Stakeholder solutions for building interdisciplinary and international synergies between Climate Change Adaptation and Disaster Risk Reduction

Journal Article

Author(s):
Booth, Laura; Schueller, Lynn A.; Scolobig, Anna; Marx, Sina

Publication date:
2020-06

Permanent link:
https://doi.org/https://doi.org/10.3929/ethz-b-000412728

Originally published in:
International Journal of Disaster Risk Reduction 46, https://doi.org/10.1016/j.ijdrr.2020.101616

Funding acknowledgement:
- Enhancing Synergies for disaster PRevention in the EurOpean Union ()

International Journal of Disaster Risk Reduction 46 (2020) 101616

Contents lists available at ScienceDirect

International Journal of Disaster Risk Reduction

journal homepage: http://www.elsevier.com/locate/ijdrr

Stakeholder solutions for building interdisciplinary and international synergies between Climate Change Adaptation and Disaster Risk Reduction

Laura Booth [a,*], Lynn A. Schueller [b], Anna Scolobig [c], Sina Marx [d]

[a] ETH Zurich, Department of Environmental Systems Science, CHN J71, Universitätstrasse 22, 8092, Zürich, Switzerland
[b] DKKV – German Committee of Disaster Reduction, Kaiser-Friedrichstr. 13, 53113, Bonn, Germany
[c] University of Geneva, Environmental Governance and Territorial Development Institute, 66 Boulevard Carl-Vogt, 1205, Geneva, Switzerland
[d] FEMNET e.V., Kaiser-Friedrich-Str. 11, 53113, Bonn, Germany

ARTICLE INFO

Keywords:
Climate change adaptation (CCA)
Disaster risk reduction (DRR)
ESPREssO project

ABSTRACT

The existing implementation gap currently dividing the policy domains of Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR), can be attributed to institutional barriers; diverging political priorities; intersectoral misperceptions and miscommunication; unequal funding sources and varying operational timescales at national, European and international levels. A recurring question raised amongst strategic policy makers tackling climate-related risks in both sectors asks: Can reducing these divergences and seeking new streamlining synergies assist in closing the implementation gap and deliver better integrated Disaster Risk Management (DRM) policies? Specifically, can such synergising action extend to strengthening of *trans*-border and *trans*-disciplinary resilience?

The ESPREssO Project explores these questions through a two-year stakeholder engagement process-collecting opinion from European CCA and DRR stakeholders, using novel methods such as crisis simulation exercises (serious games), questionnaires, interviews and international Think Tanks to identify mutual barriers and recommend ways both sectors can overcome them. We prioritise the various solutions with stakeholders, drawing on international and intersectoral CCA and DRR perspectives to refine a set of key recommendations for synergising action.

Results prioritise the importance of clear communication, maintaining political support and inclusion of the currently under-utilised private sector in positively establishing closer cooperation between CCA and DRR. The benefits of strengthening CCA-DRR inter-sectoral links are explored as essential pathways for better-informing hazard mitigation planning under a changing global climate and in aligning localised and strategic efforts. The emphasis is on working in support of each other, avoiding unnecessary duplication of effort and harmonising competing activities.

1. Introduction

Despite striving for common goals which aim to reduce vulnerability and increase societal resilience (Mitchell & van Aalst, 2008 [1]; Sperling & Szekely, 2005 [2]), Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR) do not overlap exactly. At a global level, their activities often develop independantly of each other (Thomalla et al., 2006 [3]) within two very different policy arenas: DRR emerged within humanitarian assistance, whereas CCA developed within the scientific community (Mitchell & van Aalst, 2008 [1]). DRR approaches tend to be reactive, based on past experiences, while CCA proactively focuses on future projections. In Europe, the reactive aspect of DRR is rooted in Civil Protection branches of governance, and its extension to risk mitigation could be greatly expanded in nearly all EU countries.

DRR encompasses risks associated with all hazards (environmental and human), whereas CCA is relevant only to climate-induced hazards (Mercer, 2010 [4]; Pulhin et al., 2010 [5]).

In today's world, this is too narrow a categorisation to uphold, considering cascade effects of climate-related risks and the consequential inter-connected myriad of socioeconomic impacts, prompting CCA and DRR stakeholders to urgently re-frame their decision-making in striving for a much broader, systemic view of hazard mitigation. The urgent and often unprecedented nature of climate change related risks, particularly acting as threat multipliers, is increasingly seen in Europe to

* Corresponding author.
E-mail address: laura.booth@usys.ethz.ch (L. Booth).

https://doi.org/10.1016/j.ijdrr.2020.101616
Received 18 June 2019; Received in revised form 7 April 2020; Accepted 16 April 2020
Available online 21 April 2020

be an aligning factor that can encourage both sectors into seeking engagement of the other more closely, a relationship that we forecast will require to positively strengthen in future at both European and local levels. Climate Change Adaptation, originating largely in the scientific community, needs constant filtering to be applied effectively through planning, zonation, building regulations, as well as within environmental and agricultural sectors, with work still needed in order to advance this sustainably. Europe is beginning to break down barriers and move past "silo-thinking" of the issues, seeking to broaden sectoral inclusion for decision-making in ever more increasingly holistic and cooperative approaches that span society. Lessons learned in Europe can be applied globally to create a more synergetic co-evolution of CCA and DRR.

This paper asks two fundamental questions in the Sections that follow: a) Where do the gaps and barriers lie that hinder or prevent CCA and DRR co-development? b) How can stakeholders and sectors bridge these gaps and overcome the barriers? The key barriers are discussed in turn, before using findings from the ESPREssO Project and its stakeholders to identify solutions. These solutions focus on improving transparency through targeted communication, maintaining good relationships with media, better inclusion of the private sector and upholding political will. Results also reflect that roles currently played by Non-Governmental Organisations (NGOs) could be better utilised to achieve synergies between CCA and DRR.

1.1. Where do the implementation gaps currently lie between CCA and DRR?

Some of the main gaps existing between CCA and DRR were put to both CCA and DRR European stakeholders as part of the ESPREssO Project (*Enhancing Synergies for Disaster Prevention in the European Union),* funded by the European Union's *Horizon2020* Framework Programme between 2016 and 2018, aiming to build consensus around the needs and perspectives of CCA and DRR stakeholders, with the aim of seeking strategic solutions:

1.1.1. Institutional barriers

Institutional barriers (identified in terms of the structure of institutions) are often seen as a key challenge that hinder successful integration of CCA into DRR (Gero et al., 2010 [6]; Schipper & Pelling, 2006 [7]; Sperling & Szekely, 2005 [2]). Climate change related policies and decisions are made by ministries and organisations dedicated to managing the environment, whereas disaster management and DRR decisions are often made by ministries dedicated to infrastructure and development. The differing institutional settings disturb what could otherwise be a more organic communication process, generating an unnecessary information barrier among the institutions (Schipper & Pelling, 2006 [7]; Sperling & Szekely, 2005 [2]). As CCA and DRR efforts are often handled by two sets of organisations, their inherited cultures prevent or reduce the ability to integrate effectively (Schipper & Pelling, 2006 [7]; UNISDR, 2012 [8]). In order to overcome institutional barriers between CCA and DRR, a common institutional structure is recommended (Mitchell & van Aalst, 2008 [1]).

1.1.2. Political barriers

Another key challenge to integrating DRR and CCA is low political will (Gero et al., 2011 [9]; UNISDR, 2010 [10], 2012 [8]). Dupuis (2011 [11]) highlights that irrespective of developed or developing countries, low (or fluctuating) political interest to integrate will remain a key challenge globally. Political views can modify or reverse the influence of education or science and frequently outweigh the effects of local climate trends or weather (Biehl et al., 2018 [12]). There is weak political recognition for DRR when compared to CCA (Mitchell & van Aalst, 2008 [1]; Venton & La Trobe, 2008 [13]). In order to create an enabling environment to better integrate CCA and DRR, political commitment should be increased by high-level political authorities (UNISDR, 2010 [10]). Success stories need to be championed to encourage seeding of new bridging policies. Politics, however, works to its own timetable: In Europe, policies can change every four to five years following election cycles, which makes coordination difficult to maintain. Establishing political will is key, yet it is not only a matter of political will, it is a matter of shared interests. Every country would like to think of itself as having good, if not the best standards and governance system. Setting standards is highly controversial if it is to be taken across Europe, but this will be key for disaster management in areas like border regions which depend on flexible policies which prioritise consistency and platforms for data-sharing. Europe has an opportunity to showcase itself in overcoming political borders in development of common CCA and DRR strategies, via practices that can be transferred to other parts of the globe.

1.1.3. Inter-sectoral misperceptions and miscommunication

Climate change has long been considered an environmental issue rather than an important element of development policies (Conway & Schipper, 2011 [14]). Development practitioners have previously been reluctant to integrate CCA policies into DRR practices due to an unfavourable perception towards integration (UNISDR, 2012 [8]). They did not identify the role of CCA and DRR in the process of development (Sperling & Szekely, 2005 [2]; UNISDR, 2012 [8]). However more recently, the link between sustainable development and CCA/DRR synergy cannot be understated. Development forms an integral part of achieving sustainable synergies. e.g. the short-sighted, "quick fix" hard-engineering approaches of the past increasingly give way to more considered, longer-term, "softer" options that work with the changing environment rather than against it, seen particularly in coastal regions of Europe (Booth & Patt, 2018 [15]).

1.1.4. Unequal funding and varying operational timescales

Funding is a common barrier to the integration of CCA with DRR (Biesbroek et al., 2010 [16]; Sperling & Szekely, 2005 [2]; UNISDR, 2012 [8], 2013a [17]; Urwin & Jordan, 2008 [18]). As UNISDR (2012) [8] points out; funding for disaster risk reduction is not equally allocated between relief, reconstruction and prevention. For example, for every $100 spent on disasters and risks globally, $96 of that is spent on emergency relief and reconstruction. This highlights the low financial arrangement for disaster reduction as preventive measures. Many DRR programmes are funded by humanitarian budgets whereas CCA programmes are funded by environmental departments (Mitchell et al., 2010 [19]) which in turn leads to very different operational timescales in practice.

Funding for DRR is ad-hoc and insufficient because humanitarian assistance fails to provide an adequate allocation for DRR, whereas funding for CCA is sizable and increasing (Mitchell & van Aalst, 2008 [1]). Most adaptation strategies do not have commitments towards financial resources due to a lack of knowledge about the cost of adaptation (Birkmann & von Teichman, 2010 [20]). This leads to complex and expensive overlaps within financial commitments in disaster relief programmes. Generally, funding organisations for climate change may be reluctant to integrate funding with DRR programs (Mitchell & van Aalst, 2008 [1]).

In summary, unclear convergence has resulted in duplication of some DRR and CCA innovations, administrative inefficiencies, mismatching terminologies and even competition among DRR and CCA communities. Climate change should not be considered as a stand-alone issue, but rather incorporated into a wider DRR approach, whereby all vulnerable factors contributing to community risk are addressed in synergy. The real objective of both DRR and CCA is effective development planning: managing risks and uncertainties for all shocks and stresses. It is necessary therefore, to integrate CCA into DRR, and then DRR into the wider development policies (Mercer, 2010 [4]; Mitchell & van Aalst, 2008 [1]).

1.2. Closing the gap: Seeking synergies between CCA and DRR

Fostering coherence and collaboration across global and regional mechanisms and institutions for both CCA and DRR has become a key focus of UNISDR (United Nations International Strategy for Disaster Reduction) and its partners. Synergising efforts are embedded in the Hyogo Framework for Action (2005–2015) [21] and the Sendai Framework for Disaster Risk Reduction (2015–2030) [22], highlighted annually at the United Nations' Conference of the Parties (COPs). Views are changing, but there is a significant lag time noted by practitioners in converting changing attitudes, to policy and in converting new policies to practice. In many locations, it is home grown "practices" that emerge proactively before the policies catch up, leaving regional stakeholders feeling unsupported strategically. Legal hurdles remain, particularly when it comes to European border regions.

Emergencies tend to be planned for nationally, which can hinder possibilities for transnational cooperation from the outset. For example, transboundary emergency care in locations like the German-Polish border and the French-Luxembourg border is hampered, due to mismatching insurance schemes and lack of administrative coordination (Mission Opérationnelle Transfrontalière, 2015) [23]. Mismatching emergency equipment, e.g. different fire hose coupling diameters still used in France and Germany prevent pooling of equipment in a *trans*-border disaster, while complex administrative hurdles await emergency workers or medical staff who wish to work in both jurisdictions. Calls for border-region inhabitants to receive more coordinated border-zone emergency care is now a priority; to take into account for national strategies the possibilities which may exist on the other side of the border, especially when for some border inhabitants, hospitals can be closer abroad than in their considered country (MOT, 2015) [23].

At the maritime border between France and the United Kingdom (Strait of Dover), the Pas-de-Calais Department describes a problem of application of law linked with civil security forces at sea. Theoretically, there is no legal possibility for French firefighters to extinguish vessel fires in UK waters and vice versa. Firefighters located in the Pas-de-Calais Department are not supposed to respond to accidents at sea, even if they are trained for this, because the competence belongs to the navy fire department of Cherbourg, which is located further from the hazardous area (MOT, 2015) [23].

There is a call to harmonise CCA and DRR terminology, to provide consistent messages to the media and other organisations in consistent communication of risk. Language barriers for example, can reduce efficacy of localised alpine warning systems to tourists or to skiers and hikers of differing abilities (e.g. Burkeljca, 2013 [24], Engeset, 2018 [25]). Initiatives like the ALBINA project, are setting out to directly tackle these inconsistencies by harmonising risk communication across borders, in this case by producing consistent avalanche danger warning services between Austria's Tirol and Italy's South Tyrol and Trentino regions, (Mitterer et al., 2018 [26]).

There is significant scope and clear benefits to bringing the CCA and DRR sectors together, not least in border regions. One key area is closer incorporation of CCA measures into DRR by bridging the science-policy divide. CCA research data e.g. future precipitation predictions can be considered in DRR practice to better predict and prevent future disaster risk from flooding; storm track weather data can help plan for better coastal defences against sea level inundation; mapping precipitation and crop yield patterns can alert and improve early warning for food security in disasters. Data-sharing helps both sectors to reduce short term disaster risk while incorporating adaptation to climate change, helping to drive new longer-term policies.

Effective integration of CCA with DRR requires participation of a wide range of stakeholders, including policy makers, private sector companies, scientists, NGOs, and educators (IPCC, 2012 [27]; UNISDR, 2009 [28]). Incorporation of multi-disciplinary stakeholders and multi-sectoral processes are vital in building common understanding, commitment and consensus (UNISDR, 2009 [28]). Coordination of these different stakeholders with their different interests is however a key challenge in achieving integration, due to frequent inability to reach consensus on specific adaptation measures (Lei & Wang, 2014 [29]).

1.3. ESPREssO stakeholder engagement for building synergies between CCA and DRR

ESPREssO set out to elicit opinions of stakeholders working in both policy spheres in order to better frame the barriers which currently hinder CCA and DRR integration, then to identify solutions to overcome these. An initial stakeholder identification and mapping process applied quota sampling to select key, multi-sectoral and multi-national experts, grouped around three Core Challenges:

Challenge 1: Developing stronger synergies between CCA and DRR
Challenge 2: Bridging the science-policy interface in Risk Management
Challenge 3: Improving management of *trans*-boundary crises

A two year data collection process was conducted to maintain an extensive and active stakeholder forum (n = 45) for further analyses (Booth et al., 2017 [30]; Booth et al., 2018 [31]). ESPREssO's research plan was developed with the intention to collect strategic stakeholder input continually throughout the project and to allow each engagement phase to inform subsequent phases, as an iterative, rather than a strictly sequential process.

Fig. 1 shows the timeline for engaging ESPREssO stakeholders. An initial Stakeholder Forum framed the three Core Challenges by collecting interactive poll data on issues stakeholders prioritised the most. The results of these initial polls, alongside targeted interviews, informed question selection for an online ESPREssO Questionnaire, which collected 100 responses.

Three international Think Tanks, held in Berlin, Zurich and Naples over 2017–2018 incorporated serious gaming, to assist data-collection purposes. Running parallel to these three Think Tanks, a questionnaire and targeted stakeholder interviews corroborated findings and fed in new ideas throughout the process. Results from interviews were compared to questionnaire results to ensure consistent themes were emerging and being explored adequately. The Think Tanks collectively helped progress the project from its deliberative stages, to presentation of its results to the European Commission in Brussels, in October 2018, where stakeholders were encouraged to reflect on the engagement process and collective progress made (Abad et al., 2019 [38], Booth et al., 2019 [39], Schueller et al., 2019 [40]).

1.4. ESPREssO's stakeholder forum

ESPREssO's Stakeholder Forum comprised 44 key international experts. These stakeholders formed the main input to the project (Booth et al., 2017 [30]; Booth et al., 2018 [31]). The majority of stakeholders worked in the science domain (39%), followed by governmental institutions (25%). Non-profit organisations (18%) and the private sector (7%) were also represented. Other stakeholder organisations included EU bodies (4%) and Government/Science institutions (7%).

Most stakeholder organisations operated on an international/global scale (48%), closely followed by organisations acting at national level (43%). 7% and 2% of the organisations act at European and regional level, respectively (Fig. 2a). Approximately half of the stakeholders' organisations (43%) declared their areas of expertise as both DRR and CCA, while 48% indicated that they are exclusively focused on DRR. 9% of the participants declared an exclusive commitment to CCA (Fig. 2b) (Zuccaro et al., 2018 [32]).

2. ESPREssO stakeholder engagement data-capture methods

ESPREssO aims and corresponding data-capture methods are

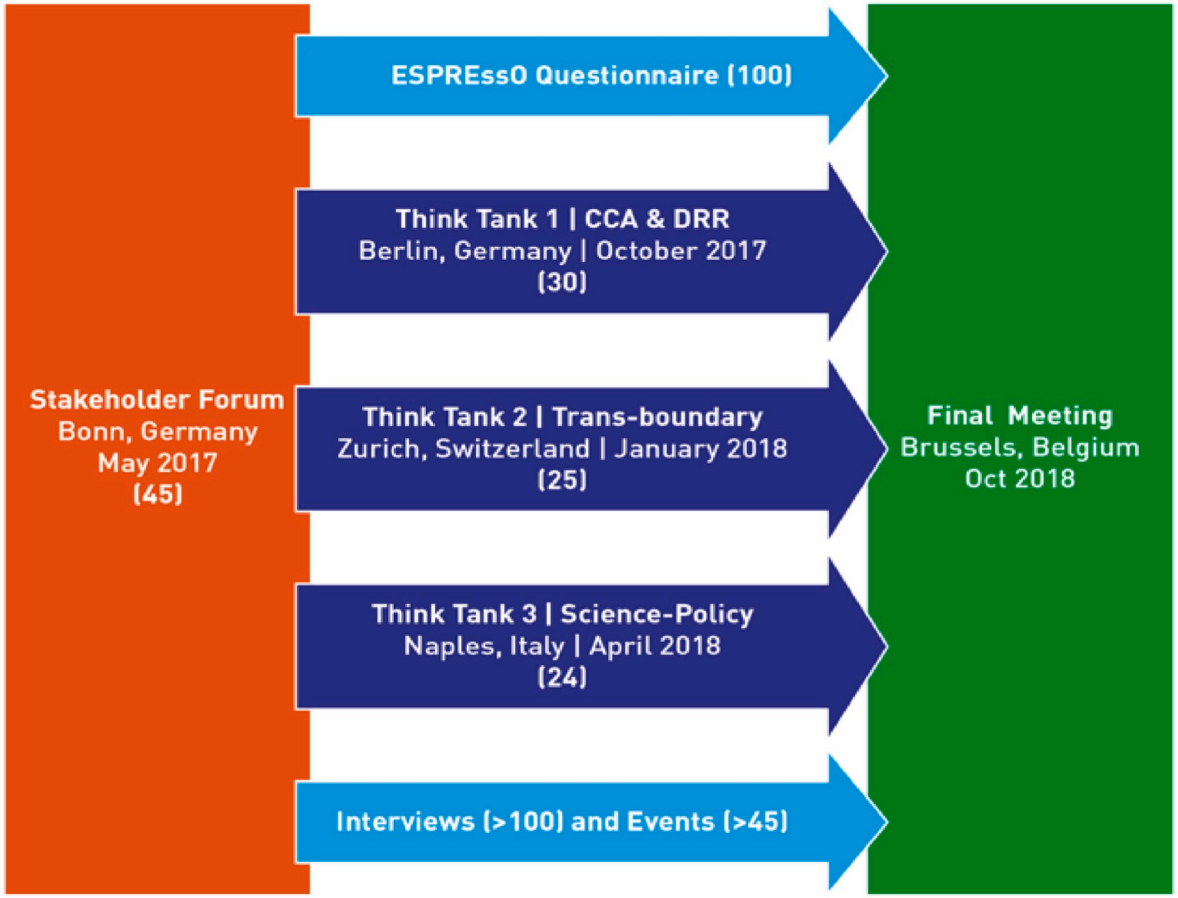

Fig. 1. ESPREssO stakeholder engagement events (Booth et al., 2018[31]).

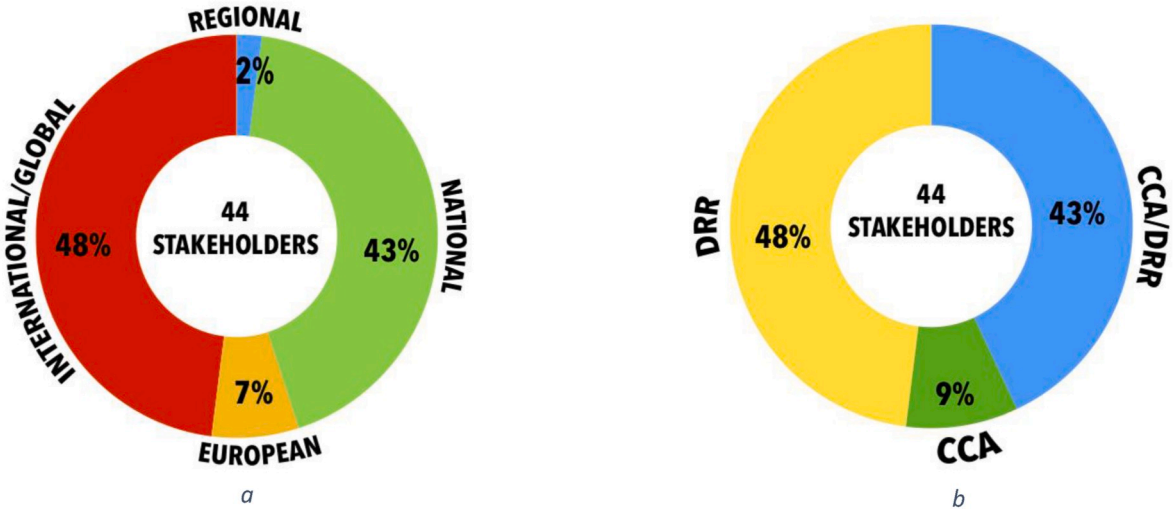

Fig. 2. a. Scope of stakeholder's organisations (Zuccaro et al., 2018), b. Stakeholder's area of expertise (Zuccaro et al., 2018[32]).

outlined in Table 1. The process was designed not only to attract initial stakeholder input amongst relevant key experts, but to retain their input for the duration of the project to collect comments on emerging priorities and to maintain momentum of parallel engagement channels through which stakeholders could contribute their needs and opinions, both online and in person.

2.1. *Serious gaming*

Serious games, defined in Michael & Chen, 2006 [33] as games where entertainment is not the sole objective, were designed to capture behavioural patterns, decision making processes and perspectives of ESPREssO stakeholders, within the context of a virtual crisis scenario, reflective of real-life issues and using the three Core Challenges as central themes (Schueller et al., 2018 [34], Fleming et al., 2019 [35]).

Table 1
ESPREssO stakeholder engagement methods.

Phase	Main aim	Methods and tools
1. Initial phase	Creating a stakeholder forum of participants with a broad range of professional backgrounds as well a geographic diversity	• Extensive stakeholder mapping to identify CCA and DRR experts • Statistical analysis and quota sampling to categorize stakeholders according to the three Core Challenges
2. Deliberative process	Promoting useful dialogue and deliberation amongst participants with intention of identifying technically, environmentally, socially and economically acceptable mitigation strategies	• Conducting initial evaluation meeting • Conducting three Think Tank workshops • Evaluation and feedback through questionnaire • Development of 3 serious games
3. Data collection	Collect data eliciting stakeholder opinions and needs regarding where the key issues lie between synergising CCA and DRR and to identify the gaps and perspectives.	• Sign up survey for initial Stakeholder Forum • Online questionnaire (n = 100) responses. • Serious games each dealing with one Core Challenge • Targeted, in-depth stakeholder Interviews
4. Outreach activities	Facilitate communication and sharing knowledge to maintain an open dialogue among stakeholders	• Social media: Twitter, Facebook and YouTube • Two videos produced to display the aims and results of the project • Outreach via newsletter, leaflets, brochures • Networking events at national and international level

The games were intended to engage stakeholders with different backgrounds during three international Think Tanks, to test stakeholder interactions objectively, with no previous collaboration necessarily required between the "players". The games allowed detailed expansion of topics that had emerged from discussion groups at the initial Stakeholder Forum, ranging from resource allocation, effectiveness of communication, to legal responsibilities. A range of outcomes were explored thoroughly and enthusiastically by players not only during the games themselves, but in the discussion sessions which followed.

The games, titled RAMSETE I, II and III (Risk Assessment Model Simulation for Emergency Training Exercise) provided an excellent discussion tool for focusing debate, where stakeholders were able to vocalise their priorities and perspectives based not only on their assigned game roles, but their real-life roles, with other stakeholders presenting a type of "peer-review mechanism", in making their points. Assigning roles focused the mind in deciding, for example, where responsibility lies at different stages of the disaster cycle; or deciding where and *when* collaboration was most effective. The games allowed a broad range of qualitative results to emerge from each Think Tank which were further used to define future research challenges related to natural hazards and Disaster Risk Management (Zuccaro et al., 2018 [32]).

2.2. Interviews

Over 100 interviews were conducted during the project by partners. Many were carried out in the process of compiling National Reports for assessing current CCA and DRR synergies in UK, Switzerland, France, Germany, Italy and Denmark (Amaratunga et al., 2017 [36]). Their primary aim was to acquire a deeper insight into stakeholders' needs and perspectives, on a more individual basis. The qualitative results were synthesised and were used to design a set of guidelines to enhance risk management capabilities (Lauta et al., 2018 [37]). Alongside interviews, a questionnaire designed by the authors of this paper sets into context the issues raised by stakeholders within the wider CCA and DRR communities.

3. Results: quantitative data from ESPREssO's questionnaire

ESPREssO's online questionnaire captured 100 responses. Stakeholders were asked to provide their perspectives based on their current roles, in their current countries. Respondents reflected a wide range of countries, predominantly from within Europe. Germany had the largest percentage of responses (28%), followed by Italy (25%), UK (7%) and Denmark (9%). Perspectives were also drawn from Jordan, Portugal, Sweden, Slovenia and Romania (Zuccaro et al., 2018 [32]). The background of respondents was evenly distributed in thirds across a) the natural sciences, b) engineering and c) management/social sciences sectors. The type of organisation within which responding stakeholders were based, was mainly institutional (47%) but included a strong element from academia (38%). Private sector and NGOs were represented at around 5% each. Other responding organisations included freelance consultants and independent research institutes.

3.1. Barriers to integrating CCA and DRR, identified by ESPREssO stakeholders

Stakeholders gave a fairly even priority weighting to listed barriers (Fig. 3), with political barriers and institutional barriers ranking most highly-this was common across all three Core Challenges. These two barriers require the most urgent attention, according to both CCA and DRR stakeholders. Social barriers also rank highly, based for example, on cultural differences, or low public support.

Financial barriers ranked in the mid-ranges for stakeholders, in terms of causing obstacles to implementation of their roles. In many areas of Europe, financial support might be in place, yet it is the institutional framework, or changing political settings that hinders access to it. Lack of scientific knowledge and technical barriers ranked fairly low, across

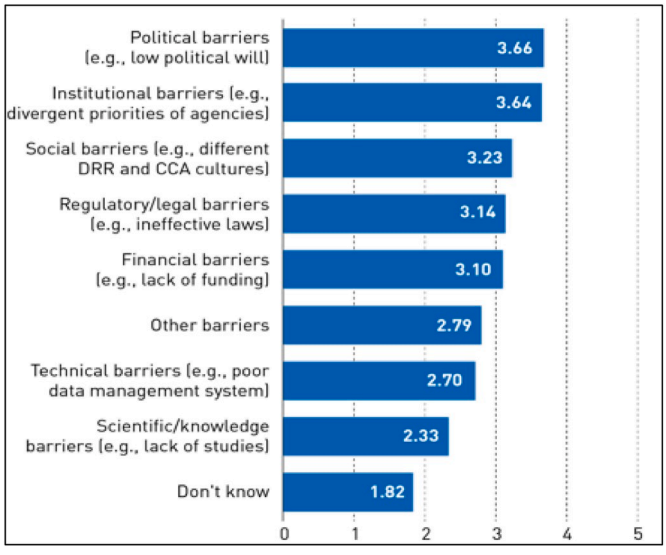

Fig. 3. ESPREssO Questionnaire (2018). Which barriers hinder integration between CCA and DRR? (Scale 1–5).

all three Challenges, positively indicating that although knowledge is being generated, it needs to be shared in a more targeted fashion, amongst the relevant sectors. This is arguably also linked to and potentially improved by greater political and institutional osmosis for full benefits to be realised.

3.2. Solutions identified by ESPREssO stakeholders

Following clarification of where the major barriers lie within the three ESPREssO Challenges, the questionnaire's main focus was to uncover solutions to the issues. Figs. 4–12 show the results, prioritised by ESPREssO Stakeholders, based on their experiences in their respective countries.

a) Developing CCA DRR Synergies (ESPREssO Challenge 1)

Seeking greater public engagement ranks highest in terms of an immediate action for synergising CCA and DRR (Fig. 4). This was raised by stakeholders at the first stakeholder Forum, with media strongly highlighted as a powerful collaborator which could be better utilised in achieving this, particularly in the communication of uncertainty. More objective reporting and keeping the memory of disasters alive in the minds of policy makers are two key areas which can help create transparent delivery of disaster risk management.

Closely following the need for creation of new synergising policies and legislation, new partnerships with specific functions to bridge the public and private sectors were favoured. Stakeholders felt this could be a role undertaken by Non- Governmental Organisations (NGOs) as part of a wider redefinition of NGO roles in CCA and DRR decision-making. Market incentives and business-oriented projects were recognised in having strong potential to generate synergies and good practice cases in coming years, helping to synergise not just the CCA and DRR sectors, but those working across borders. Partnerships, particularly in remote and *trans*-border regions are viewed as being central to engaging community planning efforts where impacts are felt most harshly (Biehl et al., 2018 [12]).

Stakeholders were asked to comparatively assess their interactions with media ten years ago, with today. Results reflect a generally improving picture (Fig. 5). Greater accessibility and public ownership of topics (generated by wider social media useage) help to increase transparency and communication about research and initiatives to maintain momentum in making and communicating progress.

Stakeholders felt that shared goal-setting and increasing accountability would help CCA and DRR sectors to work more closely (Fig. 6), and in support of this, transparency (more opportunities for data-sharing) ought to be improved. If transparency or data-accessibility improves, or becomes more centralised, it is logical that promotion of accountability and shared goal-setting could naturally follow and data quality be upheld.

b) Bridging the Science-Policy Interface (ESPREssO Challenge 2)

Similarly to Challenge 1, establishing specific partnerships to carry out the task of integrating scientific output into DRR policy and practice, was championed amongst stakeholders (Fig. 7) reflecting a ground-swell change in terms of linking sectors holistically. *Silo-thinking* is referred to as a thing of the past and a barrier which is to be moved away from.

New partnerships would drive forward a different way of integrated thinking that allows scientists to think as policy-makers and policy-makers to think as scientists. Even in simulated interactions, this experience is invaluable, illustrated during the ESPREssO RAMSETE exercises (Abad et al., 2019 [38], Booth et al., 2019b [39], Schueller et al., 2019 [40]). It is critical for science-policy interactions to cross-pollinate at all levels of governance, to become the "norm" amongst stakeholders so that they ask the right questions of themselves, and can reflect on their work and roles objectively, from a systemic perspective.

Multi-hazard risk assessment, including cascade effects and interdependencies was identified by stakeholders as the most important area to target and fund further research by the scientific communities (Fig. 8). Community-based resilience also scored highly followed by finding nature-based solutions. Both these criteria help to generate better community-based ownership of understanding risks and risk management.

When asked at which level of governance, future scientific research should aim to feed into DRR policy and practice, the local level was championed by stakeholders as requiring relevant scientific results (Fig. 9). This reflects climate change impacts being locally specific in nature, requiring locally-specific risk profiles and assessment of risks by local authorities which must be prioritised.

c) Transboundary Management of Crises (ESPREssO Challenge 3):

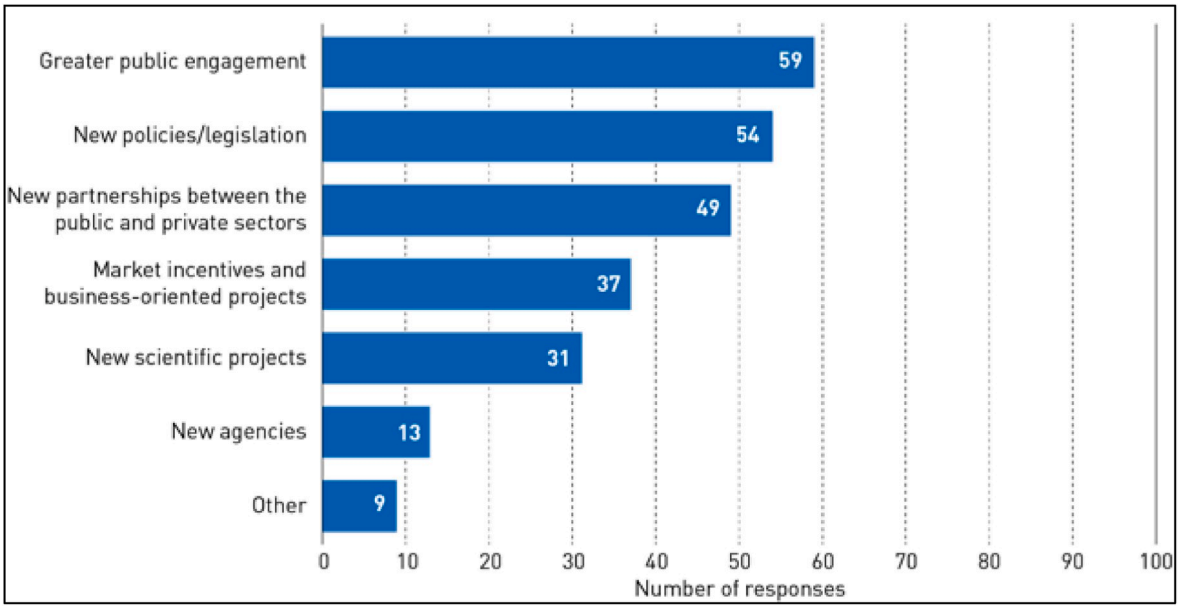

Fig. 4. ESPREssO Questionnaire (2018): Prioritise Solutions to promote synergies between CCA and DRR in your country. (Stakeholders asked to select their top 3).

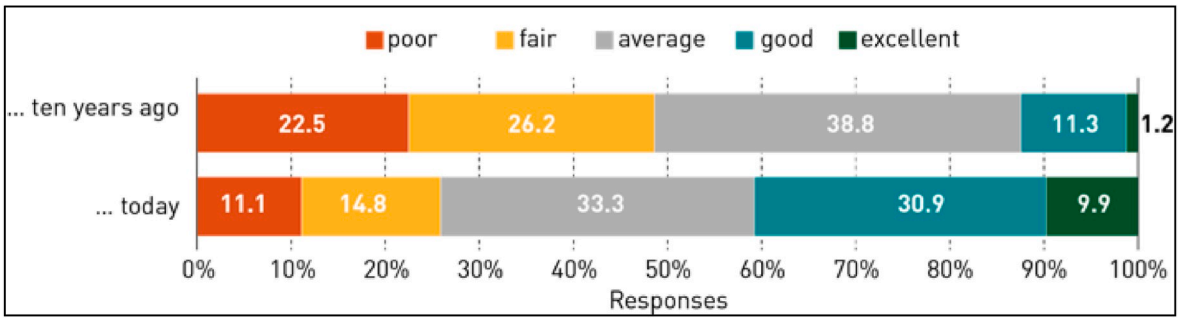

Fig. 5. ESPREssO Questionnaire (2018): ESPREssO stakeholders' assessment of media interactions.

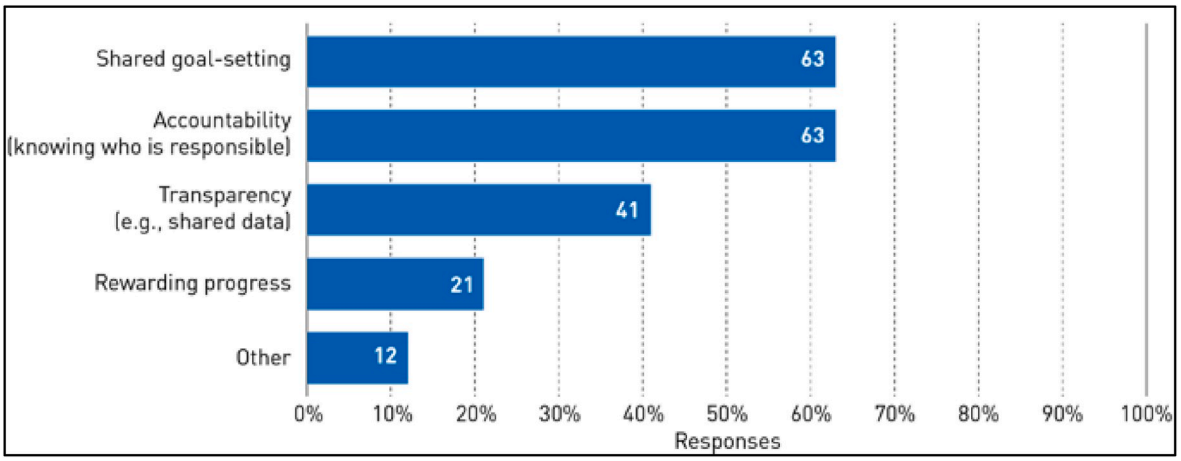

Fig. 6. ESPREssO Questionnaire (2018): Which principles are most relevant in promoting closer CCA and DRR integration?

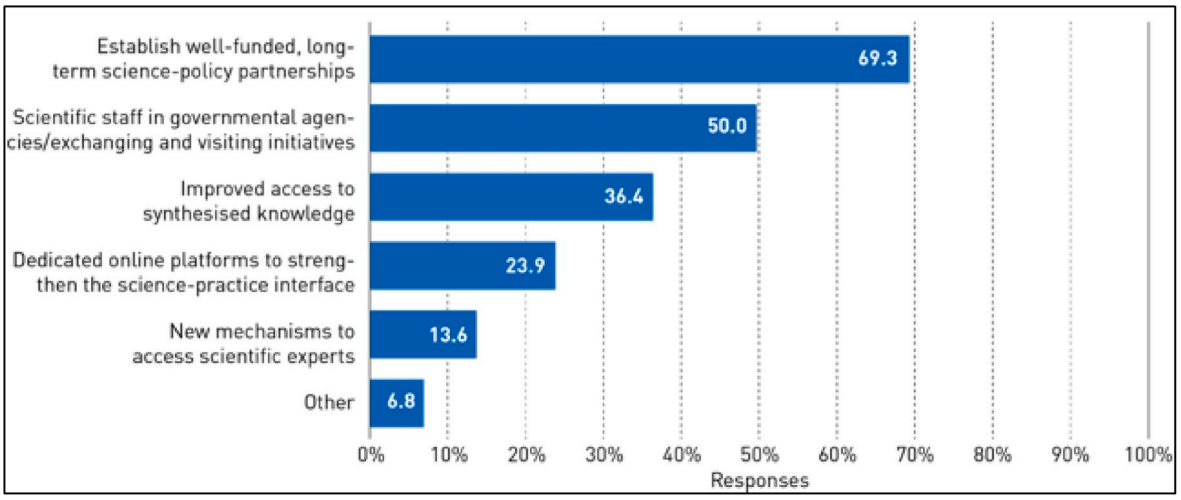

Fig. 7. ESPREssO Questionnaire (2018): Prioritise Solutions to better integrate Science results in DRR Policy and practice in your country. (Stakeholders asked to select their top 2).

Stakeholders felt that for improving transboundary disaster management, data sharing and harmonised risk assessment is to be prioritised (Fig. 10). This was echoed strongly at the second international Think Tanks where stakeholders operating in *trans*-boundary settings raised a need for standardisation of risk assessment, critical thresholds, warning and evacuation systems and a consistent terminology across borders. Access to pooled resources tends to be easier when these criteria are adequately supported by the state, along with common training initiatives, which also scored significantly amongst respondents.

When asked which sort of network would most appeal to stakeholders working *trans*-boundary on these issues, the overwhelming response was to have a state-funded network (Fig. 11).

This addresses the gap local practitioners report in tackling transboundary challenges, the complexities of which don't always filter upwards to government level in sufficient detail. Stakeholders call for better understanding and support from strategic policy makers to regional or localised (often voluntary) initiatives to lead the creation of a stronger, better-resourced support structure for home-grown

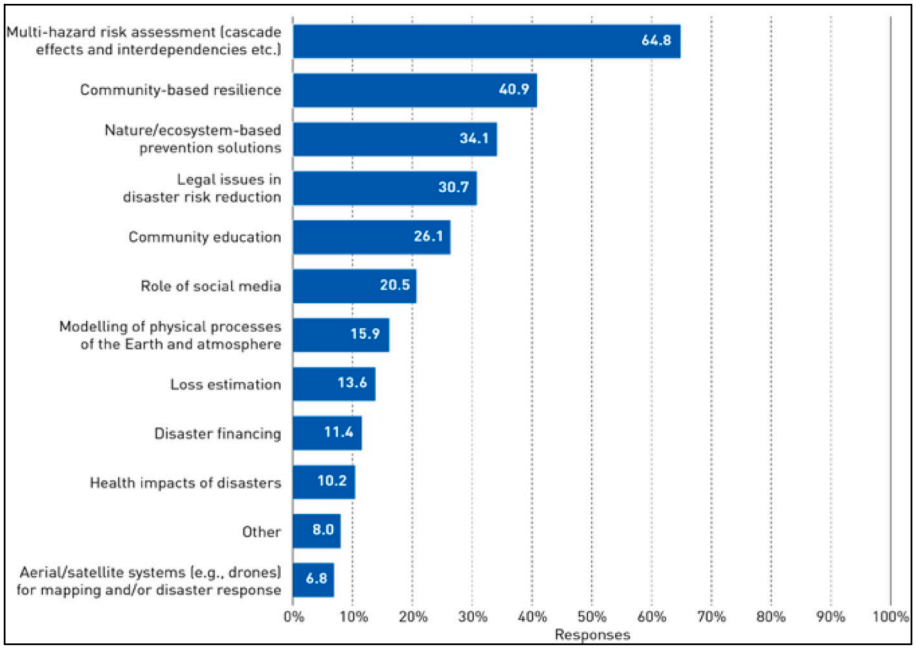

Fig. 8. ESPREssO Questionnaire (2018): Where is targeted scientific research specifically required in DRR? (Stakeholders asked to select top 3).

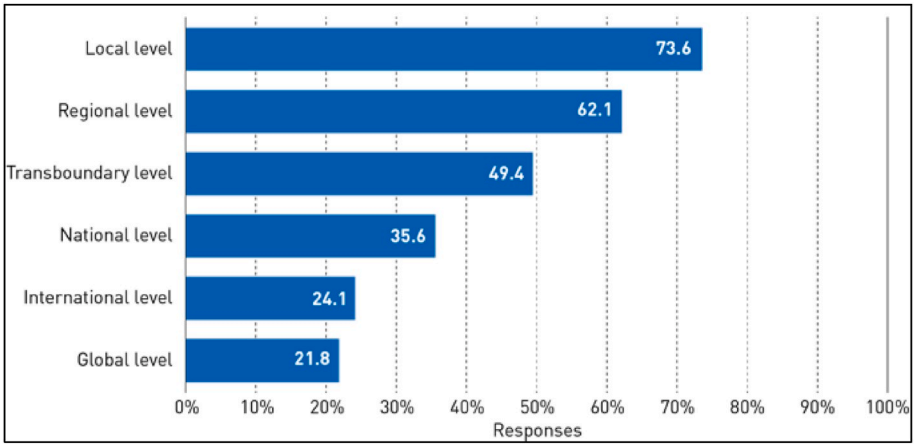

Fig. 9. ESPREssO Questionnaire (2018): At which levels of governance should future scientific research aim to feed into DRR policy and practice? Stakeholders asked to select top 3.

transboundary CCA and DRR synergies (Booth et al., 2019 [39]).

3.3. Public versus private sector engagement

Fig. 12 shows interaction of stakeholders, across all 3 Challenges with both public and private sector stakeholders. In each Challenge, it is noted that there is significantly less interaction with the private sector, than with public sector, the gap being noted most significantly in transboundary risk management (Challenge 3). With increasing critical infrastructure owned and managed privately we need to be sure the legal frameworks are in place to define responsibilities in times of crisis.

4. Qualitative results and recommendations from Think Tanks and Interviews

In support of quantitative Questionnaire data, qualitative results from the Think Tanks and Interviews feed into ESPREssO's two core project outputs: "Enhancing Risk Management Capabilities Guidelines" (Lauta et al., 2018 [37]) and "ESPREssO's Vision Paper on future research strategies following the Sendai Framework for DRR 2015–2030" (Zuccaro et al., 2018 [32]). In summary, ESPREssO Stakeholders prioritise the following actions under a few common themes to all Challenges:

4.1. Communication

A common immediate action raised across all 3 Challenges was improving communication. This includes the communication of scientific uncertainty, the current limits to scientific knowledge, as well as its contributions to CCA and DRR. Both CCA and DRR stakeholders highlight strengthening of their interaction with media as a valuable synergising opportunity.

Media accountability and ethics deserve more attention in research and practice. Stakeholders believe that media also has an increasing responsibility to recognise and portray the differences between actual and perceived effects of climate change and efficacy of adaptation measures. It is important to find positive messages that can be promoted through the media etc. rather than solely focusing on the negative after a

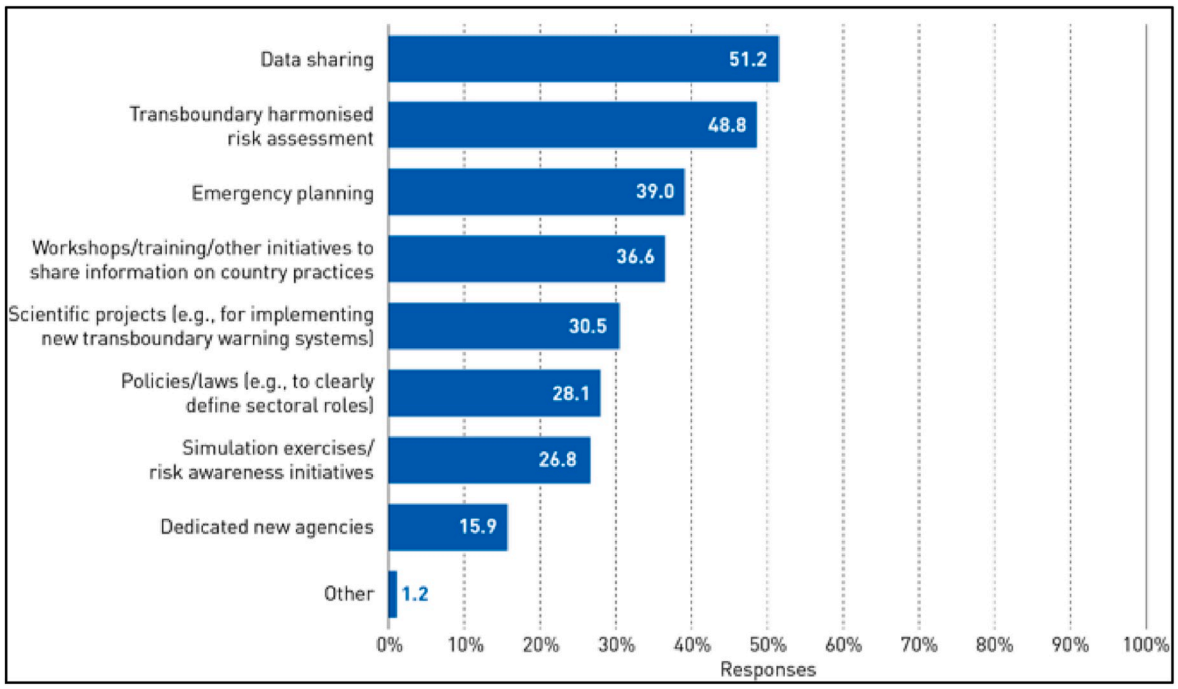

Fig. 10. ESPREssO Questionnaire (2018): Finding Solutions to improving Management of *Trans*-Boundary Crises (Challenge 3). (Stakeholders asked to select top 3).

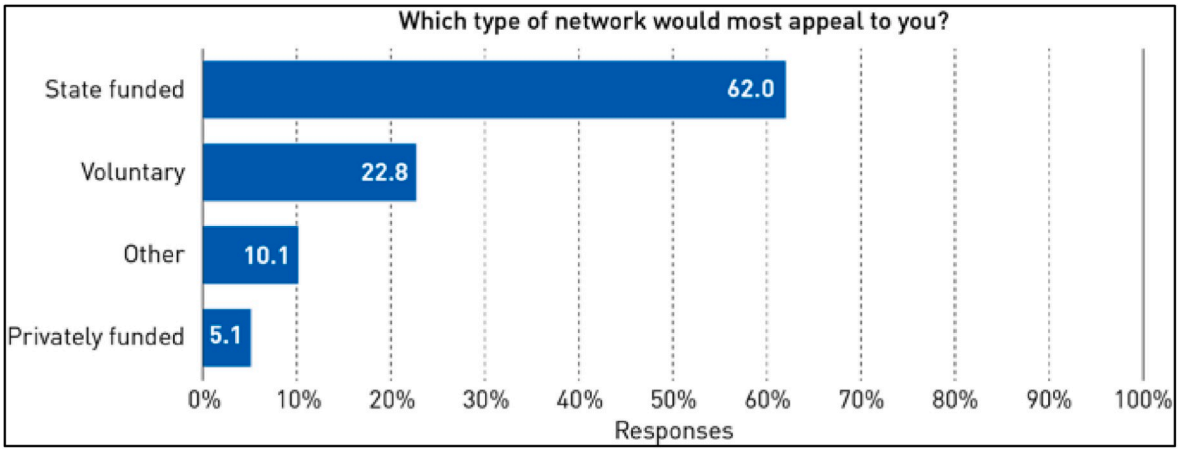

Fig. 11. ESPREssO Questionnaire (2018): Which type of *trans*-boundary network would most appeal to you?.

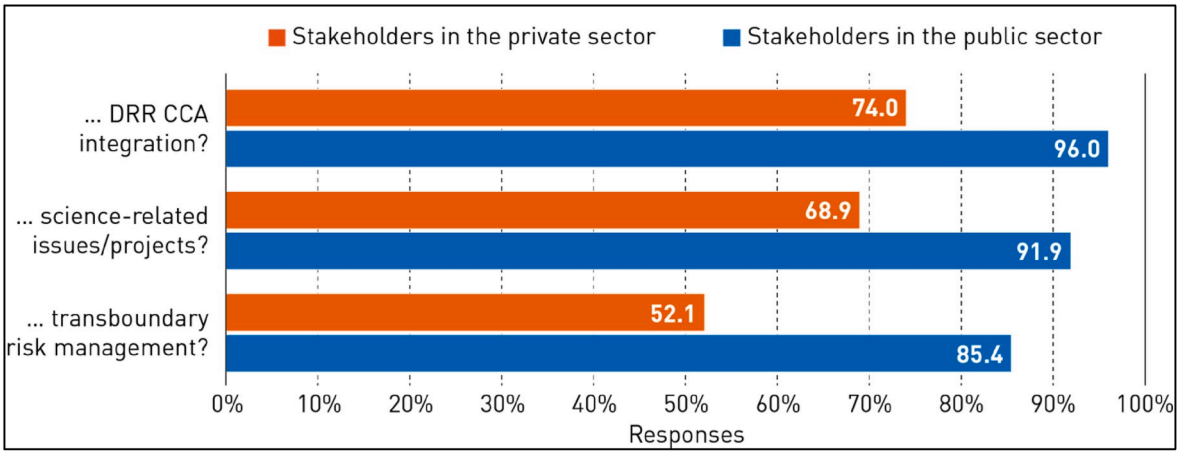

Fig. 12. ESPREssO Questionnaire (2018): Stakeholder interaction with the private and public sectors across the 3 Challenges.

disaster. For example, in Denmark, local municipalities promote 'how to make a city liveable' instead of 'how to reduce the disaster risk of a city'. 'Livability of cities' as part of quality of life could be used as a way of promoting the benefits or framing the issue. It is likely to be more attractive than focusing on costs or lives lost. Convergence will however be important in order to avoid fatigue or confusion of messages.

Stakeholders raised an issue whereby the media's principle of contradiction can drive some scientists to take up controversial positions in order to get exposure or funding –this is a central issue for creating good, solid and trustworthy scientific communication to the political branch as well as to the public. Furthermore, classic scientific virtues such as critical thinking and questioning existing conventions might be problematically abused to create unnecessary public unease in disaster situations and should be addressed.

Media plays a central role in bridging the science-policy interface and in alleviating language barriers at borders. This regards both the potential dysfunctions of information overload and the opposite, namely lack of relevant information available to the public. It remains an important challenge to manage misinformation, and secure a lean, valid and direct information. Media accountability and ethics could play an important role in future governance of this. Strengthening of scientific preparedness, with both communication and legal knowledge, is key to guaranteeing effective communication.

4.2. Political support

Stakeholders need to ask, *who* are they trying to influence? It may be necessary to target politicians indirectly. The scientific community could focus on building awareness and understanding on the public, who will in turn influence policy makers. Alternatively, major global initiatives bring many leaders together. For example, the UN Global Platform brings Heads of State together but it is a long-term process. There is also concern that the global agreements do not translate to the local level. e.g. The Sendai Framework [22], is one such example felt by stakeholders to contain such broad recommendations that there is a risk of making no statement at all for change to be made. The urgency or catalyst for change must come from the specificity of local action and coordinated governance. Build Back Better, in contrast, is viewed as a strongly synergising initiative for both sectors and with integrated approaches to retrofitting and reconstruction.

4.3. Inclusion of the private sector

Privatisation of utilities and critical infrastructure creates new barriers. When utilities are privatised, official reports are replaced by consultants' reports, meaning that knowledge of the municipalities can be lost, meaning synthesis is lost. ESPREssO stakeholders warn against a disappearing knowledge base, that can accompany privatisation of assets, with massive investment needed to now re-establish data that was once already available. This reflects how it is crucial to better engage with the private sector in creating joint CCA/DRR targets, so that cohesion is prioritised, not just for new research but to preserve and share the data we already possess. Clarification of the public and private roles in delivery of CCA and DRR between science (explain the hazards), civil protection (explain the impacts) politics (explain the situation to its population), can increase systemic efficiency. Assigning *responsibilities* while beneficial, is however to be done with caution, as it can potentially lead to a blame-culture if mishandled. Liability should not rest with individuals, but with decision-making commissions.

4.4. Role of Non-Governmental Organisations (NGOs)

NGOs, in particular have a valuable (and as yet largely untapped) potential synergising role to play in bridging the current institutional gaps that currently exist between CCA and DRR implementation in Europe, particular in partnership provision. They tend to be quicker, more responsive and more flexible than governments and where present, they often cover governance gaps, e.g. in Switzerland and Denmark, the Swiss and Danish Red Cross offer free medical care to migrants irrespective of their legal status (IFRC, 2018 [41]). Stakeholders felt that representation of NGOs in the European system is lacking and much more could be done at EU level to look into the resources of response mechanisms used by NGOs. They are not currently part of European coordination mechanisms and some are not willing to be part of these because they want to preserve their independence. There is inevitable competition between NGOs for resources, which can be both positive in terms of generating improved work on the ground but can negatively lead to an imbalance of resources. Coordination of NGOs by national authorities would be important in achieving consistency and avoiding current imbalance of actions and possible duplication of effort. New global governance models can be explored and adapted to Europe, such as in the United States where NGO efforts are "nested"- one NGO effectively leads another in emergency operations.

This research process focused primarily on the needs of European CCA and DRR stakeholders, within the governance setting of European nations striving to achieve sometimes overlapping goals, under both banners of CCA and DRR. It casts assumptions though that can be extrapolated globally. ESPREssO stakeholders provided valuable insight into trends and opinions that steer the synergies between CCA and DRR and in that sense, useful lessons can be learned. The research was successful in eliciting the opinion of current CCA and DRR stakeholders, but could be made more robust by further study, particularly into the policy-practitioner divide. Often results from both these perspectives was found to misalign, or even clash and more work can be done to harmonise these perspectives. ESPREssO set its sights on addressing strategic policy, but there are multiple examples where grass-roots actions can be powerful in prompting policy change (or synergy). High-level decision makers are urged to remain aware of this and to support and encourage new (particularly cross-border) initiatives that aim to overcome some of the Challenges presented here.

4.5. Key summary recommendations for synergising action

- In creation of new synergising policies to help align and promote CCA and DRR activities, *catalysts* are needed to overcome the barriers. Often it takes a disaster itself to act as a catalyst for generating real progress and the aim should be to ensure progress is not short-lived but maintained. This might be in the shape of new legislation (e.g. the UK's Civil Contingencies Act, 2004, which set out to define responsibilities for emergency planning for flooding in the UK after a series of flood events in 2000).
- Creation of new partnerships is needed to bring together public and private sector activities in setting common goals. There should in the short-term, be a greater push to connect with the private sector in delivering a synergetic CCA and DRR programme.
- NGOs can be explored as a vital synergising tool in bridging the gaps in emergency response planning and should be included more formally in European coordination mechanisms. Balance should be provided by national authorities to distribution of their resources in order to ensure a level playing field.
- The European Commission is called upon to highlight examples of member state leadership which generate momentum for strategic assistance to be given to independent "home-grown" initiatives that proactively work towards streamlining cross-border policies.
- The urgency of climate change related risks is an aligning element. CCA perspectives are largely predictive, based on planning to possible future scenarios, whereas DRR is still mainly adaptive, centered on learning from disasters, yet the gap is closing. Predictions for climate risks can feed directly into DRR and must be allowed to do so by policy makers to allow the synergies to become evident.

- Positive messages need to be communicated with regards Disaster Management, not just the negative, which has long been synonymous with media coverage of disasters in the past. New approaches need to be outward looking and build on what stakeholders have learnt, rather than simply retrospective "cataloguing" of disaster statistics. This will go a long way to improving community engagement in the system.
- If politicians are to be convinced, they will need evidence to show a return on investment within shorter timeframes, perhaps 5 years or within an electoral cycle. Developers and politicians will always be reluctant to engage if the returns aren't demonstrable in the short-medium term. Resilience should therefore be "sold" or viewed as an *asset* with a real, tangible value. Enabling research which helps to quantify efficacy of risk mitigation measures in ways that politicians can highlight and build on, ought to be an immediate priority in bridging the gap between science and policy.

5. Conclusions

This paper presents the obstacles faced by European CCA and DRR stakeholders in developing synergies between their sectors. It highlights a set of solutions and recommendations to overcome these obstacles, by increased streamlining of their activities and agendas based on the suggestions of stakeholders themselves. Each of the measures identified can go a long way to strengthening CCA and DRR cohesion producing a more coordinated approach to disaster risk management.

Results presented here provide a composite overview of key themes emerging from the ESPREssO project. In interpreting results from the project Questionnaire, it is important to corroborate the findings from the Stakeholder Engagement process, with results from three Think Tanks, (Abad et al., 2019 [38] (Challenge 1: Developing CCA and DRR synergies), Schueller et al., 2019 [40] (Challenge 2: Science- Policy interface) and Booth et al., 2019 [39] (Challenge 3: Management of *Trans*-boundary Crises).

The stakeholder engagement process set out to elicit the needs, perspectives and opinions of CCA and DRR stakeholders and to identify their priorities for inter-sectoral innovation and synergy. Both qualitative and quantitative data collected over the course of the project, helped to formulate delivery of ESPREssO's final outputs: A Vision Paper for future research strategies and set of Guidelines or recommendations for enhancing risk management capabilities. Successful and relevant stakeholder input was maintained from start to finish, enabling the project to capture perspectives of policy makers, scientists and practitioners, which in turn formed the key audience for dissemination of results, a continual two-way process which ran the length of the project.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The work presented in this paper was undertaken as part of the ESPREssO project (grant agreement 700342) supported by the European Union's Horizon 2020 research and innovation programme under the topic DRS-10-2015: Disaster Resilience and Climate Change topic 2: Natural Hazards: Towards risk reduction science and innovation plans at national and European level. Partners would like to thank all stakeholders for their input to the project. Thanks to Sandro Bosch, ETH Zurich for assistance with figures.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijdrr.2020.101616.

References

[1] T. Mitchell, M. van Aalst, Convergence of Disaster Risk Reduction and Climate Change Adaptation. A Review for DFID—31st October, 2008. https://www.preventionweb.net/files/7853_ConvergenceofDRRandCCA1.pdf.
[2] Sperling, Szekely, Disaster Risk Management in a Changing Climate Discussion Paper. Vulnerability and Adaptation Resource Group (VARG), 2005 (Washington, D.C).
[3] F. Thomalla, T. Downing, E. Spanger-Siegfried, G. Han, J. Rockström, Reducing hazard vulnerability: towards a common approach between disaster risk reduction and climate adaptation, Disasters 30 (1) (2006) 39–48.
[4] J. Mercer, Disaster risk reduction or climate change adaptation: are we reinventing the wheel? J. Int. Dev. 22 (2) (2010) 247–264.
[5] J. Pulhin, R. Shaw, J.J. Pereira, Climate Change Adaptation and Disaster Risk Reduction: Issues and Challenges: Issues and Challenges, vol. 4, Emerald Group Publishing, 2010.
[6] A. Gero, K. Meheux, D. Dominey-Howes, Disaster Risk Reduction and Climate Change Adaptation in the Pacific: the Challenge of Integration, University of New South Wales, Sydney, 2010.
[7] L. Schipper, M. Pelling, Disaster risk, climate change and international development: scope for, and challenges to, integration, Disasters 30 (1) (2006) 19–38.
[8] UNISDR, Disaster Risk Reduction and Climate Change Adaptation in the Pacific: an Institutional and Policy Analysis, 2012 (Retrieved from Fiji).
[9] A. Gero, K. Méheux, D. Dominey-Howes, Integrating disaster risk reduction and climate change adaptation in the Pacific, Clim. Dev. 3 (4) (2011) 310–327.
[10] UNISDR, Climate Change Adaptation and Disaster Risk Reduction: Institutional and Policy Landscape in Asia and Pacific, 2010 (Retrieved from Panama).
[11] J. Dupuis, Political barriers to the implementation of climate change adaptation policies: the case of Switzerland, in: Paper Presented at the IGS-SENCE Conference Resilient Societies-Governing Risk and Vulnerability for Water, Energy and Climate Change, University Of Twente, Enschede, The Netherlands, 2011.
[12] P.F. Biehl, S. Crate, M. Gardezi, L. Hamilton, S.L. Harlan, C. Hritz, B. Hubbell, T. A. Kohler, N. Peterson, J. Silva, Innovative Tools, Methods, and Analysis: Social Science Perspectives on Climate Change, USGCRP Social Science Coordinating Committee, Washington, DC, 2018 part 3, https://www.globalchange.gov/content/social-science-perspectives-climate-change-workshop.
[13] P. Venton, S. La Trobe, Linking Climate Change Adaptation and Disaster Risk Reduction Linking Climate Change Adaptation and Disaster Risk Reduction: Tearfund, Institute of Development Studies (IDS), 2008.
[14] D. Conway, E.L.F. Schipper, Adaptation to climate change in Africa: challenges and opportunities identified from Ethiopia, Global Environ. Change 21 (1) (2011) 227–237.
[15] L. Booth, A. Patt, The Push for Proactive Climate Change Adaptation in Europe. Current History Magazine, March issue, 2018, pp. 108–113, 2018.
[16] G.R. Biesbroek, R.J. Swart, T.R. Carter, C. Cowan, T. Henrichs, H. Mela, D. Rey, Europe adapts to climate change: comparing national adaptation strategies, Global Environ. Change 20 (3) (2010) 440–450, https://doi.org/10.1016/j.gloenvcha.2010.03.005.
[17] UNISDR, How Does Europe Link DRR and CCA? Working Paper, European Forum for Disaster Risk Reduction (EFDRR), 2013.
[18] K. Urwin, A. Jordan, Does public policy support or undermine climate change adaptation? Exploring policy interplay across different scales of governance, Global Environ. Change 18 (1) (2008) 180–191, https://doi.org/10.1016/j.gloenvcha.2007.08.002.
[19] T. Mitchell, M. Van Aalst, P. Silva Villanueva, Assessing Progress on Integrating Disaster Risk Reduction and Climate Change Adaptation in Development Processes, 2010.
[20] J. Birkmann, K. von Teichman, Integrating disaster risk reduction and climate change adaptation: key challenges—scales, knowledge, and norms, Sustain. Sci. 5 (2) (2010) 171–184, https://doi.org/10.1007/s11625-010-0108-y.
[21] UNISDR, Hyogo Framework for Action 2005-2015. Building the Resilience of Nations and Communities to Disasters, 2005.
[22] UNISDR, Sendai Framework for Disaster Risk Reduction, from UNISDR, 2015.
[23] Mission Opérationnelle Transfrontalière (MOT), Cross-border Cooperation: Obstacles to Overcome, Preparation of the Luxembourgish Presidency of the EU Council, 2015.
[24] J. Burkeljca, Shifting audience and the visual language of avalanche risk communication, in: Proceedings of the International Snow Science Workshop, 7–11 October 2013, Grenoble, France, 415 422, 2013b, 2013.
[25] R.V. Engeset, G. Pfuhl, M. Landrø, A. Mannberg, A. Hetland, Communicating public avalanche warnings – what works? Nat. Hazards Earth Syst. Sci. 18 (2018) 2537–2559, https://doi.org/10.5194/nhess-18-2537-2018.
[26] C. Mitterer, N. Lanzanasto, P. Nairz, A. Boninsegna, M. Munari, G. Geier, L. Rastner, F. Gheser, A T, S. Begnini, G.-L. Tognoni, A. Pucher, D. Nell, K. Kriz, R. Mair, Project ALBINA: A Conceptual Framework for a Consistent, Cross-Border and Multilingual Regional Avalanche Forecasting System, ISSW - International Snow Science Workshop, Innsbruck, 2018, 2018.
[27] IPCC, Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change, 2012 (Retrieved from Cambridge).

[28] UNISDR, Disasters, J. Disaster Stud. Pol. Manag. 33 (3) (2009) 436–456, https://doi.org/10.1111/j.1467-7717.2008.01082, x). Geneva, Switzerland: UNISDR, UNDP and IUCN).
[29] Y. Lei, J.a. Wang, A preliminary discussion on the opportunities and challenges of linking climate change adaptation with disaster risk reduction, N*at. Hazards* 71 (2014) 1587–1597.
[30] L. Booth, A. Scolobig, S. Marx, L. Schueller, ESPREssO Stakeholder Engagement Plan, 2017. Submitted as ESPREssO Deliverable 1.1. Available online: http://www.espressoproject.eu/images/deliverables/ESPREssO_D1.1_Stakeholder-Engagement-Plan_Overview-of-Tools_Activities.pdf.
[31] L. Booth, Schueller, A. Scolobig, Stakeholder Engagement Process: Understanding Stakeholders' Needs, Perspectives and Opinions and Identifying the Priorities of Stakeholders for Innovation. Deliverable 1.2, 2018. Submitted to ESPREssO October, 2018. Available online: http://www.espressoproject.eu/images/deliverables/ESPREssO_D1.2.pdf.
[32] G. Zuccaro, M.F. Leone, C. Martucci, G. Grandjean, K.C. Lauta (Eds.), ESPREssO Vision Paper on Future Research Strategies Following the Sendai Framework for DRR 2015-2030, 2018 (Project Deliverable 5.5) Available online: http://www.espressoproject.eu/images/deliverables/ESPREssO_D5.5.pdf.
[33] D. Michael, S. Chen, Serious Games: Games that Educate, Train and Inform, Thomson Course Technology, Boston, 2006, p. 287pp.
[34] L. Schueller, L. Booth, J. Abad, K. Fleming, in: Fakhruddin, et al. (Eds.), Learning Culture Amongst Stakeholders in Disaster Risk Reduction, Integrated Research on Disaster Risk (IRDR) paper for United Nations (UNISDR) Global Assessment Report 2019, 2019, 2019.
[35] K. Fleming, J. Abad, L. Schueller, L. Booth, A. Baills, A. Scolobig, Bojana Petrovic, G. Zuccaro, M. Leone, The use of serious games for information elicitation from Disaster Risk Reduction and Climate Change Adaption stakeholders, Gen. Assembly 2019 Eur. Geosci. Union 21 (2019) EGU2019–13926.
[36] D. Amaratunga, R. Haigh, N. Dias, C. Malalgoda, ESPREssO Synthesis Report of Existing Legal, Policy and Scientific Approaches in Relation to DDR and CCA, 2017. Submitted as Deliverable 2.1. Available online: http://www.espressoproject.eu/images/deliverables/ESPREssO_D2.1.pdf.
[37] K.C. Lauta, K. Albris, G. Zuccaro, G. Grandjean (Eds.), ESPREssO Enhancing Risk Management Capabilities Guidelines, 2018 (Project Deliverable 5.4). Available online: http://www.espressoproject.eu/images/deliverables/ESPREssO_D5.4.pdf.
[38] J. Abad, K. Fleming, B. Petrovic, L. Booth, L. Schueller, A. Baills, M. Leone, Ramsete I: assessing policy preferences amongst climate change adaptation and disaster risk reduction stakeholders using serious gaming, Int. J. Disaster Risk Reduct. Special Iss. (2019).
[39] L. Booth, K. Fleming, J. Abad, L. Schueller, K. Albris, M. Leone, A. Scolobig, A. Baills, Simulating synergies between climate change adaptation and disaster risk reduction stakeholders to improve management of trans-boundary disasters in Europe, Int. J. Disaster Risk Reduct. Special Iss. (2019).
[40] L. Schueller, L. Booth, K. Fleming, J. Abad, A. Thieken, Using serious gaming as a tool for exploring how uncertainty affects decision-making between science and policy stakeholders, Int. J. Disaster Risk Reduct. Special Iss. (2019).
[41] International Federation of Red Cross and Red Crescent Societies, Geneva, New Walled Order: How Barriers to Basic Services Turn Migration into a Humanitarian Crisis, 2018. Geneva, 2018.