The HuT

Minutes from I-DRRnF workshops

Deliverable D5.3

DEVELOPED WITHIN

WP5 Transferability and scalability, T5.2 International DRR Nexus Forum

LEAD AUTHORS

Jogscha Abderhalden (UNIGE); Anna Scolobig (UNIGE)

OTHER AUTHORS

Anna Smetanova (GWP CEE); Primož Skrt (GWP CEE); Jo-Ting Huang-Lachmann (HEREON); Cicilia Steffi Lukman (HEREON); Anke Schlünsen-Rico (HEREON); Carina Fearnley (UCL); Maryam Rokhideh (UCL); Michele Calvello (UNISA); Guido Rianna (CMCC); Adria Rubio Martin (UPV)

Version 1.0

(31 January 2024)

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

1. Technical references

Project Acronym	The HuT
Project Title	The Human-Tech Nexus - Building a Safe Haven to cope with Climate Extremes
Project Coordinator	Michele Calvello UNIVERSITA DEGLI STUDI DI SALERNO mcalvello@unisa.it
Project Duration	October 2022 – September 2026 (48 months)

Deliverable No.	D5.3
Dissemination level*	PU
Work Package	WP5 – Transferability and scalability
Task	T5.2 – International DRR Nexus Forum
Lead beneficiary	UNIGE
Contributing beneficiary/ies	GWP CEE, UCL, HEREON, CMCC, UNISA, UVP, CNR, GFZ, IIASA, UPC, NGI, HY, IMO, VU, ARANTEC, KOTIVIZIG, ICONS, LEITHA, SOR, CONF-NO, NIP, MA, MET, BGS, GNDR

* PU = Public

PP = Restricted to other programme participants (including the Commission Services)

RE = Restricted to a group specified by the consortium (including the Commission Services)

CO = Confidential, only for members of the consortium (including the Commission Services)

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

1.1. Document history

Version	Date	Lead contributor	Description
0.1	11.01.2024	Jogscha Abderhalden (UNIGE), Anna Scolobig (UNIGE)	First draft
0.2	18.01.2024	Laura Rødvand (NGI), Farrokh Nadim (NGI)	Critical review and proofreading
0.3	26.01.2024	Jogscha Abderhalden (UNIGE), Anna Scolobig (UNIGE)	Edits for approval
1.0	31.01.2024	Michele Calvello (UNISA)	Proofreading, final version

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

2. Table of contents

2.1. List of Tables

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

2.2. List of Figures

2.3. List of Abbreviations

Abbreviation	Meaning
CSO	Civil Society Organisation
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EWS	Early Warning System
I-DRRnF	International Disaster Risk Reduction nexus Forum
NGO	Non-Governmental Organisation
SFDRR	Sendai Framework for Disaster Risk Reduction

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

3. Summary

Exceeding the ambitions of the Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030, to switch the focus of DRR solutions from top-down to people-centred approaches, requires a better understanding of the complexity and dynamics of co-creation processes. Co-creation can be defined as a process where stakeholders are involved in the design, development and implementation of DRR solutions. This deliverable reports on the activities of the International Disaster Risk Reduction nexus Forum (I-DRRnF), an initiative organized by The HuT project (WP5). During the project, four I-DRRnF workshops are planned. The first one focused on how to improve stakeholder engagement processes and collaborations on the local level, how to raise interest in and awareness of the topic, and on how to transfer and integrate knowledge from different sectors.

To better understand the common barriers for stakeholder engagement and possible enabling factors to overcome those barriers, we collected information from different research projects, case studies, and from the experiences of participants in The HuT project. More specifically, we involved representatives from the ten The HuT demonstrators around Europe where innovative solutions to reduce/manage risks associated with climate change are being developed and tested. The demonstrators' representatives are active in stakeholder engagement within the Local DRR Nexus Forums (WP1). The methodology applied for the I-DRRnF includes: (1) a literature review on barriers and enablers for successful co-creation processes, including an analysis of 26 research papers published between 2015 and 2023, (2) a questionnaire administered to representatives of The HuT demonstrators and (3) a workshop with two thematic sessions in three working group discussions held during The HuT general assembly.

The results show that barriers are numerous and despite many enabling factors being identified, there is often a lack of direct and applicable solutions for several barriers experienced by participants involved in co-creation processes. The results of the literature review, the questionnaire, and the group discussion, indicate that the first crucial but challenging step for a successful co-creation process is to increase the stakeholder interest and motivation and raise their awareness on the topic of risk and DRR. The magnitude and frequency of impactful events can make the difference. However, in absence of recent events, it is important for researchers and practitioners to combine different tools, e.g. visual aids, to raise risk awareness and to show that they are interested in sharing responsibilities, whilst also giving local stakeholders a sense of ownership. Other major barriers to co-creation of DRR solutions include lack of financial resources, policy/decision-making stalemates and conflicts, as well as the lack of time for the different stakeholder groups to participate in these processes. Developing and implementing binding policy instruments for stakeholder engagement has been proposed as a possible solution both in the literature and in the stakeholder consultations.

Transferring and integrating knowledge is not only a challenge across the public and private sector, but also within the scientific community. For knowledge transfer, the importance of using dissemination methods tailored to different stakeholder groups is the most critical point. When it comes to knowledge integration, the main objective is to gain a mutual understanding of goals and success, which can be a major challenge when collaborating across sectors.

Sharing experiences and knowledge about stakeholder engagement and co-creation processes among the participants of The HuT project is crucial in order to learn from each other, gain insights on similarities and differences amongst demonstrators, and ultimately to achieve an impact in the frame of the project and beyond.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

4. Introduction

In the last decades, the number and extent of disasters, resulting in catastrophic damages and losses to vulnerable communities has increased (Calvin et al., 2023), indicating that Disaster Risk Reduction[1] (DRR) as a field of research and practice still has major challenges to overcome. In order to address them, the Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030 advocates the development of people-centred approaches for DRR (UNDRR, 2015; Yore et al., 2023). These approaches are based on the assumption that involving people in risk decisions empowers them, encourages ownership, responsibility, and participation. This may result in more effective DRR outcomes (Basher, 2006; Oxley, 2013). The building pillars of these approaches include increased stakeholder participation, responsibility shifts from the authorities to the public, two-way risk communication and emphasis on social/institutional capacity building (Scolobig et al., 2015).

However, whilst the need to promote people-centred approaches is largely acknowledged, there are numerous barriers that make their implementation a challenging task. The first The HuT ***International DRR Nexus Forum*** (I-DRRnF) workshop focused on how to overcome these barriers, as well as on the enablers of effective stakeholder engagement for the co-creation of DRR solutions. The I-DRRnF aims at fostering reciprocal learning across hazards, the project demonstration cases (WP1) and domains of expertise (WP2, WP3, WP4), and at improving the transferability of DRR solutions.

The I-DRRnF members include The HuT partners, knowledgeable stakeholders, and representatives from each demonstrator/local DRRnF. The members are involved in various ways, including interviews, surveys, and workshops at the yearly The HuT General Assemblies. During the Forum activities, they deliberate on how to:

- improve DRR strategies;
- address critical challenges related to DRR in The HuT demonstrators;
- propose new ideas for governance and policy mechanisms supporting DRR;
- transfer good practices and upscale DRR solutions.

This deliverable reports on the first I-DRRnF workshop entitled “Co-creating inclusive disaster risk reduction strategies”. The workshop was held in Valencia on October 26, 2023, and it focused on how to engage and work with different partners and communities to co-create DRR strategies as well as on how to integrate knowledge across the involved sectors and disciplines.

[1] DRR is aimed at developing strategies and plans to reduce existing and prevent new disaster risks through strengthening the economic, social, health and environmental resilience of communities and countries (UNDRR, 2016, p. 16).

This project has received funding from the European Union’s Horizon Europe research and innovation programme under grant agreement N° 101073957

5. Methodology

As preparatory work for the first I-DRRnF, we conducted a literature review on research and practices to facilitate community engagement in the co-creation of DRR solutions. More precisely, we aimed to analyse (1) which factors influence the motivation of local stakeholders and communities to engage in the topic of DRR, (2) what are the challenges for successful stakeholder engagement and co-creation of DRR solutions, and (3) which strategies and actions enable a successful community engagement in the co-creation of DRR solutions. We selected research papers focusing on the above-mentioned topics, written in the English language from the period between 2015-2023, after the implementation of the SFDRR.

In addition, we distributed a questionnaire survey to the ten The HuT demonstrators to collect information on topics they would be interested to discuss, their experiences with stakeholder engagement, expected barriers and enabling factors to successful stakeholder engagement and co-creation, transfer and integration of knowledge from different sectors, and finally their expected impacts through The HuT project. The HuT demonstrators focus on DRR for different types of hazards (i.e. forest fires, droughts, heatwaves, landslides, floods and storms) in eight countries, namely Germany, Hungary, Lithuania, Iceland, Italy, Spain, Switzerland, and United Kingdom more information available on https://thehut-nexus.eu/).

Based on the information collected through the literature review and survey, we structured and planned the I-DRRnF workshop (see the agenda in appendix). The half-day workshop lasted 4 hours and was divided in two sessions. The first one emphasised barriers and enablers for successful stakeholder engagement and co-creation of DRR solutions. The second session focused on the topic of knowledge transfer and integration. Each session of the workshop consisted of two presentations of 15 minutes followed by working group discussions. The first presentation of each session aimed at providing an overview of the literature respectively on DRR solutions co-creation and behavioural change promotion. The second presentation provided examples of good practices implemented in the city of Valencia, focusing on citizen engagement (Las Naves: https://www.lasnaves.com/) and smart platforms respectively.

After the presentations, three working groups were held in parallel for each session. Project partners (namely GWP CEE, HEREON and UNIGE) facilitated the group discussions using the same protocol. The discussions have been audio recorded. At the end of the workshop, one representative from each working group summarized the key messages in front of all the participants.

Overall, 60 participants attended the workshop, including working group moderators. The participants' background spans across different scientific disciplines (e.g. geotechnical engineering, geology, meteorology, social sciences, economy, psychology, etc.). Participants included researchers and practitioners from public and private sectors. The appendix includes the workshop agenda including key topics addressed as well as the list of participants. Participants signed a consent form to agree on the use of the information provided during the workshop.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

6. Preparatory Work

In this section, we present, compare, and contrast the results of the literature review on enablers and barriers to stakeholder engagement for the co-creation of DRR solutions with the experiences of the partners involved in The HuT project demonstrators. Co-creation processes - defined as analytical-deliberative procedures for stakeholders to achieve better DRR outcomes - can support hazard/risk assessment, the design, implementation, maintenance of risk reduction measures and plans, emergency and risk communication strategies, early warning systems, and/or recovery plans (Kench et al., 2018).

The first and necessary step of these co-creation processes involves motivating local stakeholders to engage with the topic of DRR. For this reason, we will first describe factors that influence the motivation and willingness of community members to participate. Here we focus both on internal and relational factors as well as specific actions and approaches developed by practitioners that can influence community members' motivation to participate. Subsequently, we present a number of challenges and enablers for a successful co-creation process of DRR solutions in the phases of problem framing, solution design, implementation, monitoring and maintenance. Finally, we focus on experiences and expectations about stakeholder engagement in The HuT demonstrators.

6.1. Literature review

For the literature review, we selected 26 scientific papers written in the English language published between 2015-2023, after the implementation of the SFDRR. Based on the selected literature, we identified the key points relevant to answering the research questions presented above. The key points were divided into motivational factors for participation and practical factors that have an influence on the success of co-creating DRR solutions. In both categories, we identified enablers and challenging factors. Here below, we report the results of the literature review based on the selected scientific papers (Buchori et al., 2022; Clegg, 2022; Fekete et al., 2021; Geekiyanage et al., 2020; Gerkensmeier & Ratter, 2018; Gill et al., 2021; Gupta et al., 2019; Haworth et al., 2016; Haynes et al., 2020; Johnston et al., 2022; Kench et al., 2018; Lakhina et al., 2021; Lim et al., 2022; Marchezini et al., 2017; Perera et al., 2020; Preuner et al., 2017; Ripin, 2023; Ryan et al., 2022; Sanquini, 2016; Satizábal, 2022; Shah, 2022; Sharma, 2021; Sufri, 2020; Thaler & Seebauer, 2019; Wesely, 2021; Yasmin et al., 2023).

6.1.1. What motivates local stakeholders and communities to participate?

Motivation is one of the overarching factors for successful stakeholder engagement. It is connected to individual feelings, values, and relationships. Research results reveal that one of the main drivers for the motivation to engage in the topic of DRR is risk awareness and perception, which is influenced by, amongst other factors, the experience of recent past events, the familiarity with the hazard, the level of personal knowledge, the trust in experts, etc.

Cultural beliefs, social networks and community relations are two additional factors that influence the willingness of stakeholders to engage. Research results show that a culture of neglect or an enduring narrative that someone else (typically the authorities in charge) is responsible for ensuring adequate safety levels, is an important factor for lack of proactive preparedness behaviours or actions. Concurrently, social norms and community expectations can also have a positive impact on the willingness of individuals to engage. Moreover, deep attachment to

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

ancestral land can be a barrier to engagement because at risk community members may be sceptical towards the technologies used by scientists and government agencies and fear that their local knowledge and practices will not be taken into account.

Trust and good relationships between actors of different sectors and strong bonds within the community were the two most frequently mentioned prerequisites for local stakeholders' motivation to engage in DRR. Strong community bonds can lead to a sense of cooperation to help each other locally and an increased desire of individuals to become more involved in the community, which facilitates a participation in DRR activities. Those two factors are also largely dependent on the attitude of the municipal government towards involving citizens, whether they have frequent discussions with their citizens or not and if they are willing to share some of their decision-making power and leadership. Trust and good relationships across sectors can lead to a sense of ownership and the feeling of having a real influence, which was mentioned as a motivational factor in several studies. For example, a transparent and clear communication will let the community feel that the process is worth of their trust while the lack of it can lead to scepticism.

Common barriers for the motivation of community members to engage include economic factors and the fear of responsibility and labour-intensiveness. A lack of financial support and fear of high operational costs leads to a lower willingness to engage. In addition, low-income individuals have more urgent problems to deal with than DRR, and tight schedules lead to inability to attend meetings and training. A possible action from the practitioner side to reduce the reluctance due to economic factors would be to offer part-time workplaces by contract, for example for infrastructure maintenance or weather observation. Several studies also mentioned that community members fear that committing to DRR will entail a lot of responsibility and work. Another factor hindering the willingness of local stakeholders to engage in DRR is the fear of highlighting the risks associated with disasters, which may conflict with local touristic and economic development.

6.1.2. Barriers and enablers for a successful co-creation of DRR solutions

Once local stakeholders are motivated to engage in the topic of DRR, there are still several challenges and barriers to overcome to ensure a good collaboration and co-creation of long-term solutions. First, the main challenge in co-creation is to find the ideal level of participation in the different steps, thereby finding the right balance between command and control and shared responsibility. Developing binding policy instruments (e.g. establishing participatory processes for the co-design of emergency plans) can serve as a tool to promote stakeholder engagement and to define why and how communities should participate. However, in some cases, bottom-up approaches may be hindered by institutional structures such as top-down/command and control institutional frameworks.

Second, a frequently mentioned concern stretching across all steps is time availability. During the process of problem framing and solution design, it is challenging to align the agendas amongst stakeholders. Often researchers or practitioners have difficulties to mobilise local individuals who can devote time for community activities. Also, for the installation and maintenance of DRR solutions, time availability is an issue among community members. To ensure long-term maintenance after solution implementation, it is therefore important to develop long-term relationships with partners such as NGOs and national institutions. However, the limited time of scientists, initiative takers, councils and NGOs to engage in a sustainable way after the project ends is a critical barrier to that endeavour.

Some key enabling factors for a successful co-creation of DRR solutions ranging across all engagement steps are communication and collaboration. Achieving a strong inter-institutional and

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

inter-sectoral collaboration and communication is a determining factor for the success or failure of the process of co-creation. Some actions that scientists working with stakeholder engagement can take to strengthen cross-sector communication and collaboration are to (1) Maintain regular personal interaction emphasising information exchange; (2) Identify local contact persons or community groups who can serve as mediators between local stakeholders and external practitioners; and (3) Create multi-stakeholder partnerships to ensure a voluntary but enforceable commitment between partners of different sectors.

A main challenge to consider in the design and implementation of those actions is, however, how to overcome language barriers between different actors, both technically and in spoken and written language. Even amongst experts, the use of different technical vocabularies and work cultures, for example between natural and social scientists, can pose a major challenge to a successful collaboration. Below, we present the results of the literature review of challenges and enabling factors across the different phases of DRR solution implementation.

Problem framing and solution design

In the *problem framing* phase, an in-depth analysis of different stakeholder perspectives should be conducted to better understand if there are stalemates, conflicts or simply different views about the DRR problem and its solution. For example, in the case of landslide risk reduction, some stakeholders might prioritize the implementation of structural measures, while others might prefer natural engineering measures. Some stakeholders will support low cost early warning systems, while others will be in favour of high-tech solutions or simply of the relocation of the households at high risk.

In this phase, it is vital for the external actors to conduct stakeholder mapping to gain an understanding of the community structure and needs. To ensure a successful co-design and implementation of DRR strategies, experts and external initiative takers must be willing to deeply engage and learn from community perspectives, be flexible in the research design and include local stakeholders in decision-making from the start, already in the phase of developing project aims. Actively engaging local stakeholders from the beginning serves as a kickstart for the development of a strong social capital.

Actions that can be taken to involve local stakeholders from the beginning are, for example, to establish self-help and youth groups, to organize thematic focus groups between different stakeholder groups, and to hold voluntary educational and training workshops. Creating multi-stakeholder partnerships who actively participate in the solution design can also contribute to a closer collaboration. On the third sector side, stakeholders such as NGOs, faith-based, and civil society organisations should be included, while on the community side, local leaders and community action groups should be engaged as connectors between the public and the practitioners. The establishment of such cross-sectoral networks ultimately facilitates the design of community tailored activities, emergency plans, and actions with the inclusion of both local and scientific knowledge.

Another aspect that is important from the beginning of a co-creation processes is clear and transparent communication across all sectors, ranging from the outlining of all actors' roles to the sharing of design and implementation strategies. To ensure transparent communication, not only in the beginning of the co-creation process, but throughout all the steps, an effective approach mentioned in the literature is to hold regular critical evaluation and information sessions with all relevant stakeholders. A major challenge in the co-design of solutions is, however, to institutionalise and homogenise them. Using agreements, memorandums, and policy instruments such as recommendations can facilitate the procedure.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

Solution implementation and monitoring

In the phase of *solution implementation and monitoring*, the main challenge is to implement long term solutions, both practically and financially. The government often has budget constraints and there is a lack of human resources and technical expertise to engage in implementing and maintaining DRR solutions. In addition, external actors such as scientists, NGOs or municipal councils often do not have the possibility to contribute after the end of the project. To ensure a successful implementation and maintenance of DRR solutions, it is therefore important to establish long-term partnerships, extending beyond the duration of a specific project, with external partners such as NGOs and national or regional institutions. If financial means are available, individual programs where local citizens are engaged to monitor hazards, can be employed, and compensated for their work to ensure a continuation of the monitoring after the solutions are implemented.

6.2. Results from the survey with The HuT demonstrators

Eleven researchers, practitioners, and private sector representatives engaged in the ten demonstrator areas[2] of The HuT project replied to a survey focused on:

1) their experiences with local stakeholder engagement,
2) what challenges they encountered and expect to encounter during the process,
3) which enabling conditions for successful stakeholder engagement they have identified
4) how they are planning to transfer and integrate scientific and local knowledge
5) what impacts they are expecting to have on local communities through The HuT project

At the time of the survey, all demonstrators except one had already held meetings with local administrations and relevant stakeholders in their areas. However, the ways in which the different demonstrators organized these meetings varied significantly across the different arenas. The type of involvement ranged from engaging with stakeholders on a district level event (Dem 5), holding open information sessions (Dem 6), conducting interviews and surveys (Dem 8, 10) or workshops and education sessions on natural hazards (Dem 2, 6, 9). While some demonstrators focused more on contact establishment with the local government and relevant external institutions, others worked on establishing partnerships with relevant stakeholder groups as e.g., civil protection service. In three demonstrator areas, discussions were directed to the collaboration for the installation, implementation, and use of instruments and DRR measures (Dem 2, 8, 10).

Based on their past experiences with stakeholder engagement, the demonstrators identified a total of 21 challenges and 20 enabling factors for a successful stakeholder engagement, which will be presented in more detail in the next paragraphs.

Five out of ten demonstrators mentioned challenges concerning how to engage and establish ways of communication with local stakeholders (Figure 1). These include difficulties in deciding which stakeholder groups to approach and how to gain their trust (Dem 3,4,8,9,10), as well as to which level to engage them in the different steps of co-creation. Factors mentioned in this category referred to concerns about inclusion of all social groups (Dem 5,6) and involving stakeholders in the use of technologies before they are fully developed (Dem 2). These challenges could be partly

[2] Demonstrator areas in the HUT: Dem 1 = Valencia; Dem 2 = Val d'Aran; Dem 3 = Lattari mountains; Dem 4 = Vilnius; Dem 5 = Schleswig-Holstein; Dem 6 = East Fjords; Dem 7 = Tisza River Basin; Dem 8 = Ogliastra; Dem 9 = Dorset; Dem 10 = Berne Canton

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

accounted to the limited experience with stakeholder engagement by the HuT partners (Dem 4,8). A second main category of barriers concerns political, institutional, and financial issues. The main challenges that the demonstrators face within this category are the time availability of potential participants in all sectors (Dem 3,6), the lack of knowledge on available resources, the lack of political and financial support (Dem 3,4) and the understanding of administrative and governmental structures which may partly hinder a successful engagement (Dem 1,8,9). In addition, partners mentioned gaps in the understanding of roles and responsibilities, e.g., across the warning value chain (Dem 9), limited interest of stakeholders to engage in the topic of DRR (Dem 8), internal stakeholder conflicts (Dem 8), and the lack of trusted long-term relationships (Dem 3). These last factors can be grouped into a third category that we labelled individual motivation.

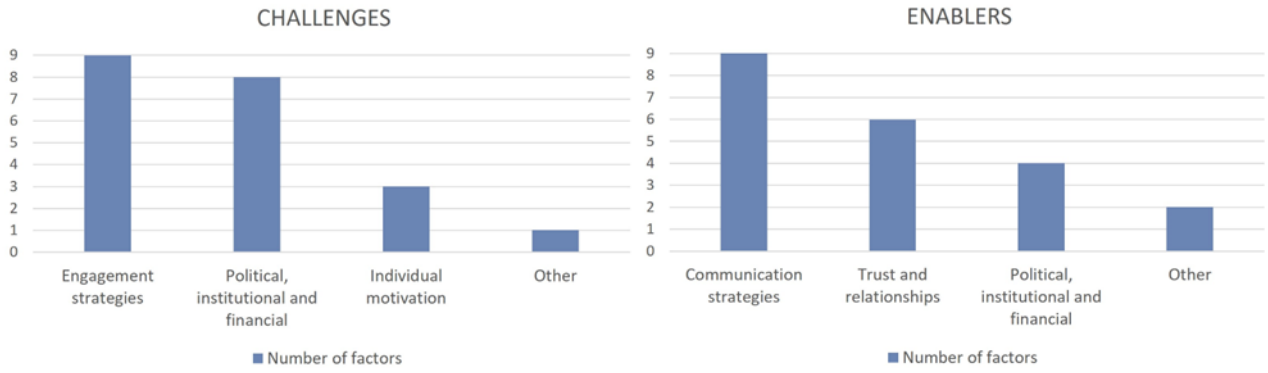


Figure 1: Main categories of challenges and enablers identified by partners of the HuT project. The bars indicate the number of factors identified in each category.

Despite the many encountered challenges, the demonstrators also identified a number of enabling factors for successful stakeholder engagement. These factors concerned primarily three categories: communication strategies, trust and relationships, and political, institutional and financial concerns (Figure 1). Frequent and transparent communication in the form of e.g. information and evaluation meetings to learn from each other (Dem 2,9,10), providing concrete examples of possible solutions (Dem 3,8) and asking stakeholders about their expectations (Dem 10) were mentioned as enabling communicational factors. Furthermore, demonstrators suggest that developing educational material and strategies devoted to different generations and social groups (Dem 2,5,6) can enhance the quality of knowledge exchange and raising of awareness. Moreover, in the category of trust and relationships, building trust between those responsible for the organisation of external initiatives and the local communities can be facilitated by engaging local experts and building relationships with municipalities and different administrative units. Making data and results openly available (Dem 10), visualising them in a simple way (Dem 4) and disseminating them (Dem 2,4,6) through internal platforms may also contribute to improve both communication and cross-sector relationships. On the policy side, demonstrators mentioned supporting local forums through civil contingency institutions (Dem 9), providing background for developing new types of financing mechanisms and regulations (Dem 8), building interregional natural hazard partnerships (Dem 9), and developing tools for co-creation of risk prevention protocols (Dem 4) as possible enablers for successful co-creation processes.

In addition to barriers and enablers for successful stakeholder engagement, the HuT partners were asked how they are planning to integrate scientific and local knowledge in the ongoing fieldwork and stakeholder engagement processes. The responses could be divided into two categories, namely knowledge transfer and knowledge integration. To ensure knowledge transfer across

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

different sectors, the HuT partners suggested using dissemination platforms to enable two-way knowledge transfer (Dem 6), combining science-based tools with local narratives (Dem 5), and to gather local knowledge through meetings with different local stakeholder groups (Dem 6). Regarding the integration of different types of knowledge in the co-creation process, the HuT partners proposed that local knowledge of past events can be integrated in the risk analysis to validate modelling results (Dem 2,8,9,10), to create an inventory of local events (Dem 3), to detect potential multiple hazards (Dem 10), and to assess previous actions for risk prevention and reaction (Dem 4). In addition, one partner suggested that scientific knowledge can contribute to an increased understanding of phenomena and their dynamics, as well as to the monitoring of phenomena and potential adaptation solutions (Dem 3).

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

7. International DRR nexus Forum: first workshop

This section provides a summary of the first The HuT I-DRRnF workshop, held at the annual meeting of the project at UPV in Valencia on October 26, 2023. The forum was divided in two sessions. The first one was focused on enablers and barriers for a successful stakeholder engagement to co-create DRR solutions. In the second session, the presentations and discussions evolved around knowledge transfer and integration across different sectors and disciplines.

7.1. Session 1: Co-creation and stakeholder engagement

Barriers and enablers

In the first part of the thematic session, participants were asked to individually think about barriers and enabling factors for successful stakeholder engagement and co-creation processes, write them down on sticky notes and classify them in the categories resulting from the preparatory work (see survey results presented in section 5.2) (Figure 2). Moreover, participants could add new categories, if deemed appropriate. For the barriers, the main categories were engagement strategies; political, institutional, and financial barriers; and individual motivation. For the enablers the pre-defined categories were communication strategies; trust and relationships; and political, institutional, and financial enablers. After the workshop, a framework to connect identified barriers and enabling factors to overcome them (Table 1) was developed based on the post-it answers from all the three working groups (see section 4 for a description of the methodology). The results were categorised into ten main types of barriers for a successful stakeholder engagement process and co-creation of DRR solutions. In parallel, enablers to overcome each barrier type were identified.

Time or the lack of it was mentioned as a barrier in different contexts by the participants in all three groups, showing that it is a central issue to ensure successful co-creation processes and sustainable solutions. Another main barrier identified was the *interest and motivation* to devote time to the topic, both from the practitioner/scientist and the local stakeholder side. In addition, the limited availability of both human and financial *resources* as well as unfavourable *policy environments* (e.g. the lack of political interest, competence, and legal frameworks) were mentioned as two main challenges. *Collaborating* across sectors, understanding *community needs and structures* to ultimately be able to work towards *common objectives* were also emphasised as three main challenges to overcome. To overcome the above-mentioned challenges, a major barrier is posed by the lack of *expertise* from the scientist/practitioner side in working with stakeholders, as well as the lack of experience in dealing with natural hazards from the community side. Finally, the importance and role of the *media* was recognised while common issues and challenges in dealing with the media were also emphasised.

Figure 2: Whiteboard with sticky notes on the different categories of barriers and enablers. Photo: Jogscha Abderhalden

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

Table 1: Barriers and enablers (to overcome the respective barriers) identified during session one of the first I-DRRnF workshop

	BARRIERS	ENABLERS

TIME	- finding time to meet
	  ○ tight schedules of practitioners and local stakeholders
	- lack of understanding of the time and effort stakeholder engagement takes
	  ○ from funding bodies
	  ○ from scientists and practitioners
		➔ having long-term project partners
		➔ recognizing capacities and remits of stakeholders
		➔ building long-term networks
		➔ understanding that stakeholder engagement and co-production is a process and takes both time and effort
		➔ taking time to get to know people

INTEREST AND MOTIVATION	- motivation of researchers and practitioners to devote time to the topic
	  ○ stakeholder engagement is not valued in academia (only publications are considered a steppingstone for professional advancement)
	- motivation of local stakeholders and practitioners to devote time to the topic
	  ○ importance is not understood
	  ○ lack of interest in local communities
	  ○ not having experienced extreme events recently
	  ○ individuals that are not impacted
	- life stress – there are more urgent things/pressing issues to take care of
		➔ increase recognition of stakeholder engagement in academia, provide space and funds for professional development in stakeholder engagement
		➔ strong community bonds and personal commitment of mayors or trusted community members in small municipalities can raise interest
		➔ simulations of climate extreme events
		➔ using visuals to help people understand the risk

RESOURCES	- lack of long-term solutions
	  ○ timed resources and budget
	  ○ lack of long-term engagement of stakeholders and participants
	  ○ lack of capacity to attract funding
	- lack of manpower and resources
	- low or no budget dedicated to stakeholder participation
	  ○ low willingness to participate without economic resources
	  ○ low political will
		➔ dedicated funding
		➔ communicating the benefits of participation to the community
		➔ funded EU projects on the topic

POLICY ENVIRONMENT/ INSITUTIONAL CAPACITY	- legal and competency limitations
	- process legitimacy
	- disagreement between political bodies
	  ○ low sense of responsibility in local authorities and institutions
		➔ active participation and integration with existing policies
		➔ policy guidance
		➔ global planning procedures
		  ○ inviting diverse political groups
		➔ work with local leaders
		➔ recognise capacities and remits of organisations

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

COLLABORATION/ COORDINATION	- working in silos
	  ○ lack of collaboration between local and regional institutions
	  ○ lack of collaboration between different scientific disciplines
	- not speaking the same “language”
	  ○ across sectors
	  ○ within the scientific community
		➔ cross-organisational connection and roles within the municipality
		➔ using interactive and two-way communication
		➔ implementing meetings for residents
		➔ using different modes of communication, taking account for different ways of expression and language
		➔ simplify language and avoid using technical terms
		➔ having transdisciplinary mediators within scientific projects

COMMUNITY NEEDS	- lack of knowledge and awareness of risks and complexity of risks not addressed in political spheres - reaching all social groups - lack of knowledge on community needs ○ lack of understanding of community structure and social groups	➔ apply local knowledge and experiences of risk management approaches ➔ experience or recent events ➔ educational strategies and implementing the topic in formal education ➔ developing information, dissemination tools targeting all social groups ➔ fostering two-way communication ➔ engaging with “local champions” and knowledgeable community members ➔ mapping existing relationships and community stakeholders
COMMON OBJECTIVES	- divergent views on key issues - challenges identifying and establishing long term relationships with key contacts and stakeholders, getting foot in the door (reaching beyond activists/loudest voice)	➔ find common ground, core areas to connect such as the common goal for community to succeed ➔ involve all stakeholders and a wide spectrum of opinions ➔ listening and respecting different views and opinions ➔ identifying shared goals early in the process
TRUST AND INCLUSOVENESS	- lack of trust that researchers/practitioners are non-biased/neutral participants (difficult to convince stakeholders to be part of the change) - top-down approaches and only engaging with stakeholders through consulting are often applied	➔ early communication and low-threshold meetings with municipality ➔ communicating the benefits of participation to the community ➔ involving stakeholders in the design process ➔ listening and not always telling ➔ showing results and impact ➔ implementing bottom-up engagement ➔ involving stakeholders in decision-making, give them ownership ➔ appreciate and use feedback by stakeholders

EXPERTISE	- lack of experience and expertise
	  ○ of scientists/practitioners in engaging with stakeholders
	  ○ of municipalities in working with hazards and extreme weather
		➔ establishing stakeholder engagement mechanisms
		➔ being flexible and build trust between experts and residents in communities at risk

MEDIA	- misinformation from media ○ information being disseminated through social media before the responsible authorities can inform	➔ effective communication such as videos ➔ involving the media in early warning especially at local level ➔ closely collaborate with media to avoid dissemination of wrong information

This project has received funding from the European Union’s Horizon Europe research and innovation programme under grant agreement N° 101073957

In all the working groups, participants agreed that the basis for stakeholder engagement is motivation and interest. Motivation of scientists and practitioners to actively engage with local stakeholders and build relationships, and the interest and motivation of local stakeholders to be involved and participate in the topic of DRR are essential. Starting with the motivation of HuT partners to commit to these processes, one of the researchers participating in the workshop mentioned that for them, stakeholder engagement is a passion that goes beyond the physical sciences and the modelling of risks. Indeed, this allows them to help communities in finding solutions. However, a main barrier to actively engage with stakeholders, especially for scientists, is that it is not valued in a scientific career path and thus it has limited career benefits. Despite being motivated to engage with stakeholders, several participants stated that trying to make a difference can be frustrating when participants show little interest or do not even attend meetings. One participant even experienced that stakeholders joined a participatory process with the aim to stop or hinder it. These experienced problems brought the discussion to the issue of reaching beyond the "loudest voices" (people that are already interested in the first place) to engaging the public to find solutions or strive for change (Figure 3).

Figure 3: Group discussing barriers and enablers for successful co-creation and stakeholder engagement. Photo: Jogscha Abderhalden

According to the HuT partners, a main reason for the lack of interest and motivation of local communities to engage in the topic of DRR is the lack of awareness and sensitivity to the topic, which is amplified in case of absence of recent extreme events. As an example, participants from Hungary and Italy stated that local stakeholders do not have enough knowledge and experience with natural hazards to understand the urgency of the topic and show little interest to engage. On the other side, Icelandic partners stated that in their case it is the opposite and people are eager to engage because the frequency of events is high, and people know what they are dealing with.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

To the question on how we can increase awareness of risks and extremes in areas where there is a lack of recent events, participants in one of the groups suggested that we must start investing in the education section and bring the topics of climate change, disaster risk and sustainability into formal education, in different formats including artistic and musical projects. Even though the topic is given some attention in schools, where it can increase schoolchildren's awareness and perception, forum participants agree that there is a lack of legal engagement mechanisms. This is valid not only for the education sector, but also for engagement strategies with stakeholder groups to implement DRR strategies. From a Civil Society Organisation (CSO) perspective, involving stakeholder engagement in binding processes is a crucial step to move from a consultation only approach to engaging communities in decision-making and to having a real impact. One of the workshop participants brought a good example of how such a process can look like in real life, where stakeholders are actively involved in the decision-making process for climate change adaptation strategies in urban areas (Box 1). A participant working in an NGO mentioned a similar example of a Global Network of CSO's for Disaster Reduction called "Views from the Frontline" where local stakeholders showed increased interest and motivation to participate because they gained a sense of ownership for the implemented solutions through active participation in the process.

Box 1 – Best practice example of stakeholder engagement mechanism applied in urban areas in Italy:

In some urban areas in Italy (e.g., Milan), a renovation approach where citizens are actively involved in all steps of decision-making has been applied. The process starts with a municipality deciding to renovate an area. As a first step, municipality representatives approach residents, and ask them for suggestions and ideas for the renovation of their residential area. Next, the suggestions are evaluated together with experts, e.g., architects and other relevant stakeholders, and then implemented, if possible. After the implementation, the new solutions are monitored and then implemented permanently if deemed successful/purposeful. As an example, in Milan some areas that were previously crowded and had a lot of traffic have been transformed into pedestrian areas with a playground and local services for young people. In this way, municipalities have found a way to achieve positive changes through active involvement of local citizens.

Through processes as the examples presented just above, stakeholders shared a common goal and agenda, and listened to each other. This was mentioned as an important prerequisite to build trust and good relationships in several of the working groups. Another way to engage with citizens actively or passively, to collect specific knowledge or opinions, is crowdsourcing. One of the tasks of the HuT project is exposure mapping of buildings in different areas and for different hazards (Task 4.3), where crowdsourced information from the open street map is used as the main input (Box 2).

Despite having good practice examples showing that such frameworks could solve numerous issues, participants see major barriers to develop and successfully implement legal frameworks and stakeholder engagement mechanisms, especially concerning the political and financial sectors. To establish real engagement mechanisms, politicians need to be willing to lose some of their power and share responsibilities, which is usually not something they want. In addition, engaging with stakeholders and establishing co-creation processes in a sustainable way takes, as stated by several participants, a lot of time and effort, i.e., a lot of resources.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

Box 2 – Exposure mapping using crowdsourced data
One of the HuT partner organisations (GFZ) crowdsourced information about buildings from the open street map and used it as an input for building exposure modelling and mapping. Open street map is a large open-source platform for spatial data, where people can add their own data via a smartphone application. Such platforms are an easy approach to engage with citizens and collect place-specific data. In addition to crowdsourcing through the open street map, the researchers also directly approached local stakeholders riding the bus to collect data for their maps and models.

This cycle of limited time and resources on the one hand, and the requirement of devoted time and focused resources on the other, makes it very difficult to successfully engage stakeholders and co-create sustainable DRR solutions. Unfortunately, fundings and resources are rarely allocated specifically to co-creation processes. Even in cases where enough financial resources are available, it is unclear which part of the budget will be invested in adaptation to climate extremes. In some cases, local authorities do not know or do not have the authority to access such fundings.

Another frequently mentioned problem regarding the time and financial resources of the scientists is the lack of long-term solutions reaching beyond the timeline of specific projects. Workshop participants found it challenging to identify specific solutions to this challenge. One suggested solution was to allocate budget more specifically to stakeholder engagement in project proposals, which could also contribute to enhancing the value of such engagement in a scientific career and thus increase the motivation of scientists to commit to such work.

A final main challenge that was discussed during the thematic session was how to deal with the media. Generally, participants agree that the media are crucial both to raise risk awareness, perception and understanding of the population, and to inform what is going on. Nevertheless, several participants reported issues and challenges in dealing with media regarding early dissemination of information, sometimes even before official information, that results in scaring people more than informing constructively. Partners mentioned the issue that media often present a one-sided picture of the problem and fail to replicate and show the complexity of the matter. Despite working in close collaboration with media and dedicating specific human and financial resources to the topic, misinformation and disinformation are a recurring challenge that practitioners in the HuT project face concerning the media and dissemination of information.

7.2. Session 2: Knowledge integration and impact

Using the same logic adopted for the first thematic session, participants wrote down some key aspects linked to knowledge integration and classified them in the categories resulting from the preparatory work (see survey results presented in section 5.2). Moreover, participants could add new categories, if deemed appropriate. The key aspects identified by the participants served as a basis for the ensuing group discussions. In the next paragraphs, we first describe the key points of discussion that emerged during the workshop around the topic of knowledge transfer. Afterwards, challenges and examples of knowledge integration are presented.

Concerning knowledge transfer, the working groups focused mainly on multi-tool/multi-sense communication strategies with an emphasis on reaching all social groups and on ways to share experiences and best practices. The proposed dissemination modes (Table 2) mentioned by the participants range from social media over narrative media, arts (Figure 4), print media and public speaking. Public events such as science festivals can contribute to sharing knowledge on the topic of DRR and raise public awareness. In addition, dissemination platforms such as geoportals, monitoring platforms, weather observation websites and open database repositories where both

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

local stakeholders, practitioners and scientists can upload information, are considered effective tools for two-way knowledge transfer and ensuring that everyone has access to information. Such platforms can be developed on a community basis for specific projects but can also be upscaled to regional and national levels across sectors and organisations. A good example of the value of such endeavours was brought up in one of the groups where health and meteorological organisations connected and harmonized databases. In this way, they detected new weather-related diseases that have not been explained/understood before.

Figure 4: Example of how cartoons can be used to illustrate issues in knowledge transfer. Artists: Hameed Khan and Eugenia Rojo

Table 2: Suggested communication and dissemination strategies to ensure knowledge transfer

	Examples
SOCIAL MEDIA	➔ YouTube ➔ TikTok ➔ Blogs
NARRATIVE MEDIA	➔ Storytelling ➔ Playback theatre ➔ Serious games
MEDIA ART	➔ Sci-art as cartoons ➔ Videos ➔ Pictograms ➔ Infographics
PRINT MEDIA	➔ Scientific papers ➔ Popular science books
PUBLIC SPEAKING	➔ Webinars ➔ TEDx talks ➔ Conferences

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

Moving on to the integration of knowledge across sectors, one main topic that was discussed in two of the three working groups was the issue of speaking the same language and having a mutual understanding of common goals and objectives (Figure 5). The discussion started off with communication issues within the scientific communities. Here, several participants stated that breaking silos, even within single departments, is critical to improve DRM knowledge and capacities. Others mentioned that even though scientists and practitioners from different fields decide to work together, there is a lack of a common language and understanding of how to measure the success of the project. This applies not only to the definitions of the same terms (e.g. risk, vulnerability) across disciplines but also to the shared understanding of what robust research means. One participant mentioned the issue that such differences in views are often addressed and noticed late, which can be problematic. Therefore, there is a need for intermediaries, i.e. people working at the interface between disciplines and sectors (Box 3).

Figure 5: One of the working groups discussing the topic of knowledge integration. Photo: Ilan Kelman

Box 3 – Why do we need intermediaries/facilitators for knowledge integration across sectors and who are they?

The knowledge, skills, and capabilities of intermediaries - i.e. professionals who are able to interact with colleagues from different sectors and disciplines - are extremely valuable. Even if there is a high demand of such professionals, e.g., applied scientists that can build a bridge between experts in atmospheric sciences, social sciences and citizens, it is often difficult to find them. These intermediaries have, for example, geography degrees and can understand and communicate the point of view of both physical and social scientists. On the one side, physicists may work on the model development, and, on the other side, a geographer may ask: “Great, but what are the practical implications?” (practitioner). Another example is expertise in risk/disaster related economics that is often difficult to find but it is highly valuable, e.g., to contribute breaking silos between the public and private sector.

This project has received funding from the European Union’s Horizon Europe research and innovation programme under grant agreement N° 101073957

In the same way as scientists and practitioners sometimes do not understand each other across silos or sectors, scientists and local stakeholders often struggle to communicate effectively and reach a mutual understanding of phenomena and local conditions. Thus, it is important for scientists to use simple language and not to assume that scientific knowledge is best. One of the Italian partners brought a best practice example where shepherds, firefighters and scientists achieved a common understanding of the problem and developed a solution to deal with prescribed burns (Box 4). In this case, a particularly important step has been to include different views of "what the problem is" and "how it can be solved". However, it was also emphasized that being able to work towards a common objective is a time consuming and long-term process (10 years).

Box 4 – "The shepherds and the firefighters"

During the working group discussion, an example about wildfire risk reduction was reported. It focused on the use of pastoral fires to rejuvenate the pastures in the Ogliastra region in Sardegna, Italy. One of the critical issues is related to a gap of knowledge transfer between shepherd generations concerning prescribed burns. This type of burn is a tradition, and part of their agricultural practice. The local research team wanted to better understand the effect of prescribed burning on the landscape.

As reported during the working group by a researcher involved in this project: "The most difficult part was putting everybody around a table and gain a mutual understanding of the different needs and objectives and trying to find common solutions. For example, we developed this program that we have run since 2011 together with the forest service, which helped the shepherds with prescribed burning, selecting specific days, analysing the weather condition, weather window, vegetation dryness, and all the physical components. We helped the forest service in analysing the weather conditions and selecting suitable days. Now the shepherds are happy, the forest fighters are happy because they can train their own personnel, and especially the young people, in understanding how fires can spread and how they can be controlled. Finally, we are also happy because we are collecting a lot of information on prescribed burning impacts on the territory." (researcher)

Time is not only critical to gain a mutual understanding between local stakeholders and scientists but also within scientific communities and across scientific fields. Several participants emphasised the importance of getting to know each other and socialising within a scientific community, especially in international and interdisciplinary projects such as the HuT, where people are coming from different places, different disciplines, and different cultures. Partners underlined that physical meetings such as general assemblies with informal events are very valuable to create shared meaning and understanding, to ultimately achieve an impact on the local, regional, national, and European level through the project.

Most of the participants are working on local and regional levels. It was emphasised during the discussion that making impacts and doing changes on the local level is easier and more straightforward than scaling up and transferring across levels. Nevertheless, partners in the HuT project recognise the importance of transferring and scaling up local experiences and best practices to national and European levels and are hopeful that this goal can be achieved.

To achieve an impact beyond the local and regional levels, cross-level communication is key. We need to learn about processes in different regions and identify the best practices. Then we need to brand them and understand not only what is working but also why it is working. As mentioned above, dealing with different countries with different cultures, regulations, and methodologies is

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

a challenge. Therefore, it is crucial to understand the context of approaches and practices that are working to be able to adjust them to different local contexts and eventually scale them up to national or European levels. Gained knowledge does not only need to be transferred from the local level to the national and European levels but also the other way around.

In that respect, questions came up in several groups about how we can ensure that we make an impact and how we can measure that impact. Policy briefs or summaries for policy makers are important deliverables that can be crucial for a project to have an impact. The problem is that while such documents often exist, they often do not reach out to policy makers and communities. We need to learn to make better use of policy briefs, for which several participants mentioned that Interreg Europe[3] projects are a good example. Interreg projects have a scheme that is focused on changing the policy document used for the project. Project participants are required to have a strict connection with the regional government from the start to be sure that they will adopt the proposed changes in the end.

In order to achieve an impact, the timing of reporting is also essential. On the one hand, impact may not happen directly after project completion, thus it might be useful to continue reporting for several years after the project, as is the case for example in the UK. Although it is a lot of work and a tedious process, participants see the value in such long-term reporting. A remaining issue is that there are no regulations for consequences if no impact is achieved. On the other hand, in cases where disasters happen before a project ends and suggestions for change go into policy, important information should be delivered to local authorities in urgent situations.

Nonetheless, it is difficult to assess whether a positive trend after a project is an impact resulting from the work done within the project or if other variables affected the outcome. An example mentioned in one of the groups was a tornado Early Warning System (EWS) in the US where the number of fatalities had been reduced after the implementation of the new EWS. However, it was impossible to assess whether this trend could be attributed to the performance of the EWS as no major event happened for a long period after the implementation. Therefore, a better approach to measure impact rather than looking at the number of fatalities would be to focus on the effect on the community, on their awareness, perception, and their satisfaction with implemented changes. In Europe, we will likely have much fewer fatalities caused by natural hazards than in developing countries in Asia. Still, this does not necessarily mean that the impact of implemented changes is less. It is important to consider that measuring impacts is relative to the scale of implementation of changes (local-national-global) as well as to the geographic region.

[3] "Interreg Europe is an interregional cooperation programme, co-funded by the European Union. The European Union strives to reduce disparities in the levels of development, growth and quality of life in and across Europe's regions. The programme contributes to this objective and runs from 2021 to 2027." (Interregeurope, 2023)

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

8. Conclusions

This document summarises the results of a literature review, questionnaire and working group discussions of the first I-DRRnF focusing on barriers and enablers to successful stakeholder engagement for the co-creation of DRR solutions. Special emphasis was devoted on how to gain stakeholder's interest and develop collaborations on the local level as well as on how to transfer and integrate knowledge from different sectors. A literature review and a questionnaire submitted to project partners served as preparatory work for the I-DRRnF workshop which represents the main body of this deliverable.

The discussions and presentations during the first I-DRRnF illustrated challenges as well as crucial aspects for the success of co-creation processes for disaster risk reduction, which were largely aligned with the findings from the literature review. The workshop participants discussed topics including barriers for successful stakeholder engagement, how to overcome those barriers through different actions and approaches, how to transfer and integrate knowledge from different sectors to ultimately make an impact on local communities, and beyond.

Strategies to encourage local stakeholders to engage in the topic of DRR have emerged, yet the challenge of reaching beyond the "loudest voices" and raising local communities' risk awareness remains, often due to the absence of recent natural hazard events. Establishing structured frameworks and implementing engagement mechanisms to facilitate stakeholder engagement and co-creation processes is an ongoing need.

During the workshop discussions on knowledge transfer and integration, the effective utilisation of dissemination platforms targeted for different stakeholder groups was emphasised as an important tool for knowledge transfer. Challenges in working across silos and gaining a mutual understanding of terms, needs and success were identified as main obstacles to collaboration.

Examining the expected impacts of stakeholder engagement processes remains a challenge. Participants agreed that it is often easier to foresee and measure impacts at the local level than attempting to achieve and assess them at national or European level. Notwithstanding, project participants exhibited optimism regarding the transfer and amplification of insights derived from the local level and think that the HuT project can be a good example in bringing those learnings and good practices to other contexts. Suggestions such as design of policy briefs for dissemination and reporting impacts over several years after the project end were proposed. When measuring the impact of a project or endeavour, it is important to account for the context, including the geographic location or DRR measures already in place.

Overall, the I-DRRnF represents a platform for sharing experiences and discussing common issues amongst scientists and practitioners in the HuT project. Group discussions in the thematic group sessions enhance mutual learning, reflexivity, contribute to building stronger connections, and foster a collective motivation to engage with stakeholders to implement or improve co-creation processes and solutions. Sharing learned lessons and best practice experiences within a transdisciplinary research project is vital to guide future collaborative efforts and to ensure that everyone is working towards common objectives.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

9. References

Basher, R. (2006). Global early warning systems for natural hazards: Systematic and people-centred. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 364(1845), 2167–2182. https://doi.org/10.1098/rsta.2006.1819

Buchori, I., Zaki, A., Pangi, P., Sejati, A. W., Pramitasari, A., & Liu, Y. (2022). Adaptation strategies and community participation in government-led mitigation projects: A comparison between urban and suburban communities in Pekalongan, Indonesia. International Journal of Disaster Risk Reduction, 81, 103271. https://doi.org/10.1016/j.ijdrr.2022.103271

Calvin, K., Dasgupta, D., Krinner, G., Mukherji, A., Thorne, P. W., Trisos, C., Romero, J., Aldunce, P., Barrett, K., Blanco, G., Cheung, W. W. L., Connors, S., Denton, F., Diongue-Niang, A., Dodman, D., Garschagen, M., Geden, O., Hayward, B., Jones, C., … Péan, C. (2023). IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland. (First). Intergovernmental Panel on Climate Change (IPCC). https://doi.org/10.59327/IPCC/AR6-9789291691647

Clegg, G. (2022). Towards an improved understanding of participation in natural hazard early warning systems. International Journal of Disaster Resilience in the Built Environment, 13(5), 615–631. https://doi.org/10.1108/IJDRBE-11-2020-0120

Fekete, A., Aslam, A. B., Brito, M. M. de, Dominguez, I., Fernando, N., Illing, C. J., Kc, A. K., Mahdavian, F., Norf, C., Platt, S., Santi, P. A., & Tempels, B. (2021). Increasing flood risk awareness and warning readiness by participation – But who understands what under 'participation'? International Journal of Disaster Risk Reduction, 57, 102157. https://doi.org/10.1016/j.ijdrr.2021.102157

Geekiyanage, D., Fernando, T., & Keraminiyage, K. (2020). Assessing the state of the art in community engagement for participatory decision-making in disaster risk-sensitive urban development. International Journal of Disaster Risk Reduction, 51, 101847. https://doi.org/10.1016/j.ijdrr.2020.101847

Gerkensmeier, B., & Ratter, B. M. W. (2018). Governing coastal risks as a social process—Facilitating integrative risk management by enhanced multi-stakeholder collaboration. Environmental Science & Policy, 80, 144–151. https://doi.org/10.1016/j.envsci.2017.11.011

Gill, J., Malamud, B., Barillas, E., & Noriega, A. (2020). Construction of regional multi-hazard interaction frameworks, with an application to Guatemala. Natural Hazards and Earth System Sciences, 20(1), 149–180. https://doi.org/10.5194/nhess-20-149-2020

Gupta, M., Talankar, P., & Chavda, S. (2019). Citizens of Delhi lead resilience action. Disaster Prevention and Management, 28(1), 69–75. https://doi.org/10.1108/DPM-07-2018-0228

Haworth, B., Whittaker, J., & Bruce, E. (2016). Assessing the application and value of participatory mapping for community bushfire preparation. Applied Geography, 76, 115–127. https://doi.org/10.1016/j.apgeog.2016.09.019

Hayes, J., Wilson, T., Deligne, N., Lindsay, J., Leonard, G., Tsang, S., & Fitzgerald, R. (2020). Developing a suite of multi-hazard volcanic eruption scenarios using an interdisciplinary approach. Journal of Volcanology and Geothermal Research, 392. https://doi.org/10.1016/j.jvolgeores.2019.106763

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

Haynes, K., Bird, D., & Whittaker, J. (2020). Working outside 'the rules': Opportunities and challenges of community participation in risk reduction. International Journal of Disaster Risk Reduction, 44. https://doi.org/10.1016/j.ijdrr.2019.101396

Interregeurope. (2023, September 26). What is Interreg Europe? | Interreg Europe - Sharing solutions for better policy. https://www.interregeurope.eu/what-is-interreg-europe

Johnston, K. A., Taylor, M., & Ryan, B. (2022). Engaging communities to prepare for natural hazards: A conceptual model. Natural Hazards, 112(3), 2831–2851. https://doi.org/10.1007/s11069-022-05290-2

Kench, Paul S., Ryan, E.J., Owen, S., Bell, R., Lawrence, J., Glavovic, B., Blanckett, P., Becker, J., Schneider, P., Allis, M., Dickson, M., & Rennie, H.G. (2018). Co-creating Resilience Solutions to Coastal Hazards Through an Interdisciplinary Research Project in New Zealand. https://bioone.org/journals/journal-of-coastal-research/volume-85/issue-sp1/SI85-300.1/Co-creating-Resilience-Solutions-to-Coastal-Hazards-Through-an-Interdisciplinary/10.2112/SI85-300.1.short

Lakhina, S., Sutley, E., & Wilson, J. (2021). 'How Do We Actually Do Convergence' for Disaster Resilience? Cases from Australia and the United States. International Journal of Disaster Risk Science, 12(3), 299–311. https://doi.org/10.1007/s13753-021-00340-y

Lim, J., Liu, B., & Seate, A. (2022). Are you prepared for the next storm? Developing social norms messages to motivate community members to perform disaster risk mitigation behaviors. Risk Analysis, 42(11), 2550–2568. https://doi.org/10.1111/risa.13957

Marchezini, V., Trajber, R., Olivato, D., Munoz, V., Pereira, F., & Luz, A. (2017). Participatory Early Warning Systems: Youth, Citizen Science, and Intergenerational Dialogues on Disaster Risk Reduction in Brazil. International Journal of Disaster Risk Science, 8(4), 390–401. https://doi.org/10.1007/s13753-017-0150-9

Oxley, M. C. (2013). A "People-centred Principles-based" post-Hyogo framework to strengthen the resilience of nations and communities. International Journal of Disaster Risk Reduction, 4, 1–9. https://doi.org/10.1016/j.ijdrr.2013.03.004

Perera, D., Agnihotri, J., Seidou, O., & Djalante, R. (2020). Identifying Societal Challenges in Flood Early Warning Systems. International Journal of Disaster Risk Reduction, 51, 101794. https://doi.org/10.1016/j.ijdrr.2020.101794

Preuner, P., Scolobig, A., Linnerooth Bayer, J., Ottowitz, D., Hoyer, S., & Jochum, B. (2017). A Participatory Process to Develop a Landslide Warning System: Paradoxes of Responsibility Sharing in a Case Study in Upper Austria. Resources, 6(4), Article 4. https://doi.org/10.3390/resources6040054

Ripin, K. (2023). Support for Multi-Hazard Risk Reduction in Urban Local Bodies. Halduskultuur, 22(1), 66–79. https://doi.org/10.32994/hk.v22i1.285

Ryan, B., Johnston, K., & Taylor, M. (2022). Recognising and measuring competency in natural hazard preparation: A preparedness competency index. International Journal of Disaster Risk Reduction, 73, 102882. https://doi.org/10.1016/j.ijdrr.2022.102882

Satizábal, P. (2022). The power of connection: Navigating the constraints of community engagement for disaster risk reduction. International Journal of Disaster Risk Reduction, 68(Query date: 2023-06-13 15:57:32). https://doi.org/10.1016/j.ijdrr.2021.102699

Scolobig, A., Prior, T., Schroter, D., Jorin, J., & Patt, A. (2015). Towards people-centred approaches for effective disaster risk management: Balancing rhetoric with reality. International Journal of Disaster Risk Reduction, 12, 202–212. https://doi.org/10.1016/j.ijdrr.2015.01.006

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

Shah, A. A. (2023). Community social barriers to non-technical aspects of flood early warning systems and NGO-led interventions: The case of Pakistan. Frontiers in Earth Science, 11(Query date: 2023-06-13 15:57:32). https://doi.org/10.3389/feart.2023.1068721

Sharma, R. (2021). Community Based Flood Risk Management: Local Knowledge and Actor's Involvement Approach from Lower Karnali River Basin of Nepal. Journal of Geoscience and Environment Protection, 09(06), 35–65. https://doi.org/10.4236/gep.2021.96003

Sufri, S. (2020). Progress in the early warning system in Aceh province, Indonesia since the 2004 earthquake-tsunami. Environmental Hazards, 19(5), 463–487. https://doi.org/10.1080/17477891.2019.1653816

Thaler, T., & Seebauer, S. (2019). Bottom-up citizen initiatives in natural hazard management: Why they appear and what they can do? Environmental Science & Policy, 94, 101–111. https://doi.org/10.1016/j.envsci.2018.12.012

UNDRR. (2015). Sendai Framework for Disaster Risk Reduction 2015—2030.

UNDRR. (2016). Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction | UNDRR. https://www.undrr.org/publication/report-open-ended-intergovernmental-expert-working-group-indicators-and-terminology

Wesely, J. (2021). Towards understanding enabling environments for good practices in disaster risk management: An analysis of critical junctures in Manizales, Colombia. Environment and Urbanization, 33(2), 599–615. https://doi.org/10.1177/09562478211008873

Yasmin, T., Khamis, K., Ross, A., Sen, S., Sharma, A., Sen, D., Sen, S., Buytaert, W., & Hannah, D. M. (2023). Brief communication: Inclusiveness in designing an early warning system for flood resilience. Natural Hazards and Earth System Sciences, 23(2), 667–674. https://doi.org/10.5194/nhess-23-667-2023

Yore, R., Fearnley, C., Fordham, M., & Kelman, I. (2023). Designing Inclusive, Accessible Early Warning Systems: Good Practices and Entry Points | GFDRR. World Bank. https://www.gfdrr.org/en/publication/designing-inclusive-accessible-early-warning-systems-good-practices-and-entry-points

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

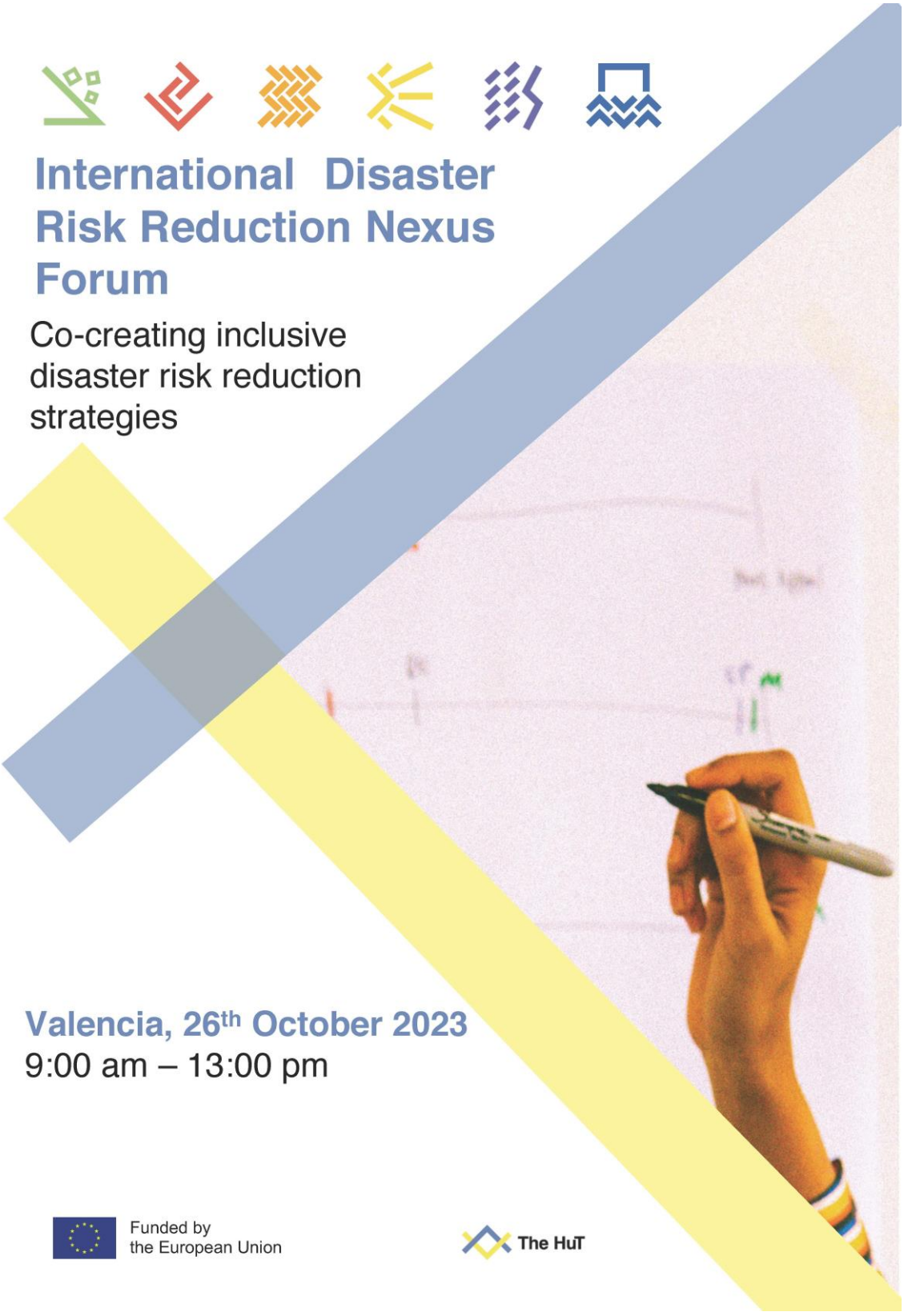
10. Appendix

10.1. Presentations

- *"Co-creating inclusive disaster risk reduction strategies"*
  Anna Scolobig and Jogscha Abderhalden, University of Geneva
- *"Good practices: Las Naves co-design experience, MAtchUP"*
  Las Naves, Valencia
- *"Raising awareness and preparedness – the challenges of promoting behaviour change for warnings"*
  Carina Fearnley, Ilan Kelman and Maryam Rokhideh, University College London
- *"Good practices & Co-design of the smart platform for monitoring and generating warnings in València"*
  Ernesto Faubel-Cubells, Smart City Valencia, Universitat Politècnica de València

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

10.2. Workshop agenda



This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

Background and rationale

The HuT International DRR Nexus Forum (I-DRRnF, WP5) aims at fostering reciprocal learning across hazards, demonstration cases (WP1) and, domains of expertise (WP2, WP3, WP4), and at improving the transferability of DRR solutions.
We deliberate on how to:

- improve disaster risk reduction strategies (DRR);
- address critical challenges related to DRR in the HuT demonstrators;
- propose new ideas for governance and policy mechanisms supporting DRR;
- transfer good practices and upscale DRR solutions.

The I-DRRnF members will include HuT partners, knowledgeable stakeholders and representatives from each demonstrators/local DRRnF. The members are involved in various ways, including interviews, surveys, and workshops (at the HuT General Assemblies).

As mentioned above, the ambition of the I-DRRnF is to better understand how to upscale inclusive disaster risk reduction strategies. Despite multiple good practices of DRR implementation at the local level, there is still limited/fragmented support for replication and upscaling. In each of the I-DRRnF workshops, we will address different aspects of upscaling.

The first I-DRRnF workshop will be held in Valencia on 26th of October and it will focus on impacting the local level, i.e. how to work with different partners and communities to co-create DRR strategies. Co-creation processes are defined as analytical-deliberative procedures for stakeholders to achieve better disaster risk reduction outcomes.

The preparatory work for the first I-DRRnF workshop included a literature review and a survey submitted to the ten HuT demonstrators/partners, to better understand their views on enablers, barriers, limitations and expected impacts of planned co-creation and/or stakeholder engagement processes. The survey also asked questions about their past experiences with these processes.

The results will be presented during the first I-DRRnF workshop. Moreover, the state of the art and good practice examples will be discussed (see agenda).

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

Agenda

	Moderator: Guido Rianna
09:00-09:15	*Welcome, Forum presentation and objectives* Michele Calvello, Anna Smetanova and Anna Scolobig, HuT coordinators, Global Water Partnership, and University of Geneva
09:15-09:30	*Co-creating inclusive disaster risk reduction strategies* Anna Scolobig and Jogscha Abderhalden, University of Geneva
09.30-09:45	*Good practices: co-design experiences in Valencia* Las Naves
09:45-10:45	*Thematic session 1: participants will be divided in groups (stickers on nametags)* Enablers and barriers for stakeholder engagement in the HuT demonstrators
10:45-11:00	*Wrap up: summary of thematic session 1*
11:00-11:15	Coffee/tea break
	Moderator: Anna Smetanova
11:15-11:30	*Raising awareness and preparedness: the challenges of promoting behavioral change for warnings* Carina Fearnley and Ilan Kelman, UCL
11:30-11:45	*Good practices & Co-design of the smart platform for monitoring and generating warnings in Valencia* Ernesto Faubel, Head of Smart City Valencia at the Municipality of Valencia (*https://www.lasnaves.com/*)
11:45-12:45	*Thematic sessions 2: participants will be divided in groups (stickers on nametags)* Integrating knowledge and making an impact in the HuT demonstrators
12:45-13:00	*Wrap up: summary of thematic session 2* *Conclusion: making a contribution to the academic debate and getting the message out to policy makers and general public. Next I-DRRnF workshops* Michele Calvello/Guido Rianna, Anna Smetanova and Anna Scolobig, HuT coordinators, Global Water Partnership, and University of Geneva

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

Abstracts

Co-creating inclusive disaster risk reduction strategies
Anna Scolobig and Jogscha Abderhalden, University of Geneva (Switzerland)

New policies are advancing the institutionalization of co-creation processes – defined as analytical-deliberative procedures for professionals and citizens to make better use of each other's assets, resources and contributions to achieve better public decision outcomes – for disaster risk reduction, and beyond. For example, the European Union (EU) has firmly positioned itself as a promoter of citizen and stakeholder engagement, e.g. several Horizon Europe research calls and EU Missions feature prominently the co-creation of transformative pathways for desirable futures.
Evidence about these processes shows that they can improve knowledge quality, lead to the identification of new problem-solving options, decrease opposition, contribute to legitimize decisions, improve policy effectiveness and increase the likelihood that policy implementation will be more effective, efficient, and sustainable. Notwithstanding several successful examples, these processes face a number of methodological and theoretical challenges. For example, there is a lack of generally accepted quality standards and of a comprehensive evidence base on their effectiveness. Financial and institutional challenges are often overlooked and include, among others, the availability of human and economic resources for the implementation of these processes as well as a systematic inclusion of these processes in existing policy and regulatory frameworks. This presentation screens some case studies focused on co-design, co-development, co-implementation and co-evaluation of disaster risk reduction solutions. It presents enablers, barriers, limitations and it ends with some reflections on the future co-creation agenda, at the interface between practice and research.

Raising awareness and preparedness: the challenges of promoting behavioral change for warnings
Carina Fearnley and Ilan Kelman, University College London (UK)

The issuance of a warning itself is not enough for a warning system to be effective, as the effectiveness of warnings is determined by the quality and speed of the overall response. Generating action from a warning, a 'Call to action' warning, is a key challenge. Whilst global conversations focus on the role of Impact-Based Forecasts and Warning, initial research on the effectiveness of these systems is that they still may not influence behavioural responses. Long-standing investigations from multiple perspectives indicate that the more types of impact information people receive, the more effective the warning is at prompting a behavioural response. However, whether the actions provided are meaningful and tailored enough is yet to be explored. Emerging research led by GNS in New Zealand has a growing ambition to develop warnings that will be automatically triggered for individuals based on probabilistic and spatial hazard and impact forecasts, informed by digital footprints, and supported by tailored guidance advice.

Why do people not respond to warnings? The characteristics of the receiver include everything about a person from their physical strength, vision and hearing to languages and socioeconomic resources, their predecisional processing, and core perceptions. These can vary drastically so that the receiver understands the warning in a different way to that intended. Protective action decision making involves risk identification and assessment, searching for

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

possible protective actions and assessing the options, and implementing them. Often some crises require fast action and being flexible and adaptive, this is particularly the case for multi-hazard events that may have conflicting guidance.
To address these issues requires developing embedded warning systems that are part of everyday life. This requires co-production to enable warnings awareness and preparedness to occur, putting the end users as an early part of the warning value chain, i.e being part of the first mile, rather than the last mile. Doing so enables inclusivity in warnings as it enables examinations of the specific conditions and needs of different groups and individuals. Frequently there are many requirements for an individual, referred to as intersectional needs. One of the ways to consider how to implement or adapt warning awareness and preparedness is to adopt checklists to enhance communication and integration to achieve more bespoke warnings.

****

The results of the workshop will be summarized in HuT D.5.3 - "Minutes from the I-DRRnF workshops". A background paper synthesizing the results of the literature review and the HuT demonstrators survey is available upon request (please contact the organizing team).

Organising team

Anna Scolobig and Jogscha Abderhalden, University of Geneva

Contact:
Jogscha.Abderhalden@unige.ch

Co-organisers (in alphabetical order)

Adria Rubio Martin and Manuel Pulido Velazquez, UPV Valencia
Anna Smetanova and Ivana Korn Varna, Global Water Partnership
Carina Fearnley and Ilan Kelman, University College London
Chiara Serio, Icons
Guido Rianna, Euro-Mediterranean Center on Climate Change
Jo-Ting Huang-Lachmann, Helmholtz-Zentrum Hereon GmbH
Michele Calvello, University of Salerno

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

10.3. List of Participants

Name	Institution	Country
Adria Rubio Martin	Universitat Politecnica de Valencia	Spain
Alfonso Rossi Filangieri	Universitat Politecnica de Valencia	Spain
Ana Gabriela Fernandez Garza	Universitat Politecnica de Valencia	Spain
Andrey Krasovskiy	International Institute for Applied System Analysis	Austria
Anke Schlünsen-Rico	Hemholtz-Zentrum HEREON	Germany
Anna Scolobig	University of Geneva	Switzerland
Anna Smetanova	Global Water Partnership Central and Eastern Europe	Slovakia
Brian Golding	MET Office UK	United Kingdom
Carina Fearnley	University College London	United Kingdom
Chele Esteve Sendra	Universitat Politecnica de Valencia	Spain
Chiara Serio	Foundation ICONS	Italy
Cicilia Steffi Lukman	Hemholtz-Zentrum HEREON	Germany
Constantino Sirca	Centro Euro-Mediterraneo sui Cambiamenti Climatici	Italy
Eisharc Jaquet Solé	ARANTEC Enginheria SL	Spain
Enrique Vidal	ARANTEC Enginheria SL	Spain
Eric Gielen	Universitat Politecnica de Valencia	Spain
Erna Rakel Baldvinsdottir	Austurbru	Iceland
Evy Dutheil	-	-
Flavio Alexander Asurza Veliz	Universitat Politecnica de Catalunya	Spain
Florian Kraxner	International Institute for Applied System Analysis	Austria
Francesca Cossu	Confagricultura Nuoro Ogliastra	Italy
Francesco Lo Conti	LEITHA S.R.L.	Italy
Francis Nieto Torres	ARANTEC Enginheria SL	Spain

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

Gabor Harsanyi	Middle Tisza District Water Directorate	Hungary
Gaetano Pecorano	Università degli Studi di Salerno	Italy
Giedre Godiene	Vilnius University	Lithuania
Gintautas Stankūnavičius	Vilnius University	Lithuania
Guido Rianna	Centro Euro-Mediterraneo sui Cambiamenti Climatici	Italy
Harpa Grimsdottir	Icelandic MET Office	Iceland
Hjördis Gudmunsdottir	Icelandic MET Office	Iceland
Ilan Kelman	University College London	United Kingdom
Ilaria Bonetti	Foundation ICONS	Italy
Ingibjörg Lilja Omarsdottir	Icelandic Department of Civil Protection and Emergency Management	Iceland
Janina Käyhkö	University of Helsinki	Finland
Javier Orozco Messana	Universitat Politecnica de Valencia	Spain
JoAnne Bayer	International Institute for Applied System Analysis	Austria
Joanne Robbins	MET Office UK	United Kingdom
Jogscha Miriam Abderhalden	University of Geneva	Switzerland
Jon Kristinn Helgason	Icelandic MET Office	Iceland
Jo-Ting Huang-Lachmann	Hemholtz-Zentrum HEREON	Germany
Katy Freeborough	United Kingdom Research and Innovation	United Kingdom
Laura Rødvand	Norwegian Geotechnical Institute	Norway
Laurens Oostwegel	German Research Centre for Geosciences	Germany
Manuel Pulido Velazquez	Universitat Politecnica de Valencia	Spain
Marcel Hürlimann	Universitat Politecnica de Catalunya	Spain
Marcos Concepcion Raba	Global Network of Civil Society Organisations for Disaster Reduction	United Kingdom
Maria Vittoria Gargiulo	Università degli Studi di Salerno	Italy
Mario Rohrer	University of Geneva	Switzerland

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957

Maryam Rokhideh	University College London	United Kingdom
Michele Calvello	Università degli Studi di Salerno	Italy
Nieves Lantada	Universitat Politecnica de Catalunya	Spain
Péter Gergö Katona	Middle Tisza District Water Directorate	Hungary
Péter Solyom	Middle Tisza District Water Directorate	Hungary
Primoz Skrt	Global Water Partnership Central and Eastern Europe	Slovakia
Raimon Calabuig	Universitat Politecnica de Valencia	Spain
Silvana Gargiulo	Commune di Sorrento	Italy
Sirkku Juhola	University of Helsinki	Finland
Tinna Halldorsdottir	Austurbru	Iceland
Unnur Blær A. Bartsch	Icelandic MET Office	Iceland
Valentina Bacciu	Consiglio Nazionale delle Ricerche	Italy

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101073957