigenous peoples than among the populations that subsequently occupied these areas in a dominant manner. Therefore, now the idea that the possession of domain-specific knowledge does not influence risk perceptions seems outdated.

Mercer et al. (2010) have upheld the need to integrate indigenous and scientific knowledge. Thus, they have defined the two concepts in the following way:

- **Indigenous knowledge:** The information acquired by a population, coming from experience and handed down from generation to generation, which includes traditions, rituals and society-environment relations (see also Sillitoe, 1998; Kelman et al., 2012). Thus, indigenous knowledge is based on qualitative information and synchronic observations (Dekens, 2007).
- **Scientific knowledge:** The knowledge produced by the scientific community, which is based on scientific methods to collect data and test and verify results.

3.2.2.2 Awareness

People's awareness of the objective risk is a fundamental part of DRP. In particular, two different kinds of awareness are discussed here:

- **Continued awareness:** According to the literature research carried out by Luis et al. (2018), a continued awareness (strictly linked to experience) of threatening situations seems to lead to the development of strategies that minimize the perceived risk (Lima, 2004; Lima et al., 2005; Luís et al., 2016; Parkhill et al., 2010). When individuals experience a threat, they eventually become used to its presence, which can result in a negative association between the presence and awareness of a hazard and the people's risk perception (effect of risk perception normalization, see Barnett & Breakwell, 2001; Schultz et al., 2014; Spence et al., 2012);
- **Situational awareness:** This concept, introduced by Vieweg et al. (2010), describes the idealized state of understanding of what is happening in an event, especially with respect to the needs of command-and-control operations. A situational awareness perspective is helpful for anticipating how individuals, groups and communities can use information contributed by others in a social media context (Vieweg et al., 2010).

In general terms, communication usually aims to increase population awareness, but the correlation between demographic factors and levels of awareness is still debated among the scientific community (see, e.g., Bradford et al., 2012; Pagneux et al., 2011; Poortinga et al., 2011).

To conclude, the connection between awareness and worry is a subject of hot debate. On this issue, Raaijmakers et al. (2008) have sustained that an increase in awareness could lead to heightened

worry, leading to the increased likelihood of preparedness activities. Then, O'Sullivan et al. (2012) expanded this concept, suggesting that increases in preparedness lead to social resilience, and that risk communication that attempts to increase awareness or worry should also aim to increase resilience through capacity building.

3.2.2.3 Information Flows

Individuals seek or receive, manage, and interpret information on a possible risky event in different ways and then use or reject it. Cash et al. (2002) argued that at the core of any decision process, individuals assess the salience, credibility and legitimacy of the available flow of information. Further to this, Cash et al. (2003) proposed that an effective management of these three components of information is central to successful knowledge production and the ability to mobilize knowledge in order to prompt the desired actions. In other words, risks are described as 'socially constructed through the processes of amplification and attenuation during risk communication, notably from the media' (Yong & Lemyre, 2019, p. 322). For this reason, risk communication has to take into account how personal experiences affect perceptions and beliefs about environmental hazards (Coi et al., 2016). The way risks and crises are communicated to the public now, also influences the perception of the events in the future (Dressel, 2015).

The recent phenomenon of 'fake news' has highlighted the risks and fears of information gone out of control and the associated force multiplier effects of digital connectivity in affording both the spread and the speed of disinformation. As described in D3.1, it is crucial to underline that, regardless of whether information is true or false, DRP has an impact on society in that it has the potential to change the state of systems. In other words, in the event that a system undergoes a change as a result of perception, the information is equally relevant regardless of whether it is true (objective facts) or false (fake news or any type of intentional disinformation or misinformation, or any type of unintentional error). In turn, the derived perception also has an important effect on the preferences and objectives on which decisions are based. Therefore, on the one hand, the causes of system changes (e.g., natural hazards, acts of terrorism, or political interference) must be thoroughly understood to facilitate the identification of relevant and efficient decision alternatives for managing the risks, and on the other, equal attention must be paid to adequately convey the information to the various recipients.

Further details on false information (disinformation and misinformation) can be found in D2.1 in relation to the vulnerability of social groups (e.g., minorities in post-terror attacks), in D3.1 as barriers to authorities' use of SMCS, and in D4.1 concerning disaster communication technologies.

3.2.2.4 Trust

Many studies that have focused on various hazards in different countries have found a strong correlation between trust and the perception or acceptance of hazards (Bronfman & Vazquez, 2011; Song, 2014; Vainio et al., 2017; Visschers & Siegrist, 2013). Trust is a vital factor in influencing DRP

or the acceptance of hazards, which is historically linked to trust in the institutions that are responsible for DRM (initially only in relation to some anthropic risks, see e.g., Freudenburg, 1993). This is also an intra-dimensional concept, which closely interacts with the others. Thus, according to the literature review, several factors can influence it:

- **Value similarity:** As the basis of social trust (i.e., people tend to trust persons with values similar to their own), which in turn often influences the hazard perception (e.g., Earle & Cvetkovich, 1995; 1997);
- **Knowledge:** If knowledge is lacking (because a person is not an expert in a particular field), trust is used to assess the benefits and risks associated with a hazard and may ultimately influence the acceptance of a technology (Siegrist & Cvetkovich, 2000);
- **Information flows:** Many different forms of communication currently exist, but if there is no trust in the source, any message and policies are likely to be disregarded, no matter how well designed and well delivered they may be (Hagen et al., 2016). For each sector, a different set of sources generally has credibility and inspires trust;
- **Experience:** Wachinger et al. (2013) have revealed that personal experience of a natural hazard and trust — or the lack of thereof — in authorities and experts have the most substantial impact on DRP.

What sometimes creates further confusion in people is that, in some countries, there is still a significant gap between the recommendations provided by the scientific community and the actual actions taken by the public and policymakers. All of this does not facilitate trust (Hagen et al., 2016). Cornia et al. (2016) have underlined how experts can be perceived as independent from politics. Therefore, experts could have a major role in communication, especially in those countries where mistrust in authorities is associated with a low level of trust in the mass media. In this context, communication between the various actors becomes a fundamental element.

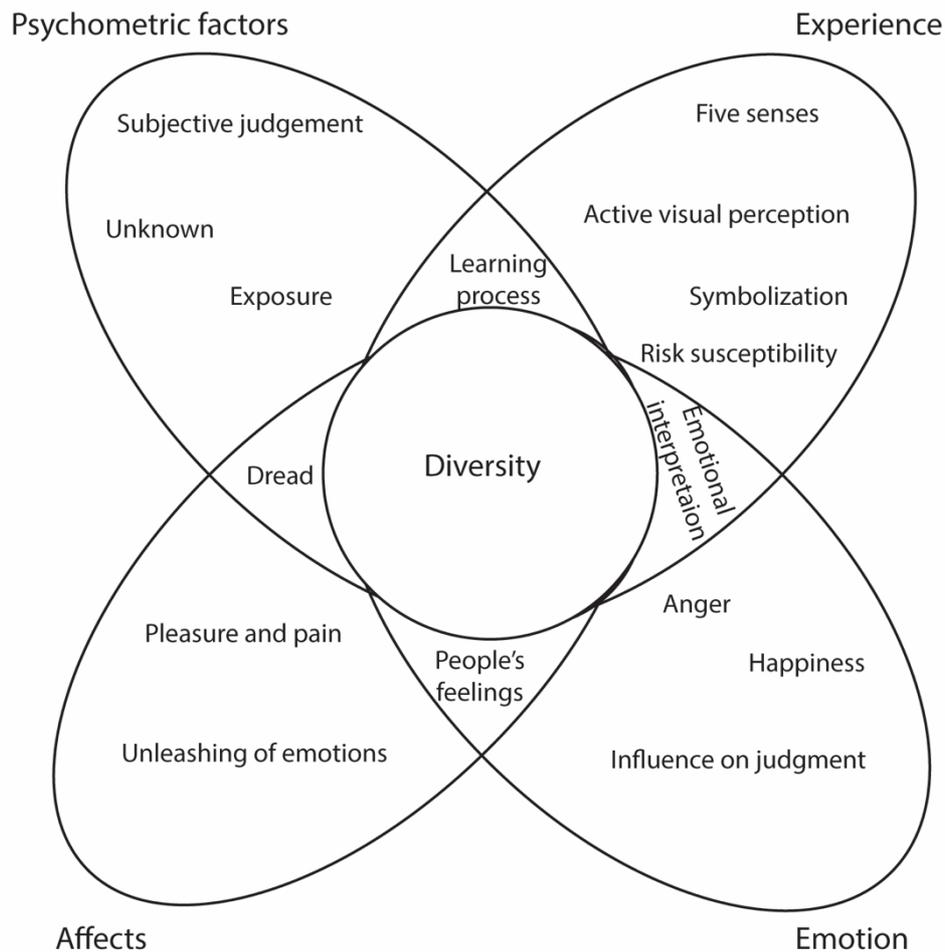
However, the importance of trust is still a controversial issue because some situations have been observed where trust seems irrelevant (e.g., when people are convinced that their knowledge is sufficient to assess the risks; see Eiser et al., 2002; Sjöberg, 2001; Viklund, 2003). According to this reasoning, people's attitude, based on individual learning, the perceived importance of the issue, the methods employed to measure trust and its conceptualization, is a factor that influences both trust and risk perception at the same time (Earle, 2010; Earle et al., 2007).

To conclude, according to Wachinger et al. (2013), individual factors such as age, gender, education, income, social status, and so on, do not play such an important role but act as mediators or amplifiers of the main causal connections between experience, trust, perception, and the preparedness to take protective actions.

3.2.3 'Individual' Factors

Finally, the lower level encompasses factors that are strictly related to the individual/person, that is, psychometric factors, affects, and experience (Figure 8).

Figure 8: The 'Individual' Factors



Source: Authors contribution based on the literature

3.2.3.1 Psychometric Factors

As already explained, risk is a subjective construct and not an objective attribute (Slovic et al., 1985; 2016). Therefore, the degree of hazard depends on people's subjective judgment. Based on a factor analysis, three elements (dread, the unknown, and exposure) can instead increase the perceived risk (Slovic et al., 1985). Therefore, the psychometric paradigm explains the mental processes, and some evaluations of safety culture, at the individual level alone. According to Wildavsky (1987), the psychometric paradigm helps show differences within individual effects, but does not explain the differences between them or the extent to which they can contribute to the overall risk perception in aggregation with other variables. In this perspective, the psychometric variable is useful in

research to highlight the relative positionality of risks encountered in day-to-day life. However, it is hamstrung by low predictive power with respect to the psychological mechanisms existing behind how people perceive risk and the ability to explain and measure them (Siegrist & Árvai, 2020).

3.2.3.2 Affects

In the psychological life of an individual, affects are the aspect that instinctively react to the solicitations of the external world in relation to the poles of pleasure and pain, implying the unleashing of emotions. However, in the concrete applications of affects, in the majority of cases heuristic studies do not really include the description of emotions, as intuitable, but mainly focus on attitudes and evaluations. For this reason, emotions can be considered as a derived and separate variable. The affect heuristic assumes that the affective meaning evoked by a hazard influences risk perception. All the images in people's thoughts are marked to varying degrees with affects in their positive and/or negative association with a situation (Slovic et al., 2004). People rely on this aspect when they make judgments. Affects can be directly related to people's feeling of dread, worry, and anxiety or the degree of valence they associate with a hazard. When formulating personal risk perceptions, they can lead to the danger of distorted judgments about risks or erroneous distractions (Siegrist & Sütterlin, 2014; Siegrist & Árvai, 2020). In more recent times, in the use of the 'affects variable', questions have been formulated about the greater or lesser importance of negative or positive associations and the directionality of causation (does risk perception drive affective responses or do individual affects drive risk perception?).

3.2.3.3 Emotion

The emotional dimension is closely connected to many variables, in particular affects, the category to which emotion belongs. However, the affects heuristic does not deal with emotion in detail. It deserves to be addressed as an individual variable in order to understand how emotional status can produce different responses. Emotions influence judgments and decisions in ways that are sometimes detrimental and sometimes beneficial, depending on the emotion expressed and the context (DeSteno et al., 2013; Ferrer et al., 2015; Ferrer et al., 2016; Lerner et al., 2015; Loewenstein & Lerner, 2003; Williams & Evans, 2014). Theoretical frameworks suggest that discrete emotions (e.g., fear, anger or happiness) have systematic influence on decisions regarding uncertainty, risk, and reward (Han et al., 2007; Lerner et al., 2015; Waters, 2008).

A central idea in risk perception research is that intuitive risk perceptions are shaped by subjective experiences, especially emotion and feelings (Mrkva et al. 2020). Emotions such as dread and fear influence risk perceptions, implying that transient factors which evoke emotions result in transient changes in risk perception (Loewenstein et al., 2001; Slovic et al., 2004). According to Prior et al., (1993), allowing for the effects of emotion on risk perception improves the prediction of risk judgments a great deal more than using outcomes and probabilities alone.

Focusing especially on fear, what emerges by the literature analysis is that in the distant future, people will pay more to avoid risks when they are made to feel fear (Van Boven et al., 2012). In addition, since people perceive their immediate emotions as more intense than previous emotions, they perceive immediate fearful threats as more dangerous and worthy of mitigation than previous threats that happened and aroused emotions (Huber et al., 2011). In such a perspective, the idea that fear is a core dimension of DRP illustrates the importance of emotional influences in risk evaluations (Bhatia, 2019). However, emotion has a somewhat complex influence on DRP, in that feelings of risk both influence and are influenced by non-emotional factors and at the same time emotions interact with each other as well (Johnson & Tversky, 1983; Loewenstein et al., 2001).

3.2.3.4 Experience

Perception can be placed under the notion of experience, defined as a 'cover-all term for the various modes through which a person knows and constructs a reality. These modes range from the more direct and passive sense of smell, taste, and touch, to active visual perception and the indirect mode of symbolization' (Tuan, 2011, p. 8). In addition, experience is a learning process that goes from perception to understanding (Richardson et al., 2001). Thus, perception is part of experience, and also a consequence of the sensorial and emotional interpretation of what happens (Tuan, 2011).

Furthermore, experience conditions a community or an individual's level of risk susceptibility. Knuth et al. (2014) have found that previous and direct experiences with a hazard influence risk perception and that these experiences also could affect perceived risk for at least some other hazards. In addition, nationality and cultural factors appear to be influential, with the greatest variation between countries pertaining to the perceived risk of earthquakes, followed by the risk of terrorist attacks and floods.

3.2.4 Diversity

As anticipated, diversity is considered here as a cross-cutting dimension. As defined in D2.1, it includes all the individual conditions that make a specific individual more or less vulnerable. They include demographic, social, economic and cultural characteristics, that is, age, gender, social status, religion, ethnicity, health, culture, perception, knowledge, and cultural and social values. Accordingly, diversity is based on the idea that 'the varying experiences of vulnerability and resilience within a disaster are due to social differences within a community or country, making certain individuals and groups more vulnerable or resilient (Finch et al., 2010)' (Dominey-However et al., 2014, p. 909). This condition is also at the basis of different levels of DRP.

Considering the gender dimension, Poortinga et al. (2011) and Sjöberg (1998) have stated that women seem to be more worried about several risks than men, especially if parents or living in a rural or poor area, where fewer women have the possibility of having an education and are forced to trust in other recommendations (e.g., husband, community). However, no scientific findings have proven so far that this generally higher risk perception among women leads to greater preparedness

(Hofer, 2017). Rather, in some studies (Olofsson & Rashid, 2011; Bradford et al., 2012) women do not show a higher perception of risk and therefore do not show a higher level of vulnerability than men nor a strong relationship was found between worry and gender.

On the other side, there are very few works that try to assess the DRP of vulnerable groups. Some material, however, can be found about immigrants. Outside Europe, immigrants have been classified as a vulnerable group in order to analyse their DRP and behaviour in comparison with that of individuals born in that state. According to Yong and Lemyre (2019), risk communication and management are generally not directed at addressing immigrants' unique needs and concerns. In fact, immigrants often experience a lack of i) hazard awareness, ii) knowledge about preparedness, iii) access to mainstream communication channels, and iv) trust in authorities. Therefore, disaster risk reduction (DRR) strategies that do not take these barriers into account (the four shortcomings mentioned above) may be inadequate for immigrants.

However, as stressed in the LINKS project, diversity is not only an individual property, as it works as a bridge between the other levels and systems. Accordingly, every level needs to be considered in relation to the diversity of the individuals, situations and contexts that can influence and shape them. Thus, as said for vulnerability in D2.1, DRP also has to be considered as a fluid concept.

Key takeaways from Section 3

- **Risk** is a complex concept that refers to something that has not happened yet and is related to random chance and possibility. It is an objective variable that may be quantified, but people evaluate risk based on 'subjective' dimensions. To define/quantify risk, it is necessary to establish interactions between subjective risk perception and the scientific need for objective measurement.
- **Disaster risk perception (DRP)** is the individual judgment and appraisal of risks made by people when characterizing and evaluating hazards. Many variables concur to its definition (see Section 3.2), which mainly differ depending on the type of risk, the risk context, the personality of the individual, and the social context (to name just a few aspects). There are many ways to define and classify DRP (see Annex II for a summary of the main definitions of DRP).
- **Risk culture** defines which risks are considered to be acceptable or tolerable and which are not, helping individuals to create meaning, coherence and social order. There are three ideal types of risk culture:
 - State-oriented risk culture: disasters can be avoided, and this task is the responsibility of the respective authorities, in whom there is a high level of trust;
 - Individual-oriented risk culture: disasters could be prevented and that the responsibility for prevention lies with the individual person together with the

- authorities; the fault if a disaster occurs can be attributed to the failure of individuals, their weak sense of self-efficacy and unpreparedness;
- Fatalistic risk culture: disasters are perceived as unpredictable and unavoidable, and thus prevention is not a shared concept; trust in the crisis management capabilities of the responsible authorities is weak.
 - A **three-level approach** has been selected to evaluate DRP in relation to SMCS. It takes into account the factors linked to the person and the environment.
 - 'Background' factors are: social values, cultural context, and spatial context;
 - 'Interpersonal' factors are knowledge, information flows, awareness, and trust;
 - 'Individual' factors are psychometric factors, affects, emotions and experience.
 - **Diversity** is a concept that plays an important role in the LINKS project. Therefore, in this analysis it has been considered a fluid concept, which cannot be classified under one of the three proposed levels. As such, it is taken to be a transversal factor that has interactions. with all the three levels.

4. STATE OF THE ART – SMCS AND THEIR ROLE IN DRP

The third and fourth research questions, formulated to construct this DRP aspects of the DRPV KB as illustrated in the Introduction (Section 1), are about the role of SMCS in relation to DRP, and the implementation of SMCS in DRP in order to increase the role of diversity in DRM and the capacity resilience of vulnerable groups (for the definition of SMCS refer to the LINKS Glossary, and D4.1).

SMCS are part of everyday life and are also prevalent during disasters since the sharing of information between users and authorities through SMCS has become a key component in the modern disaster management, especially in large-scale events. This point is discussed and analysed in detail in both D3.1 and D4.1. For our discussion, it is worth noting that the implementation of SMCS in disaster management services is a quite new and challenging research topic which some authors have dated back to 2006 (Reuter & Kaufhold, 2018), just after Hurricane Katrina in 2005, when the first example was documented of disaster related crowdsourcing developed by a private citizen (Keim & Noji, 2011). On the contrary, Reuter and Kaufhold (2018) have upheld that the first use of SMCS in an emergency can be dated back to the September 11th terrorist attack in 2001, when citizens started to create wikis to collect information about missing people and the authorities used web-based technologies to provide information.

The final purpose of this Section is to complete the interpretative framework to be applied in case-based assessment of the Framework on the basis of the literature results on SMCS and DRP (for the list of works analysed see Annex V). The multilevel-approach here suggested is thought to be used by different users, like scientific community, practitioners, policymakers, on the basis of which to structure qualitative and quantitative approaches for DRM. The approach will be translated in a methodology in D2.3.

Accordingly, this section begins by first highlighting the concepts of risk and crisis communication, since SMCS could be used for these purposes, and thus are strictly related to the concept of DRP. This is done in Section 4.1 (the risk communication concept is also presented and discussed in D4.1). Section 4.2 then presents an overview of DRP and SMCS based on the three-level classification of the factors that influence DRP set out above in Section 3.1. Thereafter, Section 4.3 contains a discussion of the role of SMCS in DRP, in particular in order to increase the function of diversity in DMP. Finally, Section 4.4 illustrates the main gaps that have been identified and need to be addressed in the LINKS Framework.

4.1 Risk Communication and Crisis Communication

Communication is decisive in protecting citizens from disasters (Silver & Matthews, 2016; Klafft, 2017). Accordingly, the way citizens perceive communication platforms and the flow of information significantly impacts on the interpretation of risk and individual coping capacities. Crisis

communication and risk communication are two distinct concepts that can be considered part of a continuum.

Crisis communication has been distinguished from risk communication owing to the difference in the urgency of the information sharing (Pfeil & Dressel, 2017). In particular:

- **Crisis communication** regards crisis management and it aims to inform citizens about the current, urgent situation (natural or man-made dangerous phenomenon) and how to cope with it, organize help, save lives, and initiate recovery measures to get society back to 'normal'. As they promote cross-platform accessibility and a constant flow of information, SMCS have many potential uses during disasters given their positive effect on dynamics of citizen (self-) resilience (Jurgens & Helsloot, 2018). More explanations about the role of SMCS in DMP and the concept of resilience can be found in D3.1. During disasters, SMCS can be used in different ways for the communication flows between authorities and citizens. More information on a visual schematization and the use of a crisis communication matrix to show these communication flows can be found in D4.1;
- **Risk communication** focuses both on the possibility of risk events occurring in the future and what and how decisions should be taken to manage those risks. Thus, risk communication occurs after the crisis and/or before a crisis which has not yet occurred, as part of a learning process (i.e., how to make it better in the future based on past crisis or emergency experiences). One of the main aims of risk communication is to raise disaster awareness and public trust in the crisis management authorities. Today, risk communication has evolved into an interactive two-way act that emphasizes the creation of trustworthy partnerships (Yong & Lemyre, 2019). The term 'risk communication' summarizes the following actions;
 - Informing the citizens about different types of disasters that can possibly occur in an area;
 - Educating them about the potential consequences of these disasters (for each individual and the society as a whole);
 - Encouraging them to take precautionary measures to be better prepared in case a disaster strike (Klafft, 2017).

When risk communication is carried out via the media, namely, when the use of SMCS is intentional, the impact, and therefore the DRP, could be different (Wählberg & Sjöberg, 2000). According to Walkling and Haworth (2020), DRP and awareness among at-risk populations are increased by correct risk communication, which also promotes preventative disaster risk reduction measures. These individual and community perceptions form an important societal component of DRM in determining responses to warnings and efforts to increase community preparedness. Thus, the literature seems to recognize that DRP influences the way communication is handled and vice versa (the way risks and crisis are communicated to the public will influence the perception of the event now and in the future) (Dressel, 2015), with potential consequences in terms of preparedness.

4.2 An Overview of SMCS and their Role in DRP

Wählberg and Sjöberg (2000) carried out a literature review to address the following questions:

- The media are often believed to be very important for DRP, but how much of an individual's DRP is really due to the media?
- Which parts of DRP and which of its qualities are influenced by the media?
- What do we really know about media influence on DRP?

One of their main results was that it was hard to find research concerning how the media can change DRP. In their opinion, it was because the main interest of those conducting the campaigns is behaviour change and not risk perception change. Although DRP can influence individual and collective behaviour, as already discussed in Section 3 (see the risk perception paradox according to Wachinger et al., 2013 in Section 3.1.3), there is not a direct correlation between the two concepts. Thus, good behaviour is not synonymous with a high level of DRP.

Unfortunately, in the last twenty years, the situation has not changed, and there is still a lack of works that discuss the role of SMCS in relation to DRP. This is why such a small number of papers (just fourteen) were found and selected (according to the parameters discussed in Section 2) to perform the literature review about SMCS in DRP. The selected papers and the completed literature review grid (see Section 2.3) are reported in Annex I. In the following section, the papers are discussed while bearing in mind the three-level classification of the factors that help to define DRP presented in Section 3.2. SMCS are mainly linked to the 'interpersonal' factors, as they involve interaction between people and the surrounding environment (Table 3).

Table 3. The DRP Factors Discussed in the Papers Selected for the Literature Review

Analysed paper	'Background' factors	'Interpersonal' factors	'Individual' factors
Vieweg et al., 2010		X	
Alexander, 2014	X	X	
Cornia et al., 2016	X	X	
Reuter et al., 2016	X		X
Silver & Matthews, 2016	X	X	X
Mehta et al., 2017		X	
Jurgens & Helsloot, 2018		X	
Lai et al., 2018	X	X	

Reuter & Kaufhold, 2018		X	
von Stülpnagel & Krukar, 2018			X
Kankanamge et al., 2019		X	
Kaufhold et al., 2019		X	
Reuter et al., 2019	X		
Walkling & Haworth, 2020	X	X	X

4.2.1 SMCS and DRP 'Background' Factors

Among the 'background' factors considered, geographical and socio-cultural context are those most taken into account to discuss the role of SMCS in DRP. Indeed, both in daily life and during a disaster, social media are used in different ways by social groups and across countries, also as a reflection of the existing social and structural inequalities (Alexander, 2014; Reuter et al., 2016; Silver & Matthews, 2016; Lai et al., 2018; Reuter et al., 2019; Walkling & Haworth, 2020). According to the authors, different cultural and legal backgrounds have a significant influence on the use of SMCS during a disaster and therefore in DRP. This is possibly caused by the fact that different countries have experienced different types of disasters, and that people look at disasters in different ways (Cornia et al., 2016). Moreover, according to Lai et al. (2018), the diffusion and use of smartphones, coupled with demographic and geographical differences, reflect disparities in disaster information behaviour and preparedness.

4.2.2 SMCS and DRP 'Interpersonal' Factors

The four factors grouped under the 'interpersonal' level (e.g., knowledge, information flows, awareness and trust) are all taken into account in the papers selected to analyse the role of SMCS in relation to DRP.

4.2.2.1 Knowledge

According to Alexander (2014), SMCS use is linked with knowledge levels (e.g., education). Moreover, Lai et al. (2018) associate a higher level of DRP with a higher level of knowledge, achieved thanks to the availability of information on SMCS.

From the empirical study carried out by Kaufhold et al. (2019), knowing the social media accounts of local and national emergency services or following their information on how to prevent and stay safe during a disaster could improve people's DRP. Nevertheless, only about half of the interviewed people thought it essential to look for and download apps released by the emergency services to stay informed during an emergency, or to read what to expect from the emergency services' social media.

4.2.2.2 Awareness

In Vieweg et al. (2010), the interpersonal factor taken into account was situational awareness. In particular, they affirmed that awareness could be improved through the understanding of the information communicated by those who are responding to the event (direct transmission from experiencing people Kankanamge et al., 2019). In Jurgens and Helsloot (2018), SMCS enhanced people's awareness and helped make sense of a chaotic situation.

4.2.2.3 Information Flows

As anticipated, SMCS could in some way modify the original information (Silver & Matthews, 2016). The information flow is strictly linked to the availability of information: as a disaster occurs, people start looking for information (Jurgens & Helsloot, 2018). In the study by Wählberg and Sjöberg's (2000), it was shown that it was not the content that influenced people's opinions, but the sheer amount of coverage. In fact, people's DRP can be influenced by the number and vividness of the articles/features. Therefore, it is not only important to receive information on risks, but also to have a reminder of them from time to time, otherwise people tend to forget and lower their risk estimates. This concept is similar to the result that the more time elapsed from the last event, the lower the people's awareness (Dominey-Howes & Minos-Minopoulos, 2004; Gregg et al., 2004). Thus, thanks to the possibility of 're-posting', SMCS can play an important role in sharing information over time.

4.2.2.4 Trust

One of the main research questions is about the citizens' trust in social media and how they define them useful in disasters. A first relevant work has been provided by Dressel (2015), according to

PRACTITIONERS' VIEWPOINT

In the H2020 project CUIDAR, Save The Children Italy created a web-based map using child/friendly version of the municipal emergency plan. The website, named 'Piano alla Mano', is a simplified and conceptual version of the (official) city map and contains information about local risks, strengths, vulnerabilities and resources identified by the CUIDAR participants with a particular focus on earthquakes.

As a result, the project contributed to a change in the perception of natural hazards from the perspective of children.

whom each of the three specific risk culture ideal types (see Section 3.2.1.1) takes media into account in a different way. In particular:

- State-oriented risk culture perceives media as helpful to overcome and tackle the crisis;
- Individual-oriented risk culture thinks that media are both credible and not;
- Fatalistic risk culture's trust in media is weak.

Then, a further work, published by Cornia et al. (2016), analysed:

- How much people from different countries in Europe trust the authorities in charge of risk prevention and the mass media as a source of information during an emergency;
- If there is a link between trust in the authorities and mass media?

The results have shown that in some countries (Austria, Germany, Sweden, and the Netherlands), the media (in particular, public broadcasters and the quality newspapers) are considered to be a neutral and trustworthy source of information, since:

- SMCS are not expected to keep any information secret to prevent the spread of panic;
- SMCS are not expected to exaggerate risk (or to dramatize a crisis) to provoke public interest and attract an audience;
- SMCS are not expected to be influenced by the news outlets' political affiliation in the coverage of crisis management activities undertaken by the authorities.

On the contrary, in other countries (Hungary and Italy) there is a widespread mistrust in the authorities, often associated with low trust in the mainstream mass media (TV, radio and newspapers). Therefore:

- SMCS are considered the 'spokesperson of the state';
- SMCS are considered too connected with the establishment (government, political parties, business and other undefined powers).

A third work that addresses the topic is that of Mehta et al. (2017), who have defined three models to approach trust in the social media during an emergency caused by natural hazards. As the authors saw it, the same models could be applied to man-made hazards too:

- The first model is the intelligence-gathering approach which treats the social media as a source of intelligence. Decisions are based on aggregate patterns in large datasets and individual updates are not considered, so there is a limited ability to monitor the processes;
- The second model is the quasi-journalistic verification of the content and source of individual messages. The verification of the content and source is based on the evaluation of emergency services staff, therefore it is a small-scale process which involves the manual verification and processing of the information;

- The third trust approach is crowdsourcing. Indeed, SMCS create a substantial and complex network of interpersonal trust relationships that predates the disaster (see D3.1).

Thus, the role of SMCS seems to be influenced by the trust that citizens have in the authorities in charge of risk prevention and in SMCS as a source of information during an emergency (Cornia et al., 2016). In addition, the trust that the authorities themselves have in the information voluntarily shared by the citizens via SMCS also seems to play a role. Indeed, whether inadvertently or deliberately, the citizens can be affected by the redundancy or inconsistency of information and the dissemination of rumours (Alexander, 2014; Reuter et al., 2016; Silver & Matthews, 2016; Jurgens & Helsloot, 2018; Reuter & Kaufhold, 2018). In this connection, it is suggested that in crowdsourcing 1% of the crowd creates the content, 10% validate it and 89% use it. Rumour propagation cannot be ruled out, nor can the dissemination of false or misleading information, whether this is done inadvertently or on purpose (Alexander, 2014).

4.2.3 SMCS and DRP 'Individual' Factors

Among the factors grouped in the 'individual' factors level, experience is usually the one that is taken into account. In Reuter et al. (2016), for example, experience has been seen as a key to understanding the reliability of the information shared by SMCS. On the other hand, in Silver and Matthews (2016), experience has been taken as one of the factors that can be influenced by SMCS. Then, in von Stülpnagel and Krukar (2018), the information about risk shared via SMCS is influenced by subjective points of view influenced by experience.

However, the work by Wählberg and Sjöberg (2000) has shown that the media are barely able to influence personal risk judgements, while personal experience (e.g., direct information from people about their experiences) is much more able to do so (see Section 3.2.3.4 about the 'experience' variable and its role in DRP). In particular, according to the authors, this happens because people with direct hazard experience tend to ignore mass media information about that hazard, since they find it inaccurate. Therefore, the media as a whole can only influence the general DRP, while different mass media seem to have different impacts.

PRACTITIONERS' VIEWPOINT

According to Province of Terni (Civil Protection Office), one of the main challenges in using social media in emergencies are fake news and disinformation. Sometimes disinformation is a consequence of the lack of knowledge and perception of what is happening, adding challenges to the work of civil protection.

PRACTITIONERS' VIEWPOINT

The role of SMCS in disaster information flow is also linked to the attitude people have to use digital platforms.

According to HBR and FRB experience, citizens prefer taking information on those existing platforms they are familiar with.

4.2.4 Diversity

Unfortunately, in the literature there are not many papers that consider a 'diversity point of view' in assessing and evaluating the use of SMCS in the assessment of DRP. A few works have been identified concerning gender.

In this direction, Reuter et al. (2019) have analysed the citizens' perception of social media use in emergencies across Europe, identifying that attitudes and behaviour are significantly related to gender, regardless of the national and cultural context, which can give an understanding of the level of perception. Across all countries and respective risk cultures, it was seen that women are significantly more likely to have used social media in a disaster than men, wherever they live. Moreover, there is a significant relationship between downloading an app and gender (towards male participants). As gender is distributed equally across the four analysed countries, these factors applied similarly in the cross-national behaviour.

On the other hand, the Appleby-Arnold (2018) study has shown that the quantitative data analysed in the island of Malta (from the CARISMAND project²) revealed no gender difference in social media usage relating to disasters. For this reason, this paper suggested that using social media as a means of providing disaster and risk-related information may help to reduce a possible gender gap in appropriate disaster preparedness. It also pointed out that further studies and targeted analysis strategies will be able to provide a better understanding of gender risk perception issues, so long as they are able to keep up with the ever faster technological development of SMCS.

Thus, Dressel (2015) has underlined how both risk and crisis communication have to take into account public risk perception patterns (and therefore, the peculiarities of each vulnerable group and country/region) in order to be successful and achieve a certain degree of compliance from the public. Therefore, the author was able to affirm that vulnerable groups, as well as different countries, could only benefit from 'targeted' disaster risk reduction communications and strategies. In other words, national and regional programmes aiming to increase citizen risk awareness must be drawn up in relation to the particular context of both the vulnerable group and the country (especially those in the developing nations, on this see D2.1).

Key takeaways from Section 4

- The way risks and crisis are communicated to the public will influence the perception of the event now and in the future;
- One of the main aims of risk communication is to raise disaster awareness and public trust in crisis management authorities;

² <https://www.carismand.eu>

- 'Risk communication' summarizes the following actions: informing the citizens about different types of disasters that can possibly occur in an area; educating citizens about the potential consequences of these disasters; encouraging citizens to take precautionary measures to be better prepared in case of a disaster;
- The use of SMCS in emergencies has become a research field; nevertheless, it is hard to find research concerning the role of SMCS in relation to DRP, mainly because the interest of those conducting the campaigns is behaviour change and not DRP change;
- This gap in the literature is perhaps because SM tend to be used for real-time notification while CS is for voluntarily community engagement, and therefore as yet they are not perceived both by authorities and citizens as useful tools before an emergency too;
- When risk communication happens via the media, that is, the use of SMCS is intentional, the impact, and therefore the DRP, could be increased;
- SMCS are mainly linked to the 'interpersonal' factors as they involve an interaction between people and the surrounding environment;
- Trust in the source of information is the main requirement for implementation of the use of SMCS in DRP;
- One of the main points that has to be addressed is to develop a culture of SMCS as a useful tool and not only as a mechanism for the spread of false information;
- It is not the content that influences people's opinions, but the sheer amount of coverage (people's risk perception can be influenced by the number and vividness of articles/features);
- It is not only important to receive information on risks, but also to have a reminder of them from time to time, otherwise people tend to forget and lower their risk estimates;
- Personal risk judgments are more influenced by personal experience than by media;
- People with direct hazard experience tend to ignore SMCS information about that hazard, finding such information inaccurate;
- Vulnerable groups are not considered in the analysed literature. However, vulnerable groups have characteristics that influence their capacity to anticipate, cope with, resist and recover from the impacts of disasters. Therefore, they need a specific focus in assessing and evaluating the use of SMCS in DRP;
- 'Targeted' communication strategies are needed to reach a greater spread of individuals.

5. RESEARCH METHODS EMPLOYED IN DRP AND SMCS STUDIES

This section aims to provide a first overview of the main methods used in DRP and SMCS studies. This overview is a basis for the D2.3 that will be delivered on Month 12. As a result, this section will be integrated with Section 5 of D2.1 to provide the DRPV methodology.

5.1 An Overview of the Main Employed Methods

According to Cohen et al. (2011), questionnaires and interviews are among the methodologies most employed to assess DRP (see categorization in the box). Moreover, in the literature that analyses SMCS and DRP, it is possible to find three additional methods: web-based interactive maps, analysis of SMCS data (i.e., tweets or posts in Facebook groups), and literature reviews.

Methodologies Categorized by Cohen et al. (2011)

- Structured questionnaires (paper or online)
- Structured questionnaires (via a computer game)
- Age-differentiated structured and semi-structured questionnaires
- Structured questionnaire based on active assessment
- Closed quantitative interviews
- Standardized open-ended interviews
- Guided interview approach based on a fictional story
- Informal conversational interview based on interviewee's drawing

In the 14 works (scientific papers) from the last ten years (from 2010 to 2020) that have been considered the most important for the literature review to define the role of SMCS in DRP (Section 4) it is possible to identify four literature reviews (see Annex III), while the others present the results of empirical research carried out by the authors involving different kinds of stakeholders (e.g., professionals in charge of DM or crisis communication and victims in Cornia et al., 2016; emergency services staff in Reuter et al., 2016; adults/residents in Kaufhold et al., 2019; Silver & Matthews, 2016; Lai et al., 2018; Reuter et al., 2019; students in von Stulpnagel & Krukar, 2018; and retired/older adults in Walkling & Haworth, 2020) coming from both EU (Cornia et al., 2016; Kaufhold et al., 2019; Reuter et al., 2016; von Stulpnagel & Krukar, 2018; Reuter et al., 2019) and non-EU countries (Silver & Matthews, 2016; Lai et al., 2018; Walkling & Haworth, 2020). Moreover, the focus of the research carried out by Vieweg et al. (2010) was public Twitter communications and not directly people.

Not all the methodologies mentioned in the box are discussed in detail below, as they lie outside the main purposes of this deliverable. The following Sections 5.1.1-5.1.3 briefly present the main

methodologies employed to assess the role of SMCS in DRP, or those considered useful by the authors of this deliverable for the upcoming deliverable (Section 5.1.4).

5.1.1 Structured Questionnaires (Online Survey)

One of the methods most employed in DRP, as told above, are structured questionnaires. Reuter et al. (2016) and Reuter et al. (2019), as part of the EU funded project EmerGent³, explored the correlation between DRP and SMCS through the use of an online survey with closed (quantitative) and open-ended (qualitative) questions based on a strategy aimed at the triangulation of micro-level (referring to individual perceptions) and macro-level (referring to organizational responses) attitudes.

In the work conducted by Kaufhold et al. (2019), as part of a wider project, the authors used a representative online survey to evaluate how the people interviewed perceived SMCS guidelines that have to be used before, during, and after a disaster.

In Annex IV are listed all the questions used to assess the role of SMCS in DMP assessment.

5.1.2 Standardized Open-Ended Interviews

Walking and Haworth (2020) and Silver and Matthews (2016) assessed risk perceptions, coping capacities, experiences before, during, and after a disaster, and risk communication preferences adopting standardized open-ended interviews (see Cohen et al., 2011) with semi-structured questions. This methodology ensured that participants were not influenced by the others' responses and allowed opportunities for participants to raise unexpected topics of interest and for the interviewer to clarify responses. Interviews lasted up to 45 min, a long enough time to balance the need for in-depth discussion and to avoid participant fatigue.

Standardized open-ended interviews can sometimes be used in focus groups, roundtables, and workshops. This is the case of the Opti-Alert project⁴ (Enhancing the Efficiency of Alerting Systems Through Personalized, Culturally Sensitive Multi-Channel Communication - SECURITY-2010-261699) that employed focus groups. The results shown in Mehta et al. (2017) have been obtained by analysing the outcomes of roundtables and workshops carried out to gather information, experiences and opinions on the use of social media in crisis communication and disaster management, and to gauge the need for further research and policy initiatives in this field.

5.1.3 Web-based Interactive Maps

In von Stulpnagel and Krukar (2018), data were collected on a web-based interactive map with the aim of assessing crowdsourced and authoritative data. People had to mark locations in the study that, based on their personal experiences and observations, they considered to be dangerous,

³ <http://www.fp7-emergent.eu>

⁴ www.opti-alert.eu

confusing or a nuisance in any other way for cyclists. An open description of the reported hazard could be added to the marking. Existing reports by other people could be supported via a 'Like' function.

5.1.4 Other Useful Methods: Structured Questionnaire Via a Computer Game

This section illustrates one method that could be useful for the upcoming deliverables and development of the DRPV methodology for the LINKS Framework and case-based assessments of the Framework. Goodman et al. (2015) evaluated people's perceptions in cases where the safety risks of normally engaged-in activities are increased by special conditions. The employed methodology was a structured questionnaire with a game interface that enabled participants to directly compare risk scenarios with a varying balance of perceived risk severity and frequency. This instrument avoided using arbitrary prompts and instead used naturalistic markers developed experimentally (prior to the actual game design) so that people roughly agreed about the degree of risk communicated. The instrument also observed individual variations from this 'rough agreement.' One advantage of this dynamic instrument over pen-and-paper alternatives is a 'tuning phase' that allows individuals' differences in perception to be controlled against the 'approximately mapped' values for naturalistic markers, which are embodied in the game's initial settings.

5.2 Limits and Challenges

Before discussing the limits and challenges of studying SMCS in relation to DRP, it is important to recall three general concepts, which are also useful in order to read this deliverable, and in particular this section, in a continuum with the other three KBs:

- **Use, role, and perception of SMCS:** Reuter and Kaufhold (2018) summarized 15 years of social media use during natural and human-induced crises, identifying different usage (i.e., types of interaction), role (i.e., types of users) and perception (i.e., views on social media) patterns between administrative and public stakeholders, both in the real (e.g., 'emergent groups' that usually act in the form of neighbourly help and on-site work, Reuter et al., 2016) and virtual domains (e.g., 'digital volunteers' who originate on the Internet and work online, Reuter et al., 2016);
- **What tool in which situation:** According to Reuter et al. (2016), there is an open question as to the perception by different emergency services in Europe of the use of social media. Even though the work by Kaufhold et al. (2019) aims to contribute to designing and evaluating citizens' guidelines for the use of social media in emergencies, there is a lack of a clear understanding of what tool to use or which tool is better in different situations. This is confirmed by the review on volunteer crowdsourcing in DRR in which the authors maintain that despite its growing popularity, there is no consensus on what volunteer crowdsourcing is, and how it supports DMP, despite a wide range of applications being available

(Kankanamge et al., 2019). For this reason, the two other KBs in the LINKS project are about DCT (D4.1) and DMP (D3.1);

- **SMCS advantages and drawbacks:** As many authors have claimed, the use of SMCS in disasters has both advantages and drawbacks. In their review, Jurgens and Helsloot (2018) underlined a variety of potential social media uses during disasters and their positive effect on the dynamics of citizen (self-) resilience. Alexander (2014) has highlighted the positive aspect of social media in promoting cross-platform accessibility and a constant flow of information. Nevertheless, according to Alexander (2014), Reuter et al. (2016), Silver and Matthews (2016) and Jurgens and Helsloot (2018), and quoted references, the appreciation of the positive employment of social media in the disaster management cycle (DMC) is balanced by their potential for risk, chaotic use and negative developments, such as the redundancy or inconsistency of information and the dissemination of rumours, the undermining of authority and the promotion of terrorist acts.

5.2.1 The Issue of Accurate Information

Von Stulpnagel and Krukar (2018), and many other works (mentioned above), have agreed that the main challenge in using SMCS in research is especially linked to understanding what information is false and distinguishing it from what is true, as well as the difficulties in selecting useful data, considering the amount of information that social media platforms produce daily. Therefore, the role of SMCS in the assessment of DRP is strictly related to trust in the source of the information and in the reliability of the information itself. On information and misinformation as barriers to authorities' use of SMCS in DMP see D3.1.

5.2.2 Scale of Analysis

Nine of the works discussed investigated a case study. Most of the works (six) are EU studies, three of which adopted a multi-national approach (Cornia et al., 2016; Reuter et al., 2016; Reuter et al., 2019). The other three works focused on non-EU countries (Silver & Matthews, 2016; Lai et al., 2018; Walkling & Haworth, 2020), discussing different cases from North America and Asia.

5.2.3 Types of Hazards Discussed

Only the work by Vieweg et al. (2010) took a multi-hazard approach. All the other works focused on only one hazard (Silver & Matthews, 2016; von Stulpnagel & Krukar, 2018; Walkling & Haworth, 2020) or on natural hazards in general, without specifications (Cornia et al., 2016; Mehta et al., 2017; Lai et al., 2018), or did not even specify the kind of hazards (Alexander, 2014; Kaufhold et al., 2019; Reuter et al., 2016; Jurgens & Helsloot, 2018; Reuter & Kaufhold, 2018; Kankanamge et al., 2019; Reuter et al., 2019).

Research or crisis communication concerning terrorist attacks has not actually tackled the topic of DRP, or if so, DRP raised by the media is rather seen as something negative (Hase, 2018). However,

in one subfield of radicalization research (the field of threat assessment, which tries to assess terrorists' profiles), there is some research on how to make ordinary people aware of radicalized behavioural traits so that they will inform the authorities. This research was conducted via standardized tests on case vignettes (Böckler et al., 2017) and has to our knowledge never been linked to SMCS.

5.2.4 Phases of the DMC

Half of the analysed works considered the emergency/response phase, while only two works were also interested at the preparedness phase (Kaufhold et al., 2019; Lai et al., 2018) and only one considered the recovery phase (Kaufhold et al., 2019). None of the articles focused on DRP analysis or on the role that SMCS can play in the assessment of DRP. For the definition of the phases in the disaster management cycle, please refer to D4.1.

5.2.5 SMCS Platforms

In general, these works referred to social media without specifying the kind that was being referred to. Only three works specified the SMCS employed: Vieweg et al. (2010) focused on Twitter communication, Silver and Matthews (2016) on Facebook, and Kankanamge et al. (2019) on crowdsourcing in general. Then, Lai et al. (2018) was interested in the use of mobile phones in general as a way to develop early warning systems. For a more in-depth definition and classification of SMCS see D4.1.

5.2.6 Vulnerability Analysis in DRP and SMCS

To our knowledge, there are no works that specifically design and apply an *ad hoc* methodology to survey DRP in vulnerable groups.

5.3 Towards a Multi-age Approach in DRPV

5.3.1 Children/Young People and SMCS in DRP Studies

The literature on children's risk perception is scarce and very recent compared with the literature about adults. Indeed, children's perceptions about nature and the environment are truly different from those of adults. According to Carone and Marincioni (2020), children's risk perception is strongly affected by the place where they live, its geographical characteristics and its cultural influence. Furthermore, their feelings concerning the environment are subject to change as they get older (Collado et al., 2015; Bandecchi et al., 2019). Similar results have been obtained by Izadkhah and Gibbs (2015). For these authors, DRP is linked to hazard awareness, knowledge of the emergency procedures, the level of anxiety and fear, and finally the evaluation of one's own level of vulnerability.

As for the available research, most of the works concerned the implementation of earthquake emergency measures, while not much is available on flood-risk perception and even less on landslides (Bandecchi et al., 2019) and other kinds of risk, such as technological/industrial risk and terrorism.

Even though the first instrument to improve DRP in children remains school and the subjects taught (e.g., recently 'civil protection' has been introduced as a subject in schools in Italy), SMCS could play an important role in increasing children's DRP if used the right way. Some SMCS (e.g., YouTube) are also employed as tools to teach about risk. Thus, SMCS could be used to increase children's knowledge of the correct behaviour and procedures during an emergency, or to enhance DRP while diminishing the level of anxiety and fear that they can feel/experience when thinking of the surrounding environment. Of course, as they grow up, SMCS could be used as a two-way communication tool with the civil protection authorities and to evaluate their level of vulnerability.

However, today there is a gap in the literature on how children interact with new technologies during disasters and how this could have effects on their DRP and preparedness. Recent studies have focused on the way children interact with technologies but without addressing the issue in relation to potential natural or human-made risks. Some works, for example, have shown that, on a weekly basis, children engage in different online activities on the basis of age, gender, smartphone ownership and daily use, their experience with the Internet, and their parents' ownership and use of mobile devices (Mascheroni & Ólafsson, 2015). Moreover, they spend more time (at least twice as much) watching TV/videos and playing with smartphones/tablet devices rather than reading books (Genc, 2014). Unfortunately, a drawback can be that children develop a digital technology dependence where games are the most commonly used applications, which can lead to a more severe dependence also associated with a greater use of learning applications and television/video (Park, 2020). Other studies have demonstrated that preschool children's cognitive and social skills can be enhanced thanks to an appropriate use of digital technology (Genc, 2014).

Finally, considering that young people's use of SMCS is influenced by that of their parents, and most of them have more applications for entertainment purposes than for learning on their devices (Genc, 2014), it is important to first change the adults' attitudes before children's risk perception can be changed via SMCS.

5.3.2 The Elderly and SMCS in DRP Studies

Moving the focus to elderly people, we note that very few works have been focused on their risk perception. An example is Walkling and Haworth (2020), who interviewed retired people living in a flood risk area in North Wales (UK) to ascertain risk perceptions, coping capacities and risk communication preferences. The results have shown that the retired population is a diverse group with varying perceptions and capacities. While personal risk perceptions were low overall, coping capacities varied and were primarily social in nature, which can be maintained despite mobility or

other limitations typical of older age. The participants expressed a preference for traditional or interpersonal risk communication methods, such as telephone calls or home visits. A key recommendation from this study was that risk communication and DMP should adopt people-centric approaches that are co-produced and that respect the differentiated vulnerabilities, capacities and needs of at-risk populations (see also D3.1). Nevertheless, even though older adults find it very difficult to use SMCS, in their literature review Coto et al. (2017) reported that in recent years there have been many works that discuss new methodologies and ideas on how SMCS can improve the quality of elderly people's lives, reduce their feelings of loneliness and increase their mental well-being. Therefore, the use of SMCS to increase elderly people's risk perception could also be an interesting research field to develop.

5.3.3 First Considerations for a Multi-age Approach

The role of intergenerational dialogue is a relevant issue to address in disaster studies. A premise about this is that children and young people have a high resilience capacity that needs to be released from the constrictions of an adult-centric vision. For instance, in disaster risk reduction and climate change adaptation processes, intergenerational justice is usually mentioned but never effectively sought. What is more, disaster studies have given limited attention to the role that children and young people may have as agents of resilience or transformation in DRR and climate change adaptation processes. Children and young people have usually been perceived as passive recipients of the initiatives and decisions in place. On the other hand, some attempts, especially focusing on climate change, have experimented with youth-centred approaches (e.g., Mitchell & Borchard, 2014; Haynes & Tanner, 2015).

In the same way, the elderly are an understudied group and, like children, they are usually classified as a vulnerable group, thereby excluded from discussions on their capacity to deal with risks and to provide help to other social groups susceptible to risks. In this connection, the practice of labelling specific groups as 'vulnerable' (as discussed in D2.1) could affect their capacity to prevent or cope with risks, as well as to act as agents of resilience.

In this perspective, new technologies can be useful tools to strengthen social links and promote resilience. This can derive from the ways and methods of involvement and interaction offered by new technologies (software, social media and crowdsourcing platforms, digital technologies, etc.) to make the DRP of the different social groups more effective, while also posing a challenge to traditional social hierarchical systems.

Key takeaways from Section 5

- The most frequently employed methods to evaluate the role of SMCS in DRP are questionnaires and interviews;

- Standardized open-ended interviews can sometimes be used in focus groups, roundtables, and workshops.
- Web-based interactive; maps with a 'Like' function could be useful to increase DRP.
- A structured questionnaire based on a computer game can allow individuals' differences in perception to be controlled;
- There is not a clear understanding of what tool to use or which tool is better in different situations and in studying DRP;
- Limitation of the use of SMCS in DRP are:
 - The issue of accurate information: the main challenge in using SMCS is linked to understanding what information is false and what is true;
 - The scale of the analysis: no multi-cultural approach;
 - The types of hazards discussed: usually the multi-hazard approach is not taken into account;
 - The phases of the DMC taken into account: works are mainly focused on the emergency/response phase;
 - The SCMC platform employed: usually not specified;
 - The analysis of vulnerability: lack of works that address this point.
- SMCS could increase children's knowledge of the correct behaviour and procedures during an emergency, or could enhance DRP while diminishing the level of anxiety and fear that they can feel/experience when thinking of the surrounding environment;
- It is important to change adults' attitudes first to then be able to change children's risk perception via SMCS;
- SMCS can improve the quality of elderly people's lives, reduce their feelings of loneliness and increase their mental well-being;
- The use of SMCS as a means of providing disaster and risk-related information may help to reduce a possible gender gap in appropriate disaster preparedness;
- Vulnerable groups could only benefit from 'targeted' DRR communications and strategies, that is, national and regional programmes aiming to increase citizens' risk awareness must be drawn up around the particular context of both the vulnerable group and the country (especially in the developing world).

6. CONCLUSION

This section presents the main results and final considerations stemming from the literature review provided in this document about SMCS and their relation to DRP. Moreover, it also presents potential gaps and future directions of the research, and thereafter, lays out the next steps for this KB in LINKS.

6.1 Summary

This deliverable assesses the literature on SMCS and their role in DRP, adopting a multi-level model to identify what are the main perception variables that have been discussed in the papers reviewed.

First, it is important to underline that even though the use of SMCS in DRM became a research field more than ten years ago, there are very few works that take into account their role in DRP. Media and SMCS are often believed to be very important for DRP, and trust in the source of information is one of the main factors in DRP studies. SMCS and the media are, in fact, usually the means used by authorities to communicate risk about disasters to citizens, and at the same time the method employed by citizens for voluntary community engagement.

Thus, the papers were analysed according to a three level model composed by background factors, interpersonal factors and individual factors. Diversity is included as a transversal level across these factors.

According to the background level, it emerges that geographical and socio-cultural context can shape individual and collective perception and influence the way people interact with digital instruments. Thus, the moving from the physical geographical space to the digital one has contributed in changing the way people perceive risks and situations, reducing (emotional) distances. On the other side, people with a low socio-economic status can have, as discussed in D2.1, less access to the digital information.

The second level, the interpersonal, is more linked with the dimensions of knowledge, awareness, information flow and trust. According to the results, SMCS can increase the level of knowledge and awareness, making available more information and promoting its sharing. Risk awareness is strictly connected with the way risk communication is carried out, with potential consequences on the level of preparedness of the communities. However, this point is also associated with the risk of disinformation and misinformation. With SMCS the sharing of bad quality information increases. The false perception of SMCS information reliability is usually associated, for example, to how many times a news source is shared. The level of attention given to information can give the wrong perception that it is reliable. Furthermore, information can be built and shared anyone, which is seen through issues such as fake news. Thus, in some cases SMCS can help facilitating and reducing the time of sharing of information, although in others it can be responsible for facilitating

misinterpretation/misperception due to the interpretative banalization of situations, and the excessive amount of information.

Then, trust emerges as one of the most relevant issues linked to the interpersonal level. Many works discuss what is the level of trust in institutional communication and SMCS tools/platforms. However, the main point is how to measure the capacity of each media channel to influence risk perception and what are the factors that increase the trust in a specific source of information. This aspect is also associated with what emerged in D2.1, according to which most marginalized groups are likely to trust in non-institutional channels of communication and to use, for example, social media platforms to receive and share information. Another point is how the trust in the different information channels can influence behaviour. As discussed in this deliverable, although DRP can influence behaviour, this does not mean that there is a direct correlation between the two concepts.

Considering the individual level, experience is the aspect most taken into account. Usually experience is used to evaluate the reliability of information. On the other side, peoples' idea of experience is changed with the advent of digital space. Thus, today we can do indirect 'digital experience' of events through, e.g., the high diffusion of information and the participating to the shared experiences of our virtual friends. However, the literature shows that who has a direct experience of the phenomenon is usually less moved to take in account social media information, considering it inaccurate.

Thus, to conclude, the main limits and challenges associated with the use of SMCS in terms of DRP identified in this deliverable are:

- Limited interests in the uses of SMCS to share/receive information, due to the limited trust in these communication channels as quality information channels.
- Misinformation, disinformation and misinterpretation of phenomena particularly among those people with less trust in institutions due the spread of poor quality or unreliable information and the absence of mechanisms to evaluate it.
- Risk of distance between real and digital spaces. Thus, the risk is that an increased attention/perception of a phenomenon through digital platforms will not necessarily corresponds to changes in actual behaviours.

6.2 Gaps and Future Directions

This deliverable has contributed both to implement the discussion on DRP in disaster risk management and to identify some first gaps that will be the starting point for potential future directions of the research.

The main gaps identified in D2.2 can be summarized as follow:

- **Methodological gaps**, that have been discussed in Section 5, and in particular:

- Geographical/scale gaps, few works have discussed DRP and SMCS in European disaster contexts and most of them adopt the national level of analysis, with the risk that the results cannot feed into more generic contexts;
 - Disaster gaps, most of the works discuss natural hazards;
 - DMC gaps, studies on perception are mainly focused on preparedness phase;
 - Quality information gaps, the risk of using data coming from SMCS is the validity of the collected information.
- **Conceptual gaps** are identified, especially in the way the concepts of culture and risk perception are discussed.

According to the results and gaps discussed in this deliverable, this section provides also some potential future directions of the research in the following areas:

To change adults' attitudes concerning the use of SMCS. Some studies have shown how adults have more applications on their mobile devices for entertainment purposes than for learning. Therefore, to promote the use of SMCS in DRP it is necessary to change the adults' perception about their phones and the apps that they download and install.

To work on 'trust' both towards communication channels and official organizations. This is a key component, as already mentioned, in order to improve the efficiency of SMCS in disasters, considering the strategic role they have in providing information in real time. The risk perception and awareness of at-risk populations are increased by correct risk communication, which also promotes preventative measures for risk reduction. These perceptions at individual and community levels form an important societal component of DMP for determining responses to warnings and efforts to increase community preparedness. Thus, the literature seems to recognize that DRP influences the way communication is handled and vice versa (the way risks and crisis are communicated to the public will influence the perception of the event now and in the future) with potential consequences in terms of preparedness. Thus, the trust relationship should be applied to the communication matrix (see D4.1) with the aim of covering all the stakeholders and the information sources (towards integrating top-down and bottom-up approaches).

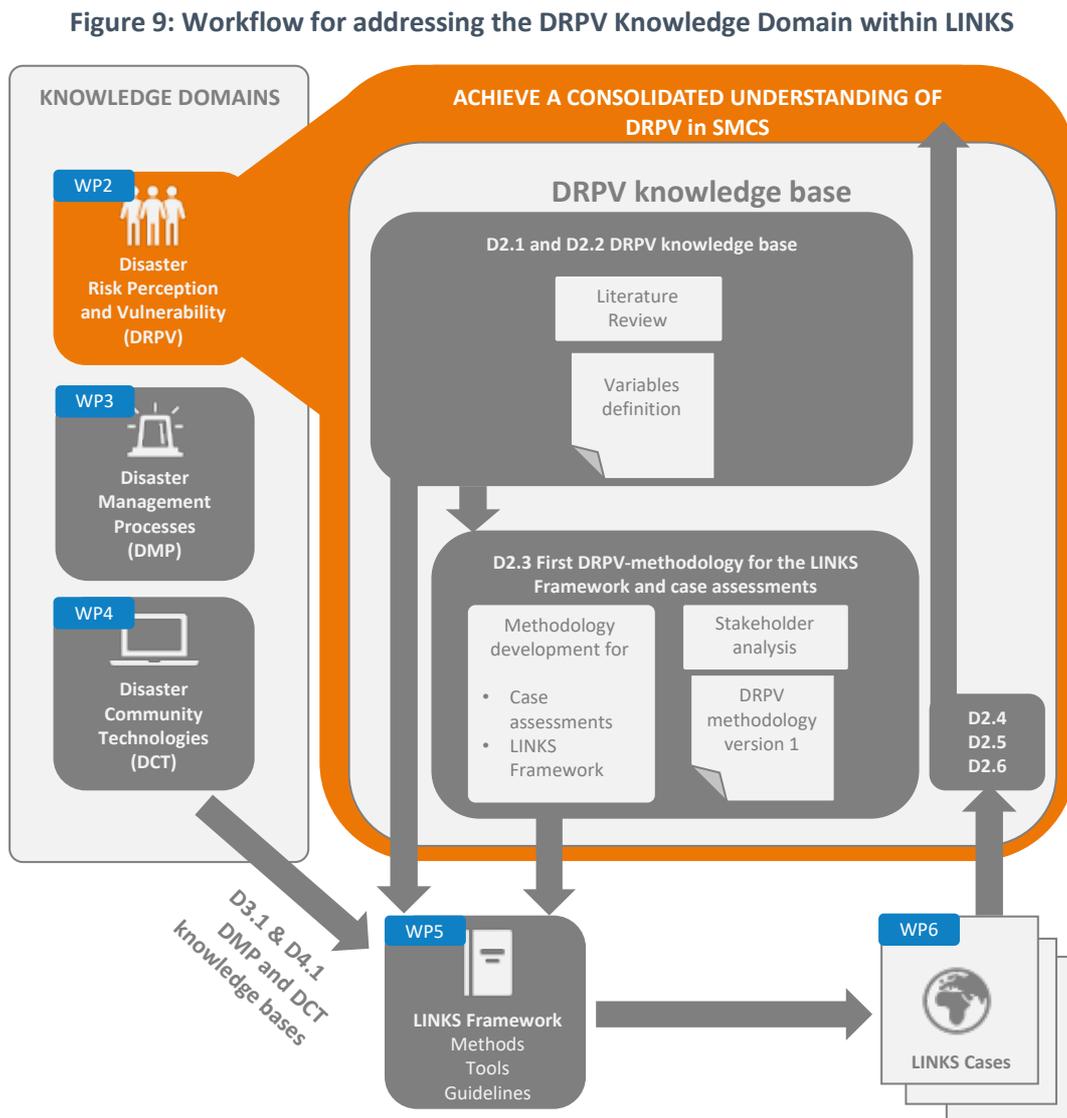
To promote a diversity approach in DRP, especially in relation to SMCS. The so-called 'risk perception paradox' underlines how risk perception does not always influence individual preparedness in the same way across time and space. That is why the LINKS Framework will have to pay attention to how diverse communities and individuals perceive and interpret risk and how they act. In this regard, SMCS play a key role in identifying how to communicate risk, also by considering different methods/ways to reach even the most vulnerable populations.

To integrate DRP with the vulnerability paradigm. This should be done not only in identifying how socially vulnerable people perceive situations and information channels, but rather how they perceive their condition of vulnerability and how they are perceived in DMPs. This also sets out to

challenge the vision on the relationship between vulnerability and resilience (see D2.1), with the aim of pushing towards a fluid interpretation of the two conditions.

6.3 Next Steps in LINKS

Together with D2.1, D3.1, and D4.1, this deliverable provides a foundation for supporting the development and evaluation of the LINKS Framework and point to the need for integration between KBs when moving forward. The overview of how the DRPV domain is addressed in LINKS is provided below (Figure 9).



Source: Authors' adaptation based on D4.1

This KB constitutes the conceptual basis on which to build the first iteration of the DRPV Methodology (D2.3) to be provided in May 2021. The state-of-the-art, the DRP multilevel-approach,

and the gaps identified in this deliverable are the main results provided by this deliverable that will be used for developing the methodology. DRPV methodology will have the purpose to assess specific assumptions and research questions in the cases, thus it will be built with the support of the local methodology responsables as identified in case assessment teams (CATs) for each case country (see D6.1). Accordingly, the local methodology responsables will be called to participate to a Methodological Taskforce that will be used as a consultation group to guide the methodology building and to have a direct contact with cases and local practitioners. The methodological taskforce is complementary to the CATs, the primary difference between the two is that the taskforce involves core partners across all cases, while the bi-lateral discussions facilitated, as needed, by WP6 involve the case assessment teams (CATs) in each country. Both are important to develop the methodologies for the case-based assessment of the Framework.

Thus, in the next step of the project, the purpose will be to apply the DRP multilevel-approach here suggested to the case-based assessment of the LINKS Framework with the aim of providing an interpretative tool for DRPV in the LINKS project.

Ultimately the knowledge gathered within this KB must be translated into the LINKS Framework through various learning materials and for different sets of stakeholders within the LINKS Community. This will be done in iterations in three phases in the project (Figure 2). The knowledge must also be accessible to those stakeholders through the LCC (WP7). This requires ongoing collaboration across all WP in the coming project phases to understand the learning needs and to enable learning potentials for different stakeholders through the refinements of the Framework and LCC. For a detailed overview of the next work plans for the Framework, cases, and LCC development, see D5.1, D6.1, and D7.1.

To summarize, the future steps of the research in WP2 will be to:

- Integrate KBs on vulnerability and DRP with the aim of producing a DRPV methodology for the case-based assessment of the LINKS framework;
- Work in connection with the other KBs, to challenge the concept of resilience and diversity in disasters in relation to SMCS and therefore inform the LINKS Framework;
- Inform the LINKS Community, by transferring the main results of this deliverable into learnable and operational outputs for different stakeholders, through the LINK Framework and LCC.

7. NOTE TO ANNEXES

The purpose of this section is to guide the reader through the annexes contained in Section 9 and to provide some first valuable overviews. These annexes represent registries of the collected knowledge on the use of SMCS and DRP.

In particular, the Annexes section guests the following registries:

1. **Annex I: Literature Review Grid.** The excel grid has been used to code the main papers on DRP and SMCS. It has been a useful tool to analyse the documents and to build Section 5 of this deliverable. However, it can be a useful basis also for future research works that aim to discuss the topic. It provides also relevant information for practitioners and policymakers, that can obtain information on the geographical distribution of the main works, on the main disasters/hazards analysed, such as on the limits and potentialities of SMCS in DM.
2. **Annex II: Main Factors that Influence the DRP and the DRP Definitions.** The table is a useful instrument that provides a first selection of DRP definitions. This could be considered in relation with other works that made similar attempts as useful basis for future literature review discussions on the concept. Although this resource is mainly thought as a output for academic community, professors, researchers and students, it could be a useful for practitioners and policymakers, to have a further perspective on the concept and that could inform future measures and policies that aim to define/approach DRP in DM.
3. **Annex III and IV: Methodologies employed to study SMCS and DRP and Main Q&A about the role of SMCS in DRP and DMP.** The table gives the reference to the main works that have discussed DRP and SMCS, grouping them according to the methods used. The table is thought as a basis for D2.3 but it also provides a state-of-the-art for future researchers that aim to explore the condition of DRP in relation with SMCS.
4. **Annex V: List of Academic Research Reviewed:** the list is a bibliography that contains all the literature analysed to discuss DRP. This could be a useful basis for future literature reviews and conceptual discussions.
5. **Annex VI: European Projects:** the table is constructed to identify potential linkages with other European projects that work(ed) on DRP and new technologies in disasters. The list could be a useful basis for future works and projects that aim to discuss the same topic.

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9. ANNEXES

9.1 Annex I: Literature Review Grid

Authors/date	It is from a project?	Project name	Empirical research	Stakeholders analysed	Phases of DMC	Method		Geographical area		Kind of hazards		Technology involved	Material available
						Multi-age	Comparative approach	Europe	Not- Europe	Hazards	Multi-hazards		
Vieweg et al 2010	X		X	Public Twitter communications	Emergency/Response	X	X		America	Flood and grassfire	X	microblog (Twitter)	



Alexander 2014				Review	Emergency/Response					Not specified	Social media	
Cornia et al 2016	X	Opti-Alert project (www.opti-alert.eu).	X	26 professionals in charge of DM or crisis communication; 31 interviews with victims			X	Germany, Austria, Italy, Hungary, France, Sweden and the Netherlands		Natural		
Reuter et al 2016	X	EMERGENT	X	761 emergency service staff	Emergency/Response	X		32 European Countries		Not specified	Social media	X
Silver & Matthews 2016	X		X	Residents	Emergency/Response	X			Ontario	Tornado	Facebook	



Mehta et al 2017	X	Social Media in Times of Crisis		Review	Emergency/Response					Natural	Social media	
Jurgens & Helsloot 2018				Review	Emergency/Response					Not specified	Social media	
Lai et al. 2018	X		X	Urban and rural inhabitants	Preparedness	X	X		Indonesia, Myanmar, Philippines, and Vietnam	Natural	Mobile thechnologies	



Reuter & Kaufhold 2018	X	EMERGENT	Review	Emergency/Response					Not specified	Social media	
von Stulpnagel & Krukar			X	undergraduated student (avarege: 22-24 years old)		X	X	Munich and Freiburg	Urban Cycling		
Kaufhold et al 2019			X	Adults	Preparedness Emergency/Responce Recovery	X		Germany	Not specified	Social media	X
Kankanange et al 2019				Review					Not specified	Crowdsourcing	



Reuter et al 2019	X	EMERGENT	X	7071 citizens	Emergency/Response	X	X	Germany, Italy, Netherlands and UK	Not specified	Social media	X
Walking & Haworth 2020			X	Retired adults older				UK	Flood	Yes	X

9.2 Annex II: Main Factors that Influence the DRP and the DRP Definitions

Factors	DRP definition	Reference
<ul style="list-style-type: none"> Cultural context 	Public risk perception is usually the result of cultural values, economic interests, and intuitive biases	Kaspersen et al., 2000
<ul style="list-style-type: none"> Social values and cultural context Spatial context 	Risk perception regards potential impacts on oneself, one's family and the community. This in turn influences individuals' policy preferences, civic engagement, adaptation behaviour and other important responses. Risk perception may be country- and culture-specific and thus difficult to generalize across a geographically, economically, and culturally diverse planet	Lee et al., 2015
<ul style="list-style-type: none"> Social values and cultural context 	Risk perception drawn from comparative analysis is more complex than many theorists have assumed so far	Renn & Rohrman, 2000
<ul style="list-style-type: none"> Social values and cultural context 	Risk perception is an example of cognition, and the primarily interested is in looking at the similarities and differences between individuals	Wählberg & Sjöberg, 2000
<ul style="list-style-type: none"> Information flows 	Risk perception defines the way communication is handled and vice versa. The way risks and crises are communicated to the public influences the perception of the event now and in the future	Dressel, 2015
<ul style="list-style-type: none"> Social values and cultural context Information flows Experience 	Risk perception denotes the process of collecting, selecting, and interpreting signals about the uncertain impacts of events, activities or technologies. Yet risks cannot be 'perceived' in the sense of being taken up by the human senses, like images of real phenomena. Mental models and other psychological mechanisms that individuals use to judge risks (such as cognitive heuristics and risk images) are internalized through social and cultural learning and constantly moderated (reinforced, modified, amplified or attenuated) by media reports, peer influences and other communication processes	Wachinger et al., 2013
<ul style="list-style-type: none"> Social values and cultural context Knowledge Information flows Experience 	People look at disasters in different ways. They can be seen as the result of divine intervention, an authority's failure to set up adequate prevention measures, the product of the citizens' lack of preparedness, simple natural phenomena or unlucky events	Cornia et al., 2016

<ul style="list-style-type: none"> • Social values and cultural context • Spatial context • Diversity 	<p>Risk perception refers to an inherently psychological construct – a subjective judgment about the likelihood felt of encountering hazards when objective information is minimal</p> <p>Risk perceptions are based on a variety of sources of information, but are heavily influenced by internal factors that often appear to be quite discrepant from the objective evidence of actual risk</p>	<p>Gierlach et al., 2010</p>
<ul style="list-style-type: none"> • Social values and cultural context • Psychometric factors • Experience 	<p>Risk perception as a psychological construct is defined as a subjective judgment made by people when characterizing and evaluating hazards</p> <p>Perceived risk, in turn, may be defined as the perceived likelihood of personally encountering a hazard</p>	<p>Knuth et al., 2014</p>
<ul style="list-style-type: none"> • Social values and cultural context • Knowledge • Information flows • Affects • Emotion • Experience 	<p>Risk perception of natural hazards can be defined as the subjective evaluation of the likelihood of a future event occurring and of the personal and material damage deriving from it</p> <p>Risk perception may be properly conceptualized as a complex process that encompasses both cognitive and affective aspects</p>	<p>Bandecchi et al., 2019</p>
<ul style="list-style-type: none"> • Knowledge • Awareness • Psychometric factors 	<p>Risk perception is defined as a subjective judgment made by people when characterizing and evaluating hazards</p>	<p>Slovic, 1987</p>
<ul style="list-style-type: none"> • Affects • Emotions 	<p>While experts evaluate risks based on probabilities of occurrence, mortality and damage, the public evaluates risks based on 'subjective' dimensions such as negativity, familiarity, and controllability</p>	<p>Yong & Lemyre, 2019</p>

9.3 Annex III: Methodologies Employed to Study SMCS and DRP

Survey methodology	Reference
Structured questionnaire (online survey)	<ul style="list-style-type: none"> • Reuter et al. (2016) • Kaufhold et al. (2019) • Reuter et al. (2019)
Standardized open-ended interview	<ul style="list-style-type: none"> • Walkling & Haworth (2020) • Cornia et al. (2016) • Silver & Matthews (2016) • Mehta et al. (2017) • Lai et al. (2018)
Web-based interactive maps	<ul style="list-style-type: none"> • von Stulpnagel & Krukar (2018)
Analysis of SMCS data	<ul style="list-style-type: none"> • Vieweg et al. (2010)
Literature review	<ul style="list-style-type: none"> • Alexander (2014) • Jurgensen & Helsloot (2018) • Reuter & Kaufhold (2018) • Kankanamge et al. (2019)

9.4 Annex IV: Main Q&A about the Role of SMCS in DRP and DMP

Reference	Questions	Possible answers
16_Reuter et al., (2016)	<p>Q1: Please indicate how strongly you agree or disagree with the following statements.</p> <ul style="list-style-type: none"> • In my private life, I use social media very often • Most of my friends use social media to keep in touch • Information provided on social media during an emergency is often not reliable • It is important for Emergency Services to use social media to keep in touch with the public during emergencies • Social media are an important tool for Emergency Services like the one I work for • Social media could be useful for gaining situational awareness information during emergencies • Social media could be a useful tool for Emergency Services to share information with citizens • Emergency Services are too busy to use social media <p>Q2: Add any other comments about your attitude towards social media</p> <p>Q3: Does your organization use social media?</p> <ul style="list-style-type: none"> • To share information with the public about how to avoid accidents or emergencies • To share information with the public during emergencies about how to behave 	<p>Q1:</p> <ul style="list-style-type: none"> • Strongly agree • Agree • Neutral • Disagree • Strongly disagree <p>Q3:</p> <ul style="list-style-type: none"> • Often • Sometimes • Occasionally • Never • Don't know

- For two-way communication with the public
- To receive messages from the public during emergencies
- To search social media sites to gain situational awareness during emergencies

Q4: Please give an example of the way(s) in which your organization used social media recently before, during, or after an emergency or incident?

Q5: Which of the following types of information shared on social media by the public would you find useful to receive during an emergency?

- General situational updates (relating to the emergency)
- Specific information (injuries, damage to property etc.)
- Information about the public mood (panic or calm)
- Photos of the emergency situation
- Videos of the emergency situation

Q6: How important do you think are the following factors to ensure that social media is widely used by Emergency Services like yours?

- Staff skills to use social media
- Organizational culture
- Funding for staff time to use social media
- Equipment
- Software to access social media

Q7: Are there any other factors that are important?

Q5:

- Very useful
- Useful
- Neutral
- Not useful
- Not at all useful

Q6:

- Very important
- Important
- Neutral
- Not important
- Not at all important

15_Kaufhold
et al., (2019),

Q1: How do you rate the following recommendations for usage of social media before an emergency?

- Know the social media accounts of your local and national ES
- Follow the information from the ES on how to prevent and stay safe
- Look for ES apps to stay informed during an emergency
- Read what to expect from ES in social media

Q1:

- Very important
- Important
- Neutral
- Not important
- Not at all important

Q2: How do you rate the following recommendations for usage of social media during an emergency?

- Social media does not replace emergency calls
- Share only official and reliable information
- Tell only facts and don't send uncertain information
- If you spot or shared false information, please correct it
- Always stay up-to-date
- Mention the ES account, include hashtags, locations, and photo
- Forward received official messages to your contacts
- Check for existing volunteer initiatives
- Look for emergent volunteer initiatives

Q2:

- Very important
- Important
- Neutral
- Not important
- Not at all important

Q3: How do you rate the following recommendations for usage of social media after an emergency?

- Help others reconstructing/handling the event
- Restore missing contacts and ask for welfare of family and friends

Q3:

- Very important
- Important
- Neutral
- Not important
- Not at all important

	<ul style="list-style-type: none"> • Follow the official accounts and continue communication • Give feedback to the authorities <p>Q4: How do you rate the following, general aspects for using social media in an emergency?</p> <ul style="list-style-type: none"> • Correct a mistake if you made one • You are responsible for your writing • Interact with respect and courtesy • Verify your information before posting • Protect your privacy and check the privacy setting • Respect intellectual property rights <p>Q5: Which are criticism or improvement suggestions for the presented guidelines about the use of social media before, during, and after a crisis</p>	<p>Q4:</p> <ul style="list-style-type: none"> • Very important • Important • Neutral • Not important • Not at all important
<p>10_Reuter et al., (2019)</p>	<p>Q1: Please indicate how often, on average, you do the following things: Use a smartphone (e.g., Android, iPhone or Windows)</p> <ul style="list-style-type: none"> • Use Facebook • Use Twitter • Use some other types of social media (e.g., Instagram, YouTube, etc.) • Post messages on social media. <p>Q2: Have you ever used social media such as Facebook, Twitter, Instagram etc. to find out or share information in an emergency such as an accident, power cut, severe weather, flood or earthquake close to you?</p>	<p>Q1:</p> <ul style="list-style-type: none"> • Hourly • Daily • At least once a week but less than daily • Less than once a week • Never <p>Q2:</p> <ul style="list-style-type: none"> • Yes, I have used it to find out and share information • Yes, I have used it just to share some information • Yes, I have used it just to find out some information • No, I have not used it in this way • Don't know/Can't remember

Q3: What types of information did you share?

Q3: Select as many as apply)

- Weather conditions or warnings
- Road or traffic conditions
- Reassurance that you are safe
- Your feelings or emotions about what was happening
- Your location
- What actions you were taking to stay safe
- An eyewitness description of something you experienced
- Advice about what actions others should take to stay safe
- An eyewitness photo
- A video
- Other (please specify).

Q4: Imagine that you posted an urgent request for help or information on a social media site of a local emergency service, such as your local police, coastguard, fire, or medical emergency service. To what extent do you agree with the following statements:

Q4:

- Emergency services should regularly monitor their social media
- I would expect to get a response from them within an hour
- Emergency services are too busy to monitor social media during an emergency

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

Q5: What might put you off using social media during an emergency?

Q5:

- Information on social media is not reliable
- There are many false rumours on social media
- I am concerned about data privacy
- It is better to call 112 than to post messages on social media
- I am not confident using social media

- This would definitely put me off
- Might put me off Neutral
- Would probably not put me off
- Would definitely not put me off

- Social media might not work properly in an emergency.

Q6: Have you ever downloaded a smartphone app that could help in a disaster or emergency?

Q7: What type of app did you download?

Q8: Please indicate how likely you are in future to use a smartphone app for each of the following purposes as a result of an emergency?

- To receive emergency warnings
- To receive tips about how to stay safe
- To contact an emergency service instead of making a 112 call
- To share information about the emergency with an emergency service
- To find out information about the emergency
- To connect with other citizens to help others affected by the emergency

Q9: Please provide any additional details of your experience of using social media in emergencies or what might encourage you to do so in future.

Q6:

- Yes
- No
- Do not know/Not sure

Q7:

- A weather app
- A warning app
- A First Aid app
- An emergency call app
- An-other type of app (please specify)

Q8:

- Very likely
- Quite likely
- Neutral
- Not very likely
- Not at all likely

9.5 Annex V: List of Academic Research Reviewed

- Agrawal, N., Elliott, M., & Simonovic, S. P. (2020). Risk and Resilience: A Case of Perception versus Reality in Flood Management. *Water*, 12(5), 1254. <https://doi.org/10.3390/w12051254>
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- Armaş, I., & Avram, E. (2009). Perception of flood risk in Danube Delta, Romania. *Natural hazards*, 50(2), 269-287. DOI 10.1007/s11069-008-9337-0
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9.6 Annex VI: European Projects

Title	Project start	Project end	Project summary	Relevance to D2.2	URL
CapHAZ-Net	2009	2012	The main objectives of CapHAZ-Net are to identify and assess existing practices and policies for social capacity building in the field of natural hazards and to elaborate strategies and recommendations for activities to enhance the resilience of European societies to the impacts of natural hazards	Deliverable 3.1 about risk perception and natural hazards	https://cordis.europa.eu/project/id/227073/it
Alert for all	2011	2013	Alert4All (A4A) focuses on improving the effectiveness of alert and communication to the population during crises within the context of the European Union. To	Analysis of SMCS posts to assess the DRP	http://www.alert4all.eu



			<p>achieve this goal, A4A developed an extensive and interdisciplinary alerting framework that integrates the key enablers to achieve significant improvements in terms of alerts penetration, cost-benefit ratio and intended vs. actual impact of alerting strategies.</p>		
Opti-Alert	2011	2014	<p>The Opti-Alert: Enhancing the efficiency of alerting systems through personalized, culturally sensitive multi-channel communication project goal was to develop concepts and prototypes for an improved alerting of the population in times of disasters. Authorities should be able to communicate with the</p>	<p>'Risk culture' concept (Dressel, 2015; Cornia et al., 2016; Dressel & Pfeil, 2017; Pfeil & Dressel 2017)</p>	<p>www.opti-alert.eu</p>



			<p>population more swiftly, consistently, and effectively. This should be enabled by an integration of different message production and message distribution systems, improved personalization and regionalization of alert messages, and tools for the simulation of the impact and effectiveness of alerts. Basis for the proposed improvement was an in-depth, qualitative analysis of the population's information needs and communication patterns, accompanied by a study on crisis communication via the mass media.</p>		
ENHANCE	2012	2016	<p>The main goal of the ENHANCE - Partnership for Risk Reduction project is to</p>	<p>Analysis of the factors that influence DRP and multi-level approach (cultural</p>	<p>http://www.enhanceproject.eu/</p>



			develop and analyse new ways to enhance society's resilience to catastrophic natural hazard impacts, by providing new scenarios and information in selected hazard cases in close collaboration with stakeholders, and by contributing to the development of new multi-sector partnerships (MSPs) to reduce or redistribute risk.	background, social-political factors, and cognitive-affective factors)	
Tactic	2014	2016	The overall aim of the TACTIC project is to increase preparedness to large-scale and cross-border disasters amongst communities and societies in Europe. To achieve this, TACTIC will consider studies on risk perception and preparedness (including good practices and preparedness programmes) in order to	Deliverable D1.1 about floods, earthquakes, terrorism, and epidemics and pandemics risk perception and preparedness.	https://cordis.europa.eu/project/id/608058



			develop a participatory community preparedness audit enabling communities to assess, impacts in a multi-hazard context, their motivations and capacities to prepare for large-scale and/or cross-border disasters.		
EmerGent	2014	2017	EmerGent regarded the positive and negative impacts and potentials of social media in emergencies for citizens and Emergency Management Services and how social media can be used during emergencies. Guidelines and tools were developed to achieve these goals.	Analysis of the use and impact of SMCS in disasters (Reuter et al., 2016; Reuter et al., 2019)	http://www.fp7-emergent.eu