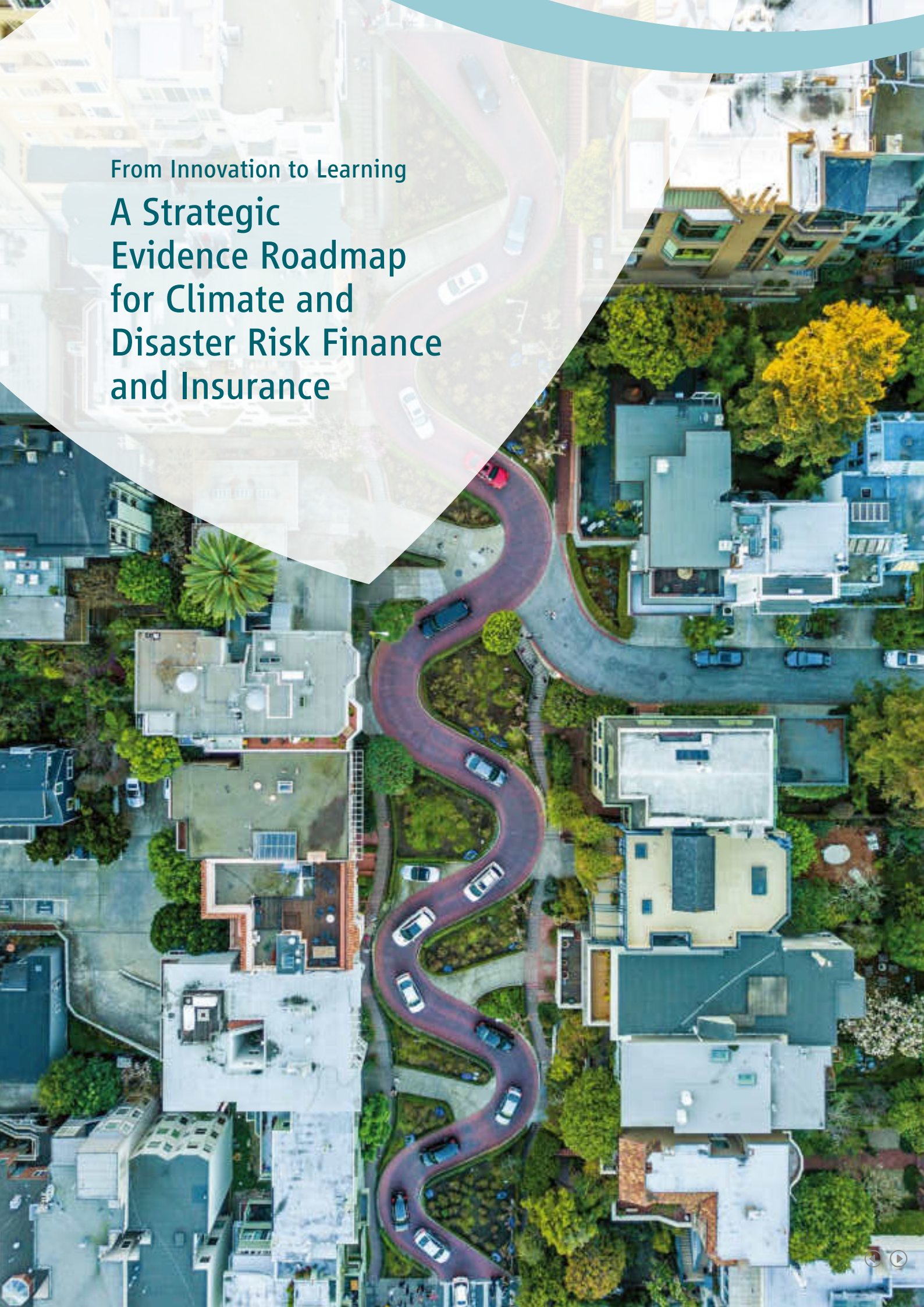
From Innovation to Learning

# A Strategic Evidence Roadmap for Climate and Disaster Risk Finance and Insurance



## About the authors

The *Introduction and Framing, State of the Evidence, Implementation Framework,* and *Next Steps for CDRFI Evidence* chapters of the Evidence Roadmap are a community product facilitated by the InsuResilience Global Partnership through its Impact Working Group. The *Evidence Priorities* chapter was authored by the Expert Author Group, comprised of the following individuals:

- People and client focused perspectives: Michael Carter and Tara Chiu (Feed the Future Innovation Lab for Markets, Risk and Resilience; the University of California, Davis)
- National and public sector perspectives: Marcela Tarazona (Genesis Analytics), Lena Weingärtner (ODI) and Valentina Ramirez (Genesis Analytics)
- Global risk finance action: Lena Weingärtner (ODI) and Marcela Tarazona (Genesis Analytics)
- Gender dimensions and impacts of CDRFI: Katherine Miles (Katherine S Miles Consulting)
- Risk information and analysis: Florian Waldschmidt (Munich Climate Insurance Initiative)
- Resilience outcomes: Jennifer Denno Cissé, Sönke Kreft, Architesh Panda (Munich Climate Insurance Initiative)

## Suggested Citation

InsuResilience Global Partnership & Munich Climate Insurance Initiative. (2021). From Innovation to Learning: A Strategic Evidence Roadmap for Climate and Disaster Risk Finance and Insurance. [Expert Author Group; Cissé, J.D.; Kreft, S.; Toepper, J.; Stadtmueller, D. (eds).]

InsuResilience GlobalPartnership

## About the InsuResilience Global Partnership

The InsuResilience Global Partnership for Climate and Disaster Risk Finance and Insurance was launched under the leadership of V20 and G20+ countries at the 2017 UN Climate Conference in Bonn. InsuResilience aims to strengthen the resilience of developing countries and protect the lives and livelihoods of poor and vulnerable people against the impacts of disasters. In doing so, it brings together more than 100 member institutions comprising governments, civil society, international organizations, the private sector, and academia. For more information, visit www.insuresilience.org.

MCII

## About the Munich Climate Insurance Initiative

The Munich Climate Insurance Initiative was initiated as a non-profit organization by representatives of insurers, research institutes, and NGOs in April 2005 in response to the growing realization that insurance solutions can play a role in adaptation to climate change, as suggested in the UN Framework Convention on Climate Change and the Kyoto Protocol. This initiative is hosted at the United Nations University Institute for Environment and Human Security (UNU-EHS). As a leading think tank on climate change and insurance, MCII is focused on developing solutions for the risks posed by climate change for low-income and vulnerable people in the Global South.

# Acknowledgements

The authors are thankful to external peer reviewers Sara Jane Ahmed (V20 Secretariat), Daniela Böhm (KfW); Annette Detken (InsuResilience Solutions Fund); Antje Kästner (Federal Ministry of Economic Cooperation and Development, Government of Germany); Maria Lourdes Kathleen Macasil (Climate Risk and Early Warning Systems Secretariat); Aholotu Palu (PCRIC), and Emma Flaherty (REAP) for excellent comments. All of these comments greatly improved the quality of the review. The document benefited additionally from the input of members of the InsuResilience Global Partnership Impact Working Group and participants in the CDRFI Evidence Workshop, as well as input and edits from Kay Tuschen, Jonathan Auer, and others with the InsuResilience Secretariat.

The authors of the *People and Climate Focused Perspectives* section would like to thank the following individuals for their contributions to this chapter: Andrew Mude (African Development Bank), Craig Churchill (International Labour Organization), Christopher Udry (Northwestern University), and Dennis Mombauer (SLYCAN Trust).

The authors of the *National and Public Sector Perspectives* and *Global Risk Finance Action* sections would like to thank the following individuals for their contributions to these chapters: Diana Almoro, United Nations Development Programme (UNDP); Juan Chavez Gonzalez, United Nations Office for the Coordination of Humanitarian Affairs (UN Office for the Coordination of Humanitarian Affairs); Daniel Clarke, Centre for Disaster Protection; Samantha Cook, World Bank; Annette Detken, InsuResilience Solutions Fund; Emma Flaherty, Risk Informed Early Action Partnership (REAP); Jon Gascoigne, Centre for Disaster Protection; Ekhosuehi Iyahen, Insurance Development Forum (IDF); Emily Montier, Start Network; Nick Moody; Kara Siahaan, International Federation of Red Cross and Red Crescent Societies (IFRC); Koko Warner, United Nations Framework Convention on Climate Change (UNFCCC); and Charlene Watson, ODI.

The author of the *Gender Dimensions and Impacts of CDRFI* section would like to thank the following individuals for their contributions to this chapter: Maria Lourdes Kathleen Macasil (Climate Risk and Early Warning Systems); Dennis Mombauer (SLYCAN Trust); Tuga Alaskary, Anastasia Thomaides, and Alexandra Dudley (InsuResilience Secretariat); Karen Sirker and Zoe Trohanis (World Bank); and Martina Wiedmaier-Pfister.

The author of the *Risk Information and Analysis* section would like to thank the following individuals for their contributions to this chapter: Preeti Koirala, Irfan Ullah, Michael Hagenlocher and Mostapha Harb (UNU-EHS); Dennis Mombauer (SLYCAN Trust); Annette Detken (InsuResilience Solutions Fund); David N. Bresch (ETH Zürich); Maria Lourdes Kathleen Macasil and John Harding (Climate Risk and Early Warning Systems); Tara Chiu and Michael Carter (the University of California, Davis); Jon Gascoigne (Centre for Disaster Protection); Nick Moody; and Stuart Fraser.

The authors of the *Resilience Outcomes* section would like to thank the following individuals for their contributions to this chapter: Michael Carter (the University of California, Davis), Dennis Mombauer (SLYCAN Trust), Lisa Schipper (University of Oxford), Swenja Surminski (London School of Economics), and Lena Weingärtner (ODI).

# Table of Contents

# Acronyms

| | |
|---|---|
| **ARC** | African Risk Capacity |
| **CCRIF SPC** | Caribbean Catastrophe Risk Insurance Facility (Segregated Portfolio Company) |
| **CDRFI** | Climate and Disaster Risk Finance and Insurance |
| **CSO** | Civil Society Organization |
| **DRF** | Disaster Risk Finance |
| **G20+** | G20 Developing Nations |
| **G7** | Group of Seven (Canada, France, Germany, Italy, Japan, the United Kingdom and the United States) |
| **GCF** | Green Climate Fund |
| **GRiF** | Global Risk Financing Facility |
| **HLCG** | High-Level Consultative Group |
| **IDA** | International Development Association |
| **IDF** | Insurance Development Forum |
| **IGP** | InsuResilience Global Partnership |
| **IPCC** | Intergovernmental Panel on Climate Change |
| **LIDAR** | Light Detection and ranging technology |
| **M&E** | Monitoring and Evaluation |
| **MCII** | Munich Climate Insurance Initiative |
| **MEAL** | Monitoring, Evaluation, Accountability, and Learning |
| **NAP** | National Adaptation Plan |
| **PCRIC** | Pacific Catastrophe Risk Insurance Company |
| **PEA** | Political Economy Analysis |
| **PFM** | Public Financial Management |
| **PPP** | Public-private partnerships |
| **REAP** | Risk-informed Early Action Partnership |
| **SDG** | Sustainable Development Goal |
| **UN** | United Nations |
| **UNFCCC** | United Nations Framework Convention on Climate Change |
| **UNU-EHS** | United Nations University, Institute for Environment and Human Security |
| **V20** | Vulnerable Twenty Group of Ministers of Finance |

# Executive Summary

Climate change is increasing the frequency and impact of natural hazards and extreme weather. Global inequities mean that these risks pose a greater and even existential threat to lives and livelihoods in the Global South. Without adequate DRF strategies and tools in place, exposed countries, communities and individuals have few options to prepare financially for and cope with the disastrous impacts of climate and geophysical extreme events. As a result, emergency response and recovery activities may be delayed with long-term consequences for livelihoods and economic growth. Countries and communities may be unable to invest in risk mitigation and preparedness and this increases the likelihood and impact of hazards. Countries and households may take on unsustainable debt burdens so as to cope with potential disaster situations.

Finance and insurance have a critical role to play in helping countries, communities and individuals to manage climate and disaster risk. While there are many different solutions, practitioners urgently need to scale up those options that work. The Climate and Disaster Risk Finance and Insurance (CDRFI) community needs research and evidence to identify the most impactful and cost-effective solutions, while also creating new innovations to leverage capital and address the most pressing risk management needs.

This Evidence Roadmap provides a structure for prioritizing both

A. investments in CDRFI research; and
B. evidence-based action to help countries, communities and people exposed to climate risks and hazards better manage disaster risk by legitimizing and meaningfully scaling up successful CDRFI solutions.

*From Innovation to Learning: A Strategic Evidence Roadmap for Climate and Disaster Risk Finance and Insurance* (CDRFI Evidence Roadmap) is a community document, facilitated under the InsuResilience Global Partnership (IGP). It was drafted and reviewed by researchers, donors, conveners, implementers, governmental and civil society representatives, and other CDRFI expert stakeholders from the CDRFI community and for the CDRFI community. The roadmap builds on the InsuResilience Global Partnership's Pro-Poor Principles and addresses one of main objectives of InsuResilience Vision 2025 – to increase the evidence base for CDRFI and move the focus from one of innovation to one of learning. It is explicit that while the community needs replicable and robust peer-reviewed knowledge, this focus on robustness should not perpetuate disciplinary hierarchies, sideline expert voices from the Global South, or ignore indigenous knowledge, community perspectives and people's lived experiences.

This roadmap strategically guides stakeholders on how to focus their efforts to gather evidence and investments. It outlines a set of 43 evidence priorities – illustrated in Figure 1 on page 7 – across the following six themes:

1. People and client focused perspectives
2. National and public-sector perspectives
3. Global risk-finance action
4. Gender dimensions and impacts of CDRFI
5. Risk information and analysis
6. Resilience outcomes

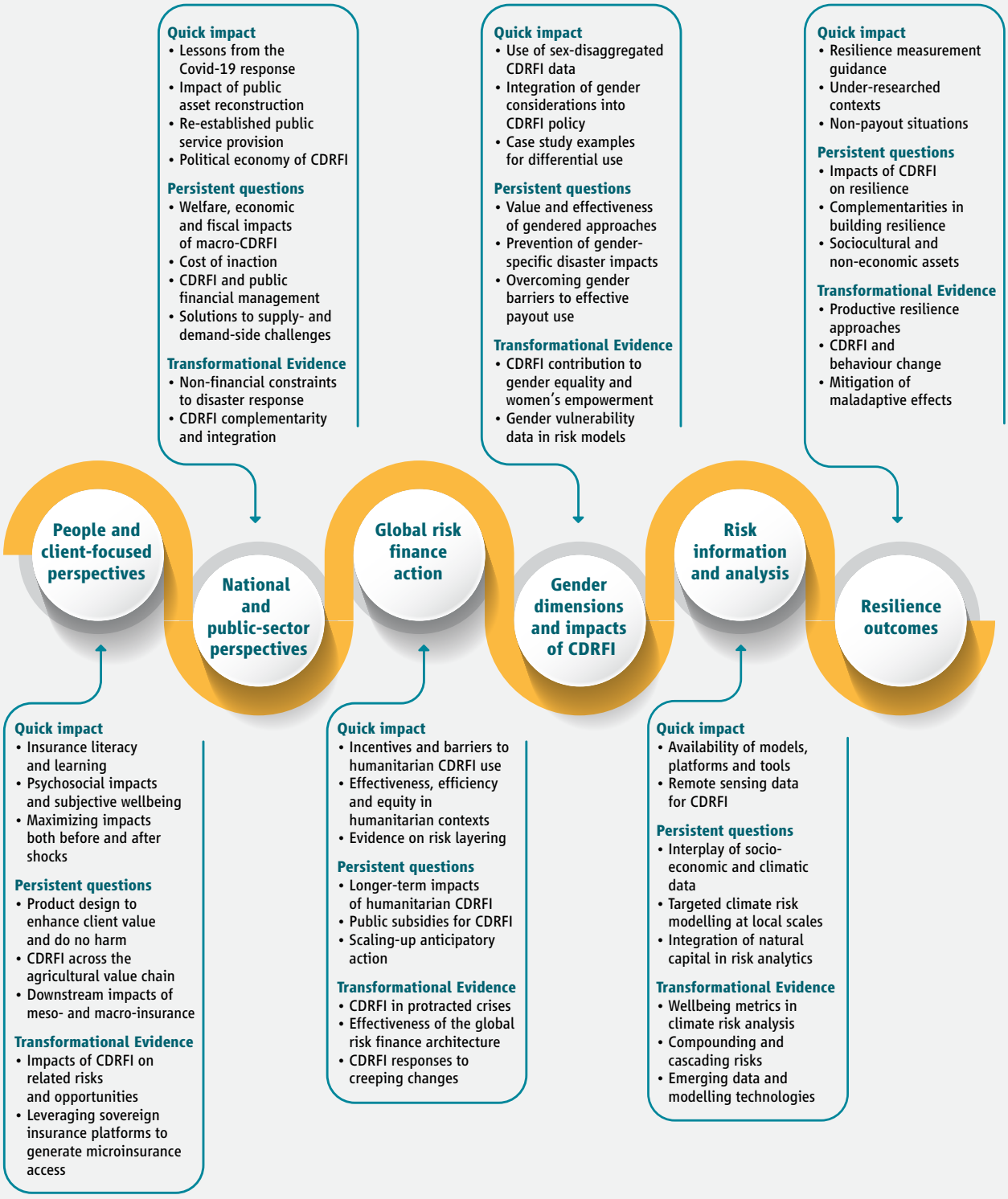
Each theme highlights eight to ten evidence priorities, two to four in each of three categories: 1) Quick Impact, 2) Persistent Questions and 3) Transformational Evidence depending on the timelines and transformational potential of the evidence priority. By focusing on these pressing evidence priorities, the CDRFI community intends to populate the evidence base, allowing for evidence-centred programming and decision-making at the micro-, meso-, and macro-level. This will be accomplished by analyzing evidence needs from three distinct perspectives (people and client focus, national and public-sector, and global risk finance), while also investing in cross-cutting evidence priorities (related to *Gender Dimensions and Impacts of CDRFI, Risk Information and Analysis,* and *Resilience Outcomes*). This will ultimately help to bring inclusive and resilience-strengthening solutions at all levels to scale.

Building on the evidence priorities in the six thematic areas, the CDRFI Evidence Roadmap also provides a framework that empowers the stakeholder community to move forward by a) suggesting collective evidence norms, actions and investments, and b) detailing the roles that various actors can play to further the CDRFI evidence story.

This roadmap is a strategic guide and a rallying cry for the broad CDRFI stakeholder community to shift its focus from innovation to learning. Working together as an evidence community, CDRFI stakeholders have an opportunity to build a future where evidence-based CDRFI solutions are logical and necessary components of policies and programmes designed to accelerate climate adaptation and strengthen the resilience of vulnerable countries, communities and people.

**Figure1**

## Evidence Priorities



# Introduction & Framing

By increasing the frequency and intensity of extreme weather events, climate change is exacerbating the negative impacts of natural hazards (Coronese et al. 2019). Natural hazards and extreme weather are destroying lives and livelihoods at an increasing rate, particularly in the Global South. Donor countries have moved to address these threats with a general increase in funding for climate finance and specifically for Climate and Disaster Risk Finance and Insurance (CDRFI). There has been an incredible amount of innovation in the CDRFI arena over the last fifteen to twenty years, as index-based weather (for agriculture) and livestock microinsurance products were piloted around the world. This work began in India, Malawi and Mongolia, and the first multi-country risk pool – CCRIF SPC (formerly the Caribbean Catastrophe Risk Insurance Facility) – was established in 2007. While the pace of innovation has only increased since the 2015 unveiling of the G7 InsuResilience Initiative on Climate Risk Insurance, these investments in innovation have often not been accompanied by adequate investments in learning and the sharing of lessons (Scott 2020).

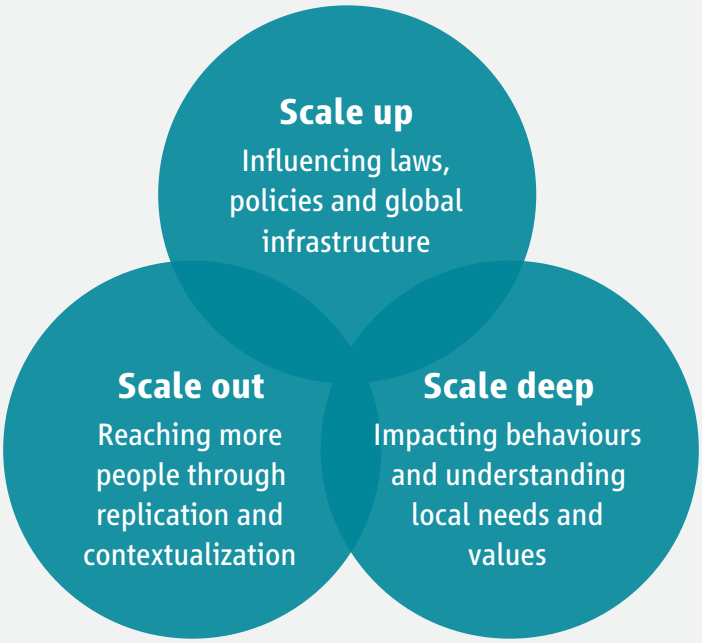
Facilitated by the InsuResilience Global Partnership, the CDRFI community drafted this Evidence Roadmap to shift the focus from innovation to evidence and learning. A focus on the evidence-based scaling of solutions is necessary for the CDRFI community to help strengthen the resilience of low-income and climate-vulnerable people to climate change and natural hazards globally. This roadmap builds on the InsuResilience Global Partnership's Pro-Poor Principles and addresses one of the main objectives of InsuResilience Vision 2025 – to increase the evidence base for CDRFI. The aim is to ensure inclusive and gender-responsive scaling.

The effective scaling of CDRFI solutions, as demonstrated in Figure 2, includes scaling up CDRFI by influencing laws, policies and global disaster risk-finance (DRF) infrastructure; scaling out to reach more people through the replication and contextualization of successful solutions; and scaling deep to impact behaviours and understand local needs and values (Moore et al. 2015). While increased resources are necessary for this scaling to be evidence-based and sustainable, it is

**Figure 2**

## Scaling out, scaling up, and scaling deep for CDRFI impact

(based on Moore et al. 2015)



critical that CDRFI donors, implementers, private-sector actors and researchers invest in, share and take note of evidence and knowledge.

Joint research and action enable the global CDRFI community to make evidence investments that generate quick impacts to improve the quality and cost-effectiveness of CDRFI initiatives. The community can also conduct the necessary research to address persistent challenges that have plagued CDRFI implementation over the past decade. This includes garnering public support for CDRFI solutions without undermining the creation and sustainability of private markets, alongside understanding the long-term impacts of CDRFI on resilience. It is even more exciting that by investing in evidence today CDRFI stakeholders have the opportunity to better understand and unleash the transformational potential of CDRFI to reshape the global humanitarian system– while also reducing vulnerability to climate change and natural hazards – and encouraging development gains and local investment in climate-exposed communities. These three categories of investment will be discussed below.

## From Innovation to Learning

The primary purpose of this CDRFI Evidence Roadmap is to move the focus of the CDRFI community from innovation to learning by highlighting CDRFI evidence priorities and strategically driving joint research action. The roadmap also serves as a tool for advocating increased and targeted donor investment in CDRFI evidence. In response to widespread interest within the CDRFI community and following a call for an increase in evidence under InsuResilience Vision 2025, the roadmap was developed as the result of a year-long participatory process, starting with a virtual workshop – hosted by the Munich Climate Insurance Initiative (MCII) in partnership with the InsuResilience Global Partnership – from 8 – 11 September 2020. The multi-day workshop focused on identifying CDRFI evidence frontiers, and brought together experts and practitioners from around the world. [3]

Building on the results of the workshop, members of the InsuResilience Global Partnership's Impact Working Group collaborated with stakeholders and other experts to identify evidence priorities and draft the roadmap document. This process builds on and incorporates output from the participatory process used by the InsuResilience Global Partnership to draft the Pro-Poor Principles of impact, quality, ownership, complementarity and equity.

### InsuResilience Vision 2025 and the CDRFI Evidence Roadmap

InsuResilience Vision 2025 is the core strategic document guiding the InsuResilience Global Partnership, laying out key result areas and specific goals. These goals are to be achieved through multiple 'pathways of change', described in the InsuResilience Theory of Change, and monitored using clear indicators.

The InsuResilience Vision 2025 Monitoring and Evaluation (M&E) framework tracks quantitative aspects of global CDRFI applications. To date, the M&E framework has not provided adequate information on the quality and impact of CDRFI coverage, especially the **'Development/Human impact'** result area. As a consequence, evidence for effective linkages between IGP outcomes and impacts remains incomplete. The priorities laid out in this Evidence Roadmap will support InsuResilience's understanding of the impact that CDRFI solutions in vulnerable countries exert on people's lives. Specifically, the Evidence Roadmap will contribute to the following:

- the identification of priority gap areas in which evidence is needed to assess and maximize CDRFI impact, outlining priority research questions that can feasibly be tackled by 2025, in support of InsuResilience Vision 2025
- the InsuResilience Vision 2025 M&E framework in outlining milestones that need to be tackled by 2025 in order to support Partnership actors in tracking, assessing and enhancing their impact
- a transformation from M&E to MEAL [4] (Monitoring, Evaluation, Accountability and Learning), facilitating improvements to CDRFI solutions.

At the same time, the Evidence Roadmap itself serves as a benchmark for **result area six under Vision 2025: Increase in Evidence'**. Indicators under this result area will track progress as evidence gaps start to be closed.

3 All workshop materials and the workshop report are available on the workshop webpage at https://climate-insurance.org/news/creating-a-cdrfi-evidence-roadmap/.

4 While many stakeholders use the M&E; monitoring, evaluation, and learning or MEL; and MEAL interchangeably, there is growing recognition of the importance not only of learning, but also of accountability in ensuring continuous programmatic improvement and cost-effectiveness of approaches. As such, the CDRFI Evidence Roadmap uses the concept of MEAL throughout.

## What Is CDRFI and When Is It Successful?

Disaster risk finance (DRF) refers to the set of tools available to manage the financial impacts of natural hazards. CDRFI refers to these same tools, while highlighting 1) increasing risk exposure due to climate change and 2) the inclusion of insurance as a tool in the DRF toolbox. These two terms are often used interchangeably. CDRFI products and solutions along with their underlying projects and activities often involve actors from a wide variety of industries and disciplines. National and local governments may identify the need or opportunity for CDRFI, perhaps in collaboration with multilateral organizations. Donors may provide funding for projects to pilot solutions and in many cases these are managed by non-governmental organizations or United Nations agencies. The project implementers carry out consultations with target consumers and local communities in order to understand needs and preferences. They may also hire climate data and remote sensing specialists or modelling agencies to develop indices which will be used to trigger the release of financing. Banks and insurers may provide risk expertise and financial services. They may also work with other private-sector entities to increase accessibility through a variety of distribution channels. At the same time, the government may be working with project implementers and civil society organizations to increase financial literacy and understanding of disaster risk management among the targeted communities. Local and international researchers drawn from a range of disciplinary perspectives may be involved in tailoring products or understanding the impact of the designed solution.

The CDRFI stakeholder set is undoubtedly vast and each individual or entity involved may have a different understanding of success (Panda and Surminski 2020). As a result, there is no consensus on what 'success' looks like: is it the amount paid out, is it the speed of payment and recovery, is it the insurance penetration and coverage, is it poverty reduction or insurance market development, the longevity of a solution or the amount being invested by funders? CDRFI solutions are used to fulfil various aims and objectives across differing domains, which influence the understanding of what the success of an insurance solution means and for whom.

CDRFI stakeholders set out this Evidence Roadmap at a time when there is both an increased mobilization of funding for innovative solutions and a greater focus on MEAL approaches. Consistent indicators and principles of success can ensure that positive impacts are improved across scales. While there are various existing principles that can inform the design of MEAL frameworks – such as pro-poor, cost-effectiveness,

risk-reduction potential and early financing – depending on varied settings, evidence on the impacts of these principles remains scarce, especially from the perspectives of demand and supply.

Short-term success of CDRFI might not lead to long-term resilience and it is important to analyze how CDRFI influences recovery from mild, moderate and extreme shocks. Solutions must incorporate performance and results-based MEAL to track progress and to demonstrate the impact and outcomes of a given project, product or policy so that clients, practitioners and other stakeholders are able to evaluate the success of CDRFI. Tracking progress requires continuous monitoring and developing outcome and impact pathway indicators for proper and desired monitoring of final success criteria. The time horizons involved stress the need to collect evidence over several years in order to be able to robustly point to the contribution that CDRFI can make towards its desired outcomes and impact.

Improving social, physical and financial resilience has become an important overarching goal in the context of CDRFI and it has emerged as a key development priority cited in global agreements such as the United Nations Paris Agreement and Agenda for Sustainable Development 2030. However, CDRFI stakeholders must move away from the traditional emphasis on output and outcome indicators as criteria for measuring success, to a greater focus on outcome and impact indicators for short and long-term resilience building.

Currently, CDRFI as a way to build resilience is applied at various scales ranging from micro products at the household level to regional pools at multi-country scale. However, practitioners may view success differently at various scales. While some CDRFI programmes focus on reducing risk and strengthening long-term risk management capacity, most CDRFI interventions are designed to deal with risks over a short time scale. These interventions do not necessarily help reduce risk or build capacity over a long period of time, especially considering the future impacts of climate change. Despite donor support for these activities, there is a lack of clear data collection requirements and reporting frameworks for CDRFI. Transparency is also lacking in terms of performance data from insurance solutions at the global, national or local level, with few insights beyond occasional reporting on the number insured or coverage levels. This makes tracking trends in the application of CDRFI difficult.

While there may be a variety of approaches to analyzing the success of CDRFI solutions, including those that incorporate demand-side, supply-side and resilience-strengthening perspectives, it is clear that – in addition to increased support for MEAL – achieving success will require clear articulation of the goals for each solution. These goals should be drafted through inclusive and gender-responsive processes that recognize how the priorities of various stakeholders may not be perfectly aligned. The active involvement of the private sector in the development of guidance for articulating solution goals would help to ensure that the goals are both feasible and representative of private-sector perspectives.

# State of the Evidence

While it is true that there is generally insufficient evidence to ensure the quality and impact of CDRFI, considerably more research has been carried out in some areas compared to others. Understanding the knowledge frontier and identifying critical evidence gaps constituted a key output of the CDRFI evidence workshop referred to above. More information is available in the workshop report and workshop evidence briefs. But what do CDRFI stakeholders really mean by 'evidence'?

## What Counts as Evidence?

There are two challenges when trying to understand the CDRFI evidence landscape. The first is that CDRFI crosses a number of sectoral and disciplinary boundaries. Evidence and knowledge are not therefore conveniently assembled in any individual journal or platform. In fact, even outside the CDRFI space there is surprisingly little evidence broadly (across fields) about effective evidence production (Oliver and Boaz 2019). The second challenge is that there is no consensus on what kind of evidence counts.

**The goal of this roadmap is to identify evidence priorities and inspire evidence action.** There is a need for replicable and robust, peer-reviewed knowledge to ensure that projects and solutions are evidence-based, not only for the sake of accountability for taxpayer resources but also due to the ethical imperative to use limited climate, humanitarian and DRF resources as cost-effectively as possible. However, this focus on robustness and quality should not perpetuate disciplinary hierarchies or sideline the voices of experts from the Global South. Nor should a focus on rigorous science ignore indigenous knowledge, community perspectives and people's lived experiences. Rather, it should highlight the need for qualitative knowledge creation that complements the generation of robust quantitative evidence. Similarly, the community must identify processes to capture the experiential knowledge acquired through years of implementation experience across the stakeholder community.

There is also a risk of only capturing positive evidence and only learning from successes. The CDRFI evidence community must commit to learning and sharing lessons from failures, both the dramatic breakdowns and also the anticlimactic fizzling out of products and projects. Reimagining what counts as robust research, learning across disciplines, focusing on local voices and expertise, and learning-by-doing and from learning-by-failing will enable the global CDRFI community to generate and elevate the knowledge it needs to improve CDRFI activities today. This will also help it to build towards the transformational potential of CDRFI tomorrow.

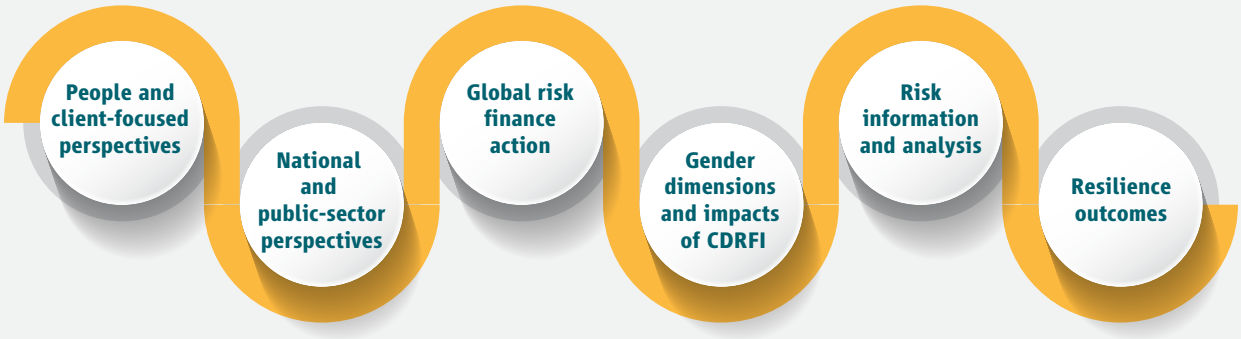
## Evidence Areas

All of the CDRFI stakeholders discussed in the roadmap are evidence actors. The various roles these actors can take to further the CDRFI evidence frontier will be discussed below in the Evidence Framework. In order to ensure cost-effective and impactful CDRFI, the roadmap lays out evidence priorities across six themes, as illustrated in Figure 3:

1. people and client focused perspectives;
2. national and public sector perspectives;
3. global risk finance action;
4. gender dimensions and impacts of CDRFI;
5. risk information and analysis;
6. resilience outcomes.

**Figure 3**

## Evidence themes



The last three themes are more cross-cutting in nature, with evidence priorities that may influence work that could be seen from all three perspectives. The Gender Dimensions and Impacts of CDRFI theme is aimed at actors involved in research and action at all levels and will focus on the evidence priorities for understanding the heterogeneous impacts and improving the equity of CDRFI solutions. The Risk Information and Analysis theme is aimed at actors involved in financing or implementing data collection and model creation and will focus on the evidence priorities for improving the quality of CDRFI products. Lastly, the Resilience Outcomes theme is aimed at actors involved in research and action at all levels and will focus on the evidence priorities for resilience measurement and for understanding and improving the climate resilience and adaptation impacts of CDRFI products.

Each theme highlights two to four evidence priorities in each of three categories:

1. Quick Impact
2. Persistent Questions
3. Transformational Evidence.

As shown in Figure 4, the Quick Impact category highlights specific or focused research and evidence questions that would respond to a specific knowledge gap and are expected to generate immediate impacts. Evidence priorities within the Persistent Questions category focus on research or evidence activities that tackle systemic, long-standing or robustness challenges and evidence gaps. The Transformational Evidence category calls attention to research or evidence activities that require long-term collaboration or special interdisciplinary participation. They have the potential to reconfigure or disrupt current practice in ways that will lead to transformational increases in the impact or effectiveness of CDRFI.

**Figure 4**

## Evidence categories

# Evidence Priorities

The Evidence Roadmap is a community document drafted by members of the CDRFI community – with the support of the InsuResilience Impact Working Group – for the CDRFI community and stakeholders. However, the evidence priorities described in this chapter were written by experts in the field who are familiar with the literature and aware of the evidence frontier related to their specific theme.

The authors have built on and synthesized the existing literature and also carried out extensive consultations as part of the priority-setting and drafting process. Those experts who provided input to these priorities are mentioned in the Acknowledgements section at the end of the document. These priorities were then shared and discussed with the Impact Working Group to ensure community support for all 43 evidence priorities. As described above, each of these evidence areas includes priorities for each of the three identified categories: Quick Impact, Persistent Questions and Transformational Evidence.

## People and Client-focused Perspectives

Authors: Michael Carter and Tara Chiu[3]

### Problem framing and definition

There is ample evidence that uninsured risk 'distorts' behaviour, driving households to engage in high-cost coping strategies that compromise future wellbeing after a shock occurs. Promising CDRFI solutions such as agricultural index insurance have emerged to overcome barriers to traditional models of insurance and increase access to this high-potential risk management tool. Research in agricultural contexts has demonstrated that these DRF solutions provide dual benefits through both the improved ability of farmers to cope should a disaster occur (Janzen and Carter 2019, and Jensen et al. 2017), as well as to take productive investment risks in the absence of any disaster (Cai 2016, Elabed and Carter 2014, Jensen et al. 2017, Karlan et al. 2014, Mobarak and Rosenzweig 2014, Stoeffler et al. 2020).

Although CDRFI has high potential, it also holds a number of pitfalls. The intrinsic characteristics of insurance create barriers to generating learning and trust. Firstly, because quality is a hidden trait since households, farmers and small enterprises cannot discern the quality of the protection provided simply by examining the contract. Alternative approaches to learning are therefore required and these should ideally encompass experiential learning. Secondly, learning through experience about products such as insurance that offer infrequent (stochastic) benefits is made more difficult as it may take years to gain understanding and confidence in a new technology, implying that demand will emerge very slowly, a problem that is even more severe for index insurance (Cai, de Janvry and Sadoulet 2020). In addition, any experience with or observations of low-quality products further impedes efforts to stimulate sustained adoption. While a growing body of evidence has identified myriad barriers to sustained adoption of CDRFI solutions, more evidence is required to inform design and test solutions with a view to overcoming these barriers.

Furthermore, the potential benefits of DRF tools are conditional on high-quality product design. Rapidly evolving technological advances continue to provide new opportunities to increase product value, including innovations in remote sensing (Benami et al. 2021) and digital technologies (Benami and Carter 2021). Despite these new resources,

3 Feed the Future Innovation Lab for Markets, Risk and Resilience, the University of California, Davis

low-quality products that fail clients persist by not providing compensation when payment is warranted and most needed (index design failure),and providing payouts too late to offer meaningful protection (implementation failure). Innovative solutions are necessary in order to ensure that products provide value and 'do no harm' to the people they are meant to benefit. Achieving this goal requires more evidence to design and test applications of these advances to CDRFI solutions.

Finally, as the global community increasingly considers macro- (including sovereign) and meso-level products, there is a lack of clarity as to whether these interventions provide value for people and clients. Assessing the impacts of DRF schemes at sovereign levels does not absolve the global community from the need to evaluate the impacts of these schemes at the individual and household level. Additional concerns persist that the layering of macro- and micro-level disaster risk interventions may 'crowd out' the market for commercial microinsurance. A key challenge remains on how to make such layered risk management interventions work more effectively for people when combined rather than each in isolation.

### Quick Impact

*Can products be made more attractive by better understanding and incorporating the approach people take to processing information and prioritizing outcomes, and, in turn, how does that impact demand?*

Research has identified possible approaches to overcoming persistent barriers to the development of insurance literacy and learning, often with conflicting results. Evidence on the role of social networks in influencing insurance decisions is mixed, with some suggesting peers may serve as an information input for decision-making (Cai et al. 2015 2020, Ward et al. 2019) while others find no evidence of learning from peers (Takahashi et al. 2020). Similarly, some studies found that experimental games can stimulate demand (Vasilaky et al. 2020, Cai and Song 2017), while others have found no effect (Janzen et al. 2021, Lybbert et al. 2010). Short-term 'smart' insurance subsidies may induce learning through experimentation (Cai et al. 2021) without obstructing future willingness to pay commercial prices (Takahashi et al. 2020).

Evidence also reveals numerous behavioural factors related to information processing and decision-making on insurance such as certainty preferences (Serfillipi et al. 2020, Elabed and Carter 2015) and individual risk preferences and subjective beliefs about risk exposure (Harrison and Ng 2016). Innovative approaches are required to leverage understanding of learning and decision-making processes to increase demand and uptake. However, it is critical to note that purchase of insurance alone may not improve (and may indeed worsen) welfare (Harrison et al. 2020, Carter and Steinmetz 2018), in particular if a contract fails to trigger indemnity payments when justified and desperately needed.

*What impacts (if any) do CDRFI interventions have on psycho-social factors and subjective wellbeing of people and clients, and what are the secondary impacts of any such changes?*

Research shows that agricultural insurance can provide 'peace of mind' to clients (Tafere et al. 2019), though impacts of insurance on other psychosocial indicators and subjective wellbeing remain limited. For example, evidence suggests that factors such as time horizons (Laajaj 2018) and aspirations (Lybbert and Wydick 2018) can stifle investments in the future. However, further evidence is required to determine if and how DRF affects psychosocial impacts such as these. Additional issues are whether this corresponds with increased investment and with other indicators associated with wellbeing (such as health outcomes or educational attainment). The extent to which this is relevant is a further concern.

*How do you structure CDRFI solutions in a way that maximizes people's ability to form adaptive decisions and behaviours before and after shocks occur?*

Disaster risk finance helps families to cope when shocks occur and can also enable investment in times when there are no shocks. However, this latter benefit is conditional on the insured being aware of the protection and that it is reliable and predictable if a shock does occur. Maximizing the potential benefits of DRF necessitates the provision of effective communication of the benefits that can be expected and when they will be delivered. Furthermore, maximizing households' ability to increase their resilience through DRF whenever possible means that risk management instruments should be linked to high-potential productive opportunities. For example, a paper by Carter et al. (2016) provides a theoretical analysis of where index insurance may be most effective as an interlinked product with credit as a standalone product. More research including pilot and testing is needed to identify such 'sweet spots' where effective financial risk protection can be coupled with productive technologies or opportunities to maximize product impacts.

### Persistent Questions

*What can be done to ensure that products being sold to people actually provide value for clients and do no harm (especially relating to index design but also with reference to non-technical components of products such as payout timing)? How do such assurances affect both supply and demand for high-value products?*

Quality product design is integral to achieving the potential of CDRFI. New innovations to increase value, such as an audit rule and dual triggers, help to overcome the challenges associated with basis risk (Carter et al. 2017) and these initiatives continue to be designed and tested. More research is required to discover what other product attributes people value and how people process product information. Evidence has yielded some information on client preferences for product attributes, including the (appropriately) stymieing effects of basis risk on demand (Ward and Makhija 2018, Janzen et al. 2021) and preferences for timely indemnity payouts over heavily subsidized premiums (Gosh et al. 2020). This area warrants further investigation to establish whether there are additional product characteristics that can be made more responsive to client priorities (such as trigger levels and payout frequency relative to indemnity amounts).

Emerging research indicates that "selling index insurance as a single, one-size-fits-all policy seems to be misguided" (Ceballos and Robles 2020). Bundling insurance with other complementary tools – both financial and agronomic – is a promising area for continued innovation. For example, current research suggests that stress-tolerant agricultural technologies (Lybbert and Carter 2015, Boucher et al. 2019, Ward et al. 2020) offer complementarities with insurance for better management of a farmer's risk profile in tandem. Additional research is needed to test the effectiveness of integrating a variety of financial, agronomic and other tools to allow households to create a flexible risk management portfolio that can evolve and change with their own needs and capabilities.

*What interventions can provide effective DRF for other actors across the agricultural value chain – both upstream and downstream? For example, can interventions be designed to address the risks of SMEs, agro-dealers and/or labourers?*

Climate shocks are not only shocks to those smallholder farmers directly impacted but to other livelihoods and enterprises across the value chain such as small enterprises, agro-input dealers, labourers and other actors. However little evidence exists on 1) how existing microinsurance products impact others in the value chain (if at all) and 2) if and how DRF can be provided directly to these other vulnerable populations. This challenge also extends to the use of index insurance to protect non-agricultural businesses. If such products can be developed, can the associated improved risk management solutions across the value chain create more resilient households and more resilient businesses and markets?

*Do meso-level (and sovereign-level) models of insurance have positive downstream welfare impacts for people and clients, and are there differential impacts on subpopulations (for example, certain livelihoods or income levels, or by gender)?*

New innovations continue to emerge in support of meso- (financial institutions, local government, etc.) and macro-level (including sovereign) CDRFI products, however the downstream impacts of these investments on people and clients remain unclear. While meso- and macro-level products can provide relief when extreme shocks occur, they may not effectively provide or communicate predictable and reliable benefits, which in turn stifles the individual-level ex-ante effects of disaster risk planning. Research is needed to design and test approaches for the enablement of all CDRFI products (micro-, meso-, and macro-level products) and the generation of dual benefits of risk management for households. In addition, limited evidence exists on whether meso- and macro-level products change medium and long-term institutional behaviour (such as collateral requirements, interest rates, etc.).

### Transformational Evidence

*What (if any) are the impacts of micro- and meso-level insurance and DRF on the related risks people face, in particular in relation to conflict and competition for resources in resource-scarce environments? What are the implications of any such impacts and how can those impacts be leveraged (if positive) or mitigated (if negative)?*

Insurance and other risk management tools affect household behaviour in ways that may indirectly impact related risks and/or opportunities. For example, while some work has indicated a potential trade-off between formal insurance and informal risk management strategies (Mobarak and Rosenzweig 2013), impacts on myriad other informal risk management approaches or self-insurance strategies (such as maintaining large herd sizes or approaches to income diversification such as migration) remain unclear. The impacts of insurance on collective natural resource management within and across communities, either through formal or informal arrangements, also remain uncertain.

The potential link between climate change, disaster risk and conflict, particularly relating to the use of natural resources, is an increasingly urgent concern. However, the role that formal insurance may play in resource scarcity or resource abundance and the associated impacts relating to conflict (if any) remains unclear. Insurance may reduce conflict in pastoral regions by bringing down reliance on large herd sizes as a kind of self-insurance and this could in turn lead to falling competition for scarce natural resources and thereby cut down conflict. On the other hand, insurance could lead to an increase in herd sizes because the presence of insurance makes holding the additional asset less 'risky' and this could further strain resources and relationships, and potentially increase vulnerability to conflict.

Greater understanding of the secondary impacts of DRF is required in order to leverage and further foster positive secondary impacts while mitigating the negative effects.

*How can microinsurance be effectively designed/integrated into the same platform as sovereign insurance mechanisms in order to maximize impacts for clients? How can such an integrated platform enhance access to and demand for microinsurance?*

Technical assistance tied to sovereign insurance programmes is often used to develop infrastructures for distributing benefits to downstream beneficiaries. These strategies create the potential for the infrastructures and platforms to be integrated with microinsurance so as to increase household access to products and reduce transaction costs for the insurance provider and for the client. This integration of sovereign insurance and microinsurance could increase client value for microinsurance, such as through improved timeliness of payouts. However, little work has been done yet to assess the potential for such an integrated approach – in relation to the commercial sustainability of microinsurance and in relation to household-level impacts of such integrated approaches.

Since sovereign insurance is increasingly being promoted as an innovative approach to disaster risk management, additional attention needs to be devoted to this issue in order to establish how such schemes could be structured in a way that complements rather than 'crowds out' microinsurance. Research is needed to determine how to structure sovereign insurance in a way that protects downstream beneficiaries without disincentivizing individual investments in disaster risk management tools and perhaps even promotes 'top up' purchases of microinsurance to complement any national disaster response strategies.[4]

## Summary/Conclusion

The path forward for DRF requires paying meticulous attention to potential pitfalls in order to generate the full potential impacts on people and clients. Product quality and client value remain under-examined, impeding the positive impacts that high-quality CDRFI can have on people and households. Future design and testing of CDRFI solutions warrant standardization of conceptually sound measures concerning quality and value, and consistent application of these measures. There have been a number of different approaches to measuring the quality and effectiveness of agricultural insurance in managing risk (Carter and Steinmetz 2018, Benami et al. 2021, Morsink et al. 2016, Stoeffler et al. 2016, Shirsath et al. 2019, Harrison et al. 2020). These approaches can be applied taking into account a multitude of quality factors valued by potential clients, including index accuracy, cost and timeliness of payments (Jensen et al. 2019). In addition, measurements of 'success' must evolve; the purchase of insurance alone cannot serve as a proxy for more sophisticated measures of resilience and wellbeing.

Finally, many of the potential impacts of disaster risk management on households require commitments to long-term research enterprises to 1) detect effects that are slow to emerge and 2) determine the durability of impacts of CDRFI solutions. Principally due to the funding cycles and accountability of donors and NGOs, it is typically not feasible to fund long-term research that allows for downstream confirmation of expected impacts, such as on health, nutrition, educational attainment, credit access, interest rates, rates of transient poverty, etc. This situation is further exacerbated since disaster insurance can only rarely demonstrate its true value despite donor expectations of more timely results. This can, in turn, lead to project dissolution before the full benefits are realized or even long before payouts occur. Long-term research commitments are critical to generating evidence on the benefits that truly accrue to households and the period for which these benefits endure.

4 Note that the complementarity of CDRFI approaches is highlighted as an evidence priority in the following theme.

# National and Public-sector Perspectives

Authors: Marcela Tarazona[5], Lena Weingärtner[6] and Valentina Ramirez[7]

## Problem Framing and Definition

Recent revisions of the literature (Hill et al. 2021) have revealed that there is stronger evidence on the impact of interventions which increase the ability to prearrange finance for a disaster at the household level than there is on the benefits of prearranging finance for public disaster response. Such evidence would be pivotal in detecting how CDRFI instruments can unlock a deeper transformation, i.e. how such tools/instruments evolve by considering the Political Economy complexities underpinning risk management. This could enhance tools for crisis outlook.

Moreover, expanding evidence on national and public-sector CDRFI responses can be crucial to influencing its prioritization within the political agenda. Greater evidence could elucidate the important and unexpected effects of CDRFI. By locating itself in a highly influential arena, public-policy design may be influencing the way citizens and companies think about risk management. Private actors learning about how policymakers are designing CDRFI strategies at the national level might bring these lessons into their own domains. If evidence confirmed such a link, it could be turned into an argument for greater visibility of CDRFI initiatives at the national level. Increased awareness is also an initial step to address the ways policymakers can help to solve problems associated with design and access.

This theme is aimed at actors involved in macro-level CDRFI products and policies, as well as national micro- and meso-schemes. It is concerned with the research questions where there is greater urgency for evidence if the CDRFI community is to increase understanding, ownership, complementarity, and equity of CDRFI products and policies at the national level.

## Quick Impact

*What lessons can be learned from the response to the Covid-19 crisis? In terms of funding mobilization (money in) and getting the money to the right people (money out)?*

The Covid-19 crisis has been a humbling systemic event providing fertile territory for policy reflection and learning. Focused research on lessons from the Covid-19 response, in terms of funding mobilization (money in) and getting money to the right people (money out) would be of great value. Evidence of this nature would be especially welcomed if it addressed how these responses can enhance the desired characteristics of pre-agreed finance in ways that would make it more impactful (i.e. poverty reduction, value for money, timely, trusted guarantee, empowering, aligned with the bigger picture). Furthermore, the Covid-19 crisis can also be seen as a natural experiment[8] providing evidence on cascading and compounding risks, related diseases and shocks.

*What is the impact of using pre-agreed finance for disaster reconstruction of public assets? What is the long-term social and economic impact of post-disaster reconstruction programmes, which would inform work on building back better?*

More evaluations would be helpful in clarifying the impact of using pre-agreed finance for disaster reconstruction of public assets and in understanding the long-term social and economic impact of post-disaster reconstruction programmes. To date, the benefit of prearranged financing on fiscal budgets is still not well understood, owing in part to the lack of data and the difficulty of identifying costs associated with disasters and ex-post rebuilding needs (World Bank Group 2021a). In order to address this evidence priority, studies would therefore also need to look at quantifying contingent liabilities and at the different factors that are decisive for a faster recovery. In other words it is necessary to identify any other conditions on public regulation and procedures, procurement processes etc. that are essential for a timely

5 Genesis Analytics
6 ODI
7 Genesis Analytics
8 "Natural experiments" are events arising naturally or otherwise serendipitously that provide random treatment without the creation of an experiment by researchers (Rosenzweig & Wolpin 2000).

use of CDRFI payouts. These evidence-based studies are key for informing work on strategies to build back better at the national level. For example, building the case for regulation requiring all post-event insured repairs to be conducted with a climate-resilient future in mind.

*What is the impact of maintaining or re-establishing the provision of public services quickly after a disaster? Is there evidence that public asset insurance improves the speed at which services are re-established?*

Evidence to understand the importance of speed and anticipatory action, will provide researchers and development practitioners with schemes aimed at benefiting the most vulnerable. Specifically, it is critical to understand the impact of maintaining or re-establishing the provision of public services quickly after a disaster. Is there evidence that public asset insurance improves the speed at which services are re-established? Does early or anticipatory action lead to cost savings and if this is the case, how can these be quantified? Evidence around these issues could also inform policymakers on the scope and reach of anticipatory action in fragile and conflict-affected states. Related findings could inform regulators in relation to if and how anticipatory action strategies should be introduced as a 'hard nudge' for private actors (especially regarding essential services industries), or for regional governments and/or state-owned companies.

*What is the political economy of CDRFI?*

A great deal of action around CDRFI at the national level ultimately depends on the willingness and capacity of national governments. Political Economy Analysis (PEA) involves looking at the dynamic interaction between structures, institutions and actors to understand how decisions are made. Evidence-based research that applies PEA to the way aid is funded and administered through interventions and institutions would be of great value in identifying the barriers that must be overcome by national governments. Ideally, such studies would clarify the incentives for governments and shed light on the factors that can be modified/changed or where it is simply better to acknowledge and accommodate.

### Persistent Questions

*What is the impact of support provided with pre-arranged finance for governments? What are the welfare, economic and fiscal stability impacts of macro-level CDRFI instruments?*

CDRFI provides financial support in times of remarkable need and enhances the disaster relief that governments make available to affected populations. A crucial persistent question that remains entirely unanswered is the impact of support delivered with prearranged finance for governments. Similarly, more evidence is needed on the timing of support given to households. Generally speaking, CDRFI stakeholders need additional evidence on the welfare, economic and fiscal stability impacts of macro-level CDRFI instruments.

*What is the cost of inaction?*

Another promising area of research would address an important evidence gap. This is related to calculating the cost of inaction and the cost of not having financial protection in place. CDRFI professionals tend to refer to the opportunity cost of resources allocated to CDRFI instruments but this has not yet been quantified. This evidence has the potential to provide a stronger rationale for the need to deploy sovereign CDRFI instruments beyond the widely understood

requirement for immediate liquidity in times of spectacular need and the understanding of risk financing as contingent liabilities on public financial management. Moreover, putting forward such a rationale could significantly help to improve communication of CDRFI strategies through the prism of public financial management.

Adam and Bevan (2020) use a general equilibrium model to examine the effects of natural disasters and alternative reconstruction paths. They found that post-financing through taxation is preferable but they also noted that in certain circumstances insurance is better than ex-post budget reallocations. On the other hand, evidence gathered at a macro-level indicates that apart from huge disasters it is better to use debt rather than insurance as a strategy for financing disaster response at a national level. Further evidence is needed around macro-assumptions behind such evaluations and assessments on governmental alternatives to CDRFI. For example, Adam and Bevan are not accounting for estimates relating to the opportunity cost of budget reallocations.

*How to better incorporate CDRFI and public financial management?*

The management of contingent disaster liabilities remains a deep-rooted challenge. This relates to insufficient incentives and constraints in the public financial management (PFM) capacity required for systematic consideration of potential future costs (Allen and Paterson 2019). After all, insurance and contingent liability concepts can be relatively complex since they deal with probabilities and intertemporal decision-making. Addressing the ways in which the capacity gap in PFM could be closed remains a persistent question and one that has multiple layers. Firstly, it is important to increase recognition of PFM and its interaction with CDRFI for disaster response. Effective integration of CDRFI into PFM systems demonstrates the government's commitment and ownership. This facilitates further scaling-up of solutions by influencing the law, policies, processes and rules. In parallel, evidence-based research on how to best increase the understanding of CDRFI across actors at the national level is needed. Lastly, evidence remains key to elucidating how to overcome both the lack of demand and supply-side challenges traditionally encountered for CDRFI instruments. Issues around knowledge and the capacity needs referred to above might be part of the proposed solutions.

*How can the CDRFI community overcome the lack of demand and supply-side challenges traditionally encountered for CDRFI instruments? How can the understanding of CDRFI be increased for national level actors?*

A considerable amount of attention has been devoted to developing and understanding CDRFI products. Yet, collecting rigorous evidence on the benefits of these products for governments is of paramount importance so as to ensure sustainability. Strengthening national disaster management systems rather than studying initiatives in disconnected silos is critical to avoid exacerbating inequalities. In order to foster connection and communication, investigation of the most effective strategies is essential in order to increase government and private-sector engagement. We need to establish how to get all the actors on board for adaptation planning, while also taking account of the efforts that the country is making to reduce national emissions and adapt to the impacts of climate change through successive nationally determined contributions. It is important to inform regulators so as to facilitate action across actors in a way that is consistent and expands their intentions beyond the efficiency-only motive. This would also shed light on how flexible institutions are to change in order to accommodate CDRFI recommended practices and if they are not, how they should adapt. The CDRFI toolkit is much more than just insurance. Perspectives on budgetary mechanisms and their flexibility/efficiency are a crucial part of the conversation.

### Transformational Evidence

*What are the non-financial constraints on effective disaster response which would allow CDRFI to be more impactful? For instance, what is the nature of the social contract, how can adequate information systems be put in place so as to inform decision-making (who to target, where to rebuild)?*

The powerful ability of the 'rational man', characterized by an 'infinite ability' to make rational decisions, has long been contested with the idea of bounded rationality, which accounts for the fact that humans have cognitive limitations and constraining structures in the environment (Gigerenzer and Selten 2002). This debate is of great relevance to CDRFI, and one where long-term interdisciplinary research is welcomed, as it is vital to acknowledge the biases that humans exhibit as constraining factors for effective CDRFI action. For example, a behavioural science perspective on CDRFI could provide a comprehensive toolset to understand the reasons behind human action by testing theories from various disciplines such as economics, psychology, neuroscience and sociology. There is no such thing as perfectly rational policymakers with complete access to relevant information who are able to make a financial calculation and implement the most appropriate CDRFI tool. More research is therefore needed in order to gain a profound

understanding of the non-financial constraints on effective disaster response and thereby enable CDRFI to be more impactful. Beyond the reasons for human action referred to above, questions around the nature of the social contract or how to ensure adequate information systems to inform decision-making (who to target, where to rebuild, etc.) are extremely relevant for smarter allocation of efforts.

*How to ensure the complementarity and integration of CDRFI instruments for national governments from a government perspective? How to incorporate protection of the most vulnerable into the design of CDRFI risk-layered approaches, insurance contracts and public-private partnerships (PPPs), rather than only focusing on the optimization of financial effectiveness?*

If we are to foster consistency within national and public-sector CDRFI action, more research is needed to discover ways of ensuring the complementarity and integration of CDRFI instruments into national governments plans and strategies. Evidence is also needed on the key factors determining what an optimum CDRFI portfolio looks like and which criteria (including economic and non-economic factors) are the most critical. This relates to a cost-effective allocation of different CDRFI instruments to various layers of risk (high-frequency and low-severity versus low-frequency and high-severity), avoiding gaps and overlaps in protection. More clarity is also needed on which delivery-channel design parameters permit effective assistance to be provided for the people who are most vulnerable but typically also hardest to reach, and on how to balance flexibility in allocating payouts with a pro-poor focus.

## Summary/Conclusion

More evidence-based research is needed to learn how to close capacity gaps in policymaking and to better understand how policy responses to climate and disaster risk can enhance the desired characteristics of CDRFI with the aim of making it more impactful. This knowledge is key to continuing to advance CDRFI prioritization in the political agenda. Questions relating to communication between policymakers and all remaining actors, and the best way of incorporating complementary concerns beyond financial efficiency would foster coherence among public financial management strategies. Lastly, complementary knowledge from multiple disciplines would create an understanding of the constraining factors holding back effective CDRFI action and allow actors to allocate efforts in a way that is smarter.

It is a gratifying fact that the risk-modelling sector and the insurance market have been playing an increasingly active role in fostering tools and ideas around CDRFI. However, to ensure sustainability it is crucial for both fields to maintain a vision directed towards strengthening national systems rather than providing disconnected initiatives that could potentially result in exacerbating inequalities.

# Global Risk Finance Action

Authors: Lena Weingärtner[9] and Marcela Tarazona[10]

## Problem Framing and Definition

Ongoing challenges with the global response to crises and the way these responses have been funded are well documented. Crisis response is often ad hoc and late, humanitarian funding can be unreliable if not arranged in advance and emergencies receiving less political or media attention tend to be underfunded. The current global system remains focused on response rather than anticipation (Clarke and Dercon 2016).

9 ODI
10 Genesis Analytics

Recognition of these issues has contributed to a push for a transformational shift in crisis response systems towards pre-agreed funding and more timely action. This includes the ability to act ahead of a disaster in order to avoid or reduce expected impacts (Scott and Clarke 2021). Linked to this are expectations that CDRFI integrated with humanitarian action would contribute to the reliability, coordination and speed of funding, increased transparency and accountability to act, and ultimately to save lives and protect livelihoods (Harris and Jaime 2019, Montier et al. 2019). More evidence about the impacts of CDRFI on humanitarian outcomes and operations might help governments and agencies to increase the efficiency of the humanitarian system and better protect those people most vulnerable to disasters.

The impacts of climate extremes, more frequent and intense as a result of climate change, have meant that CDRFI has also been viewed as a way to support climate change adaptation (Jarzabkowski et al. 2019), and to help reduce and mitigate loss and damage (Linnerooth-Bayer et al. 2018). However, the relationship between CDRFI and climate change is complex. The types of CDRFI products or approaches that might be relevant and sustainable in the long run, in light of a changing climate and other intersecting threats such as conflict or pandemics, remains a challenging question for the global community.

This theme is aimed at actors from the global community engaging in multiple countries through humanitarian assistance or climate finance, as well as those engaged in supporting or rethinking the global risk finance infrastructure. It focuses on the evidence priorities for understanding and increasing the impact of humanitarian response and global climate finance support, along with the complementarity of various CDRFI products and international structures.

### Quick Impact

*What are the incentives and barriers (institutional, capacity, regulatory, behavioural, etc.) to the use of CDRFI instruments and thinking in humanitarian action, and what can be learned from experiences where these barriers have been overcome?*

There are already practical experiences of collaboration across humanitarian and development organizations, governments, the private sector and academia around CDRFI, for instance with the African Risk Capacity's (ARC) Replica option in West Africa[11], or a recently placed catastrophe bond covering ten volcanoes across three continents[12]. Yet, in other cases, different actors are still figuring out whether and how to best work together on CDRFI. They are aiming to discover how approaches and initiatives can be coordinated and aligned, for instance at national level or across an organization. This is particularly relevant in contexts where a multitude of actors, including national governments, multilateral institutions, humanitarian agencies, civil society, bilateral donors, private companies and others engage with CDRFI in different ways.

A better understanding of the political economy of CDRFI in the context of humanitarian action, including unpacking interests, incentives and barriers for collaboration, for instance using Political Economy Analysis (PEA), would help identify practical ways for risk-financing expertise to support anticipatory action and response. This would also identify where there are limitations. Such an analysis would need to look at a number of factors. They include the different objectives and interests of humanitarian, development and private-sector actors, and the question of how these requirements can be met in joint initiatives. Further factors relate to questions of power and agenda setting on CDRFI and humanitarian aid across global, national and local levels, and questions of alignment of CDRFI with humanitarian principles. There is also an issue of how to work with products that were initially developed on the basis of metrics focused on profit rather than on humanitarian outcomes.

Examples of existing collaborations, for instance in the form of case studies, should provide valuable insights into how barriers to collaboration have been overcome, and what the role of CDRFI might be in relation to humanitarian action in the medium to longer-term.

*To what extent does CDRFI improve the effectiveness, efficiency and equity of humanitarian operations?*

Interest from humanitarian donors and organizations to apply CDRFI approaches has been linked to the expectation that CDRFI could help increase the cost-effectiveness of humanitarian response in order to maximize outcomes from limited humanitarian funding. This may happen where the different building blocks and principles of CDRFI are integrated with humanitarian operations, i.e. through pre-positioned financing and risk layering, contingency plans for the disbursement and delivery of funds, data and analytics, and the timeliness of funding (Harris and Swift 2019,

11 https://www.africanriskcapacity.org/product/arc-replica/
12 https://catbond.org/

World Bank Group 2018). A number of studies have already modelled the potential cost-effectiveness gains that could be achieved through an earlier humanitarian response compared to a late one (Cabot Venton 2018, 2013), which could be facilitated through CDRFI.

However, there are still many operational questions and challenges around the influence CDRFI may have on humanitarian operations more broadly and for anticipatory action in particular. These include whether the pre-planning element of CDRFI improves coordination within and beyond the sector, and whether this is ultimately beneficial in terms of efficiency and coverage of response operations, or whether and how CDRFI mechanisms can manage disbursements at short lead times. Shedding light on whether and how humanitarian operations have been able to benefit from CDRFI solutions and expertise to enhance the effectiveness, efficiency and equity of their funds would be critical to guide investments and enable humanitarian donors and implementers to achieve greater impact.

*Are governments and humanitarian agencies using risk-layering approaches and if not, why not? Has risk layering been cost-effective in cases where the approach is being used?*

Risk layering is the notion that a combination of different financing instruments can provide comprehensive coverage against events of different frequency and magnitude over time and for different populations. It is widely used as a principle and a conceptual framework for CDRFI, especially at sovereign level. However, in practice many countries are not applying a risk-layering approach. Out of those eligible for ARC, CCRIF and the Pacific Catastrophe Risk Insurance Company (PCRIC), fewer than a third use more than one instrument out of the following three: reserve funds, contingent credit and insurance (Martinez-Diaz et al. 2019). Humanitarian funds and financing facilities are in turn starting to look at concepts of risk layering as they expand their engagement with CDRFI. The reasons that prevent countries from using risk layering will therefore be critical for more detailed assessment necessary to determine the practical applicability, limitations and opportunities of the approach in different contexts.

While a few studies using scenario analysis and modelling have found risk layering (of CDRFI instruments and in some cases in combination with disaster risk management measures) to be cost-effective, it is important to further implement and analyze the approach in practice. Relatedly, additional robust evidence on the cost-effectiveness of risk layering is needed from empirical evaluations in order to establish the transferability of findings across countries and to judge whether the approach should be pursued and supported by countries that do not currently apply it (Global Risk Financing Facility 2021).

### Persistent Questions

*What are the longer-term impacts of CDRFI supporting humanitarian anticipatory action and response on households and individuals?*

A recent review of the evidence on prearranged disaster finance established that CDRFI actors know relatively little about the impact of such finance where this is used to support public disaster response. To a large extent, "the challenge has been the inability to show how the financing provided by DRF instruments in a disaster allows quicker, more effective support to affected people, and that this made a positive difference in their lives." (Hill et al. 2021: 27).

Few studies have rigorously evaluated the impacts from cash transfers and other forms of direct assistance provided in anticipation of, or in response to, disasters.[13] In some cases, cash transfers have been found to exert positive impacts but further robust evidence, especially related to anticipatory action, is needed to establish impact on people's recovery after a disaster strikes, as well as on their longer-term welfare (Hill et al. 2021, Weingärtner et al. 2020). This is key to better understanding of humanitarian outcomes from the delivery of CDRFI-backed anticipatory action and disaster response. It also provides a starting point for assessing the value added of CDRFI on these outcomes – especially in combination with responses to the earlier question about the effects of CDRFI on humanitarian operations.

*Do subsidies of CDRFI represent good use of public resources in a given context and how is this determined?*

Ex-ante cost-benefit analyses (e.g. Clarke and Hill 2013 on ARC), assessments of the return on investment (e.g. FAO 2018) on anticipatory action and cost-effectiveness studies (e.g. Hill et al. 2019, Cabot Venton 2018, 2013) have shown that pre-agreed finance and earlier response to disasters can be cost-effective. The proof of concept exists. However, decision-makers in governments, humanitarian agencies

13 By contrast, programmes delivering cash transfers on a regular basis instead of before or after a disaster have been extensively studied and found to support the households they cover in managing shocks (Hill et al. 2021).

and donor organizations need high-quality, context-specific analysis of the value for money provided by different CDRFI options to support public investment decisions and to understand the trade-offs between options in their specific environment. Independent and transparent value-for-money analysis that is context-specific and inclusive of country perspectives and priorities, such as strategies to reach different development outcomes such as the SDGs, will also be important to examine the use of public funds for CDRFI subsidies. It should also help to critically interrogate assumptions and criteria otherwise used to justify them.

*How can anticipatory action reach scale? Where scale is achieved, what are the critical contributing factors to scaling up approaches?*

Organizations and governments implementing anticipatory actions and donors investing in them are grappling with how to scale up anticipatory action initiatives from existing pilots or sectoral programmes "in order to achieve greater impact in preventing and dealing with disasters by covering more people, more hazards and more countries" (Wilkinson et al. 2017: 26). Challenges to achieving scale have been documented and include the depth of institutional changes and collaboration required, limited political prioritization of anticipatory action and in some cases limited or unclear accuracy of forecasting (ibid.). The next step involves learning from anticipatory action initiatives and pilots that have managed to achieve scale, for instance through integration with global funds or with national government disaster risk management and social protection systems in order to understand the enabling factors that facilitate scaling. Addressing this question will involve looking at whether and how CDRFI can help scale up anticipatory action, for example in terms of expanding coverage.

### Transformational Evidence

*What are the opportunities and risks of implementing CDRFI in contexts of conflict and protracted crises, and how can these risks be mitigated?*

Conflict and protracted crises are a current blind spot in CDRFI implementation, evaluation, and research. To date, there is limited experience with the application of CDRFI both in contexts of conflict and protracted crisis, and in terms of CDRFI supporting humanitarian anticipatory action and response to conflicts. Analyzing how the response to conflict-related crises is currently funded, how decisions about such funding are made and what the incentives and constraints are to investments in CDRFI in fragile contexts will be a starting point to addressing this gap (Wagner and

Jaime 2020). Experiences where CDRFI or anticipatory action have been used with the aim of managing expected surges in unrest, conflict and displacement (for instance the Start Fund Anticipation Window) or to enable humanitarian response could represent valuable case studies to that effect. Greater consideration of conflict and protracted crisis in relation to CDRFI will be critical to the future application of CDRFI solutions and thinking by humanitarian agencies: as of 2018, "nine of the ten countries with the largest populations in need [of humanitarian assistance] faced conflict and forced displacement" (Development Initiatives 2019: 12).

*How effective is the current global risk-finance architecture supported by the Global Risk Financing Facility (GRiF), the Green Climate Fund (GCF), the Insurance Development Forum (IDF), InsuResilience, the International Development Association (IDA) and the wider system? What global models or changes to the current architecture and support system could substantially increase the timeliness and value for money of CDRFI?*

In May 2021, the G7 Foreign and Development Ministers' Meeting Communiqué recognized "opportunities for the global risk-finance architecture to develop".[14] Over the past couple of years, international initiatives such as the Risk-informed Early Action Partnership (REAP), the InsuResilience Global Partnership and the Insurance Development Forum have been established to support this development and to enhance protection from disasters globally. Financing mechanisms (for instance the GRiF, the InsuResilience Solutions Fund and the multilateral climate funds) have been funding the design and implementation of prearranged CDRFI strategies and instruments.

However, the extent to which the global risk-finance architecture and support system have strengthened the timeliness and value for money of CDRFI is not well established. Investigating whether the current system has been able to reduce the extent to which disasters exacerbate pre-existing inequalities across and within countries is of particular importance in this context to inform the direction of further developments of the global risk-finance architecture.

*What impact will larger scale creeping changes (e.g. climate change and demographic change) have on CDRFI globally and in specific contexts? How should this influence current CDRFI product and market development, and what does it mean for linking up CDRFI with climate finance, anticipatory action and disaster response mechanisms, in light of what crises might look like in the future (e.g. in 30, 50 or 100 years)?*

The context in which CDRFI operates is constantly changing, and large-scale developments such as climate change and demographic change have particular implications for the design, implementation and viability of CDRFI approaches. Climate change, demographic change and other compounding threats will transform the frequency, intensity and impacts of disasters in the future. They thus require a shift in perspective from short-term thinking and a focus on immediate protection of assets towards a longer-term understanding of what crises might look like in the future (Jarzabowski et al. 2019). Long-term insurance products might be one option but this will have implications on the capital requirements for insurers and the affordability of products (Maynard and Ranger 2012). If we are going to make CDRFI future-proof, further investigation into the barriers to longer-term, multi-year solutions is needed. This should also shed light on the different perspectives and preferences relating to the supply and demand-side of CDRFI, and help to identify feasible options for price adjustment mechanisms to incorporate longer-term changes in risk levels such as those due to climate change.

### Summary/Conclusion

Expanding our understanding of the links and complementarities between CDRFI, humanitarian action and climate change adaptation is critical to ensure the continued relevance and impact of global risk-finance action. It will also help policymakers and practitioners across those communities to identify entry points for deepening collaboration globally, as well as in specific countries or regions where CDRFI is designed and implemented. Such collaborations require further robust evidence about the impacts of CDRFI on humanitarian response operations and the difference this eventually makes to people's lives. A thorough assessment of the political economy of CDRFI is also necessary in those contexts in order to shed light on the interests and incentives of different actors, and the opportunities and barriers to collaboration. New frontiers for global risk-finance action will include research and learning on the applicability and impact of CDRFI in contexts of conflict, protracted crises and a changing climate.

14 https://www.auswaertiges-amt.de/blob/2457880/04c742ee16a1dfaf8235e4f17974d1c0/210505-g7-foreign-and-development-ministers-meeting-communique-london-5-may-2021-data.pdf

# Gender Dimensions and Impacts of CDRFI

Author: Katherine Miles[15]

## Problem Framing and Definition

There is a growing evidence base on the gender-differential impact of climate change and disasters, such as higher mortality rates among women (Neumayer and Plümper 2007), and gender differences in access to and usage of finance (InsuResilience 2018, InsuResilience 2019, IDF 2020, IFC, AXA and Accenture 2015). This provides the foundations for establishing the *Gender Dimensions and Impacts of CDRFI* across the value chain (InsuResilience 2018, InsuResilience 2019). But there are clear gaps in the breadth and depth of evidence on the gender dimensions specific to CDRFI, which cuts across policy areas and evidence themes in this wider publication.

Where existing gender-related CDRFI evidence exists, it typically focuses on gender differences in women and men's vulnerabilities to disaster risk and climate change (GFDRR and World Bank Group 2021b). Considerations relating to the broader gender differential impacts of climate change and disasters but also specifically to CDRFI have to date primarily emphasized women-specific risks, needs and impacts (InsuResilience 2018, InsuResilience 2019, IDF 2020). In light of historical gender biases and discriminatory social norms, and in the context of the global agenda to advance gender equality and women's empowerment, this is partly in line with Sustainable Development Goal (SDG) 5 (UN 2015). Moreover, the evidence forming the business case for the gender-differential impact of CDRFI draws on quantitative and qualitative data sets from other policy areas not specific to CDRFI. For example, data is used relating to women's diverse roles in economic value chains and greater levels of exclusion from the formal economy and financial system. These factors result from social norms, power dynamics and discrimination, including the fact that legal gender differences that can

15 Katherine S Miles Consulting

hamper women's asset accumulation, economic participation (World Bank Group 2021b), and climate and disaster resilience building (InsuResilience 2019).

The gender dimensions of CDRFI evidence priorities relate not only to their content but also to whether considerations of social norms and power dynamics between women and men have been factored into the methodology underpinning the collection of evidence. A key issue is how evidence is collected and the need for evidence gathering methodologies to be inclusive, participatory and sensitive so as to take account of gender-dynamics. Methodologies must also allow for diverse perspectives to be integrated. A key part of this is factoring in when evidence is collected such as the time of day and when women or men are relatively speaking more or less available due to demands from employment or household caring responsibilities. Another consideration is who is responsible for collecting the evidence. For example, the validity of responses provided can be influenced by whether the enumerator is the same gender as the respondent (InsuResilience 2021).

Another key consideration is where the evidence on the *Gender Dimensions and Impacts of CDRFI* is gathered. Overall gender-related CDRFI evidence gaps exist but there are also gaps for specific data points in a particular region, country or at a sub-national level. Given the importance of the cultural context in defining social norms related to gender, it may not be enough to simply close any evidence gap in one geographic location. This is because a cultural context varies within and between geographies. As a result, there is a need to gather similar evidence from multiple geographies in order to build a solid evidence base and extrapolate the gender-differential impact and approaches to improve the effectiveness of CDRFI. With this in mind, the following sections set out some high-level evidence priorities and rationale on this cross-cutting topic that can be achieved over the short-term with a 'Quick Impact', the more 'Persistent Questions' and finally those evidence gaps that may result in 'Transformational Evidence'.

### Quick Impact

*Which countries collect and use CDRFI-related national or sub-national sex-disaggregated data to inform climate and disaster risk understanding and gender-responsive CDRFI solutions?*

There is acknowledged value in country-level CDRFI-related sex-disaggregated data (InsuResilience 2021b ). For example, the collection of sex-disaggregated data to track progress against the seven global targets within the Sendai Framework is encouraged (UN 2016, UN 2017). A range of data points including disaster mortality, morbidity, insurance access and demand can be disaggregated by male and female. From a governance perspective, data can be gathered on the level of women's involvement in different parts of the CDRFI value chain. While international policymakers including the Intergovernmental Panel on Climate Change (IPCC) and the United Nations Framework Convention on Climate Change (UNFCCC) have called for more and better collection and use of sex-disaggregated and qualitative data to inform climate-risk understanding (IDF 2020, InsuResilience 2021b), these data sets are not usually collected at a country or sub-national level. Moreover, existing gender data is not necessarily used by those who could benefit from its rich insights uncovering differences in behaviour, risks and impacts for women and men related to CDRFI in order to inform action at different levels within the CDRFI-related system.

*At the policy level, to what extent and how are gender considerations (e.g. unpaid care, childcare infrastructure, violence against women and girls, gender-differential reproductive health needs and gender-differential economic participation rates) integrated into the content of national CDRFI-related polices and within macro-level solutions?*

Existing data sets highlight gender differences in areas of relevance to national CDRFI-related policies and macro-level solutions such as unpaid care, childcare infrastructure, violence against women and girls, gender-differential reproductive health needs and gender-differential economic participation rates. Yet in spite of this there is limited evidence mapping as to whether these issues have been integrated into the content of national policies (UN Women 2020) that draw on CDRFI instruments to address climate and disaster risks within their specific policy remit and within macro-level solutions (InsuResilience and World Bank 2021). This is in the context of some evidence that the majority of countries have made some gender-related commitments in their National Adaptation Plan (NAP) documents (NAP Global Network and InsuResilience 2021), and some regional evidence from the Caribbean, the Pacific and Asia that selected countries have integrated general gender considerations into disaster risk management and/or policies related to climate change – although not specific to CDRFI instruments (InsuResilience and World Bank Group 2021b, GFDRR and World Bank Group 2021b, UN Women 2020). As such, further evidence should be collected to establish which countries and how the specific gender considerations mentioned are integrated at a country level in regard to national policies that relate to and incorporate CDRFI instruments to address climate and disaster risks.

*What case-study examples indicate gender differences in insurance access and usage (e.g. use of payments) and the benefits for beneficiaries from the integration of gender considerations into different models of CDRFI?*

Guidance and a limited number of case studies highlight examples of how gender-considerations can be integrated into climate and disaster insurance (InsuResilience 2019), insurance more broadly (BMZ, GIZ, International Finance Corporation, Women's World Banking 2017, IFC, AXA and Accenture 2015) and disaster recovery (GFDRR et al 2018). These case studies primarily provide anecdotal data on the benefits and gender-differential patterns of insurance access and usage. There is also some limited evidence on the different insurance needs of men and women (Hill, Campero Peredo and Tarazona 2021). Nevertheless, there is demand for deeper information on practical examples detailing what has worked in concrete terms to increase access and usage of CDRFI by different groups of women and men and to address women's specific needs for protection.

### Persistent Questions

*What is the value and effectiveness of gendered approaches to CDRFI solutions (macro-, meso-, and micro-level) in order to increase the respective resilience of women and men beneficiaries (direct and indirect) to climate-induced disasters?*

There is some evidence that women and men have different insurance needs and preferences with implications for the design and distribution of CDRFI solutions. For example, insuring health shocks has been found to be more important to women than it is to men and quite apart from this there is evidence of a gender gap in preferences for flood index insurance in Bangladesh (Hill, Campero Peredo and Tarazona 2021). Nevertheless, there is a gap in evidence on whether CDRFI approaches that address gender-differential needs and barriers increase the respective resilience of women and men to disasters induced by climate change. Taking steps to increase the collection of qualitative and quantitative data in this area can create an evidence base indicating whether these approaches are effective, provide customer value and ultimately contribute to saving lives and livelihoods and which of these approaches are most suitable.

*How can policy priorities for CDRFI and payouts prevent and reduce the gender-specific impacts of disasters on women (e.g. unpaid care burden and violence against women, and reproductive healthcare needs of women associated with vulnerabilities related to maternal health)?*

There is a body of evidence on the gender-specific impact of disasters on women including their unpaid care burden and also violence against women (IDF 2020). Moreover, there are gender-differential reproductive health needs that are relevant considerations after climate-induced disasters with implications for CDRFI solutions. However, there is a lack of research on how specific policy approaches and priorities (e.g. payout priorities) related to macro-level CDRFI solutions can and have successfully alleviated these negative impacts. In theory, payouts from sovereign risk pools may be able to prevent and address these impacts such as gender-based violence risks post-disaster. But this requires an evidence base to understand 1) if they are considered within such policy and payout decision-making and 2) where they have been applied, whether such priority-setting and subsequent resource allocation has resulted in the intended positive impact (InsuResilience and World Bank Group 2021).

*What are successful approaches for addressing gender-specific barriers to access, use and control of emergency payouts from CDRFI schemes?*

There is a body of evidence on the different barriers some women and men may face to access CDRFI payouts due to the gender gap in access to mobile phones and mobile Internet (GSMA 2021) and the gender gap in bank account ownership (Demirgüç-Kunt et al 2018). These barriers can mean that CDRFI payouts may not always reach the intended beneficiaries and are not used for the intended purposes. While there are some anecdotal case studies highlighting examples of approaches to address these challenges

(InsuResilience 2019), there is a need for empirical evidence on successful and effective approaches to overcome these gender-specific barriers and increase women's access, use and control of emergency payouts from CDRFI schemes.

### Transformational Evidence

*How can CDRFI solutions and payouts address the gender dimensions of risks and impacts related to climate disasters in order to drive gender-transformative change (e.g. related to unpaid care work) and contribute to gender equality and women's empowerment?*

There is currently no recent evidence available to indicate how different types of gender-smart CDRFI solutions (macro-, meso-, and micro-level) have positively improved women's adaptive capacities and resilience to disasters over the longer-term, and strengthened the position of women individually within society and within households. This evidence is necessary in order to establish whether these solutions and payouts (e.g. support for childcare infrastructure from sovereign schemes) addressed the gender dimensions of risks and impacts of climate disasters (e.g. women's unpaid care work) and also contributed to improved levels of gender equality and women's empowerment (e.g. increase economic participation and asset accumulation to strengthen resilience to future economic shocks from climate-induced disasters).

*Has the integration of gender-related vulnerability data into risk models and understanding improved the resilience of women and men?*

It has been reported that climate and disaster risk insights can drive gender-responsive action by drawing on the evidence base that risk exposure and vulnerability to disasters can vary based on gender, with women and girls often more severely and differentially impacted. However, current evidence suggests that gender data is not integrated into public or private-sector catastrophe risk analytics and modelling and existing disaster databases as a matter of course (IDF 2020). Yet there is clear recognition of the potential value in the analysis of this data for CDRFI to support more targeted allocation of resources. Going forward, there is a need to build the evidence through tracking the integration of gender data and how this is done. It is also important to see how it is applied within a range of gender-smart CDRFI solutions but even more importantly to ascertain whether as a consequence this has changed the climate and disaster resilience outcomes for women and men (InsuResilience 2021a).

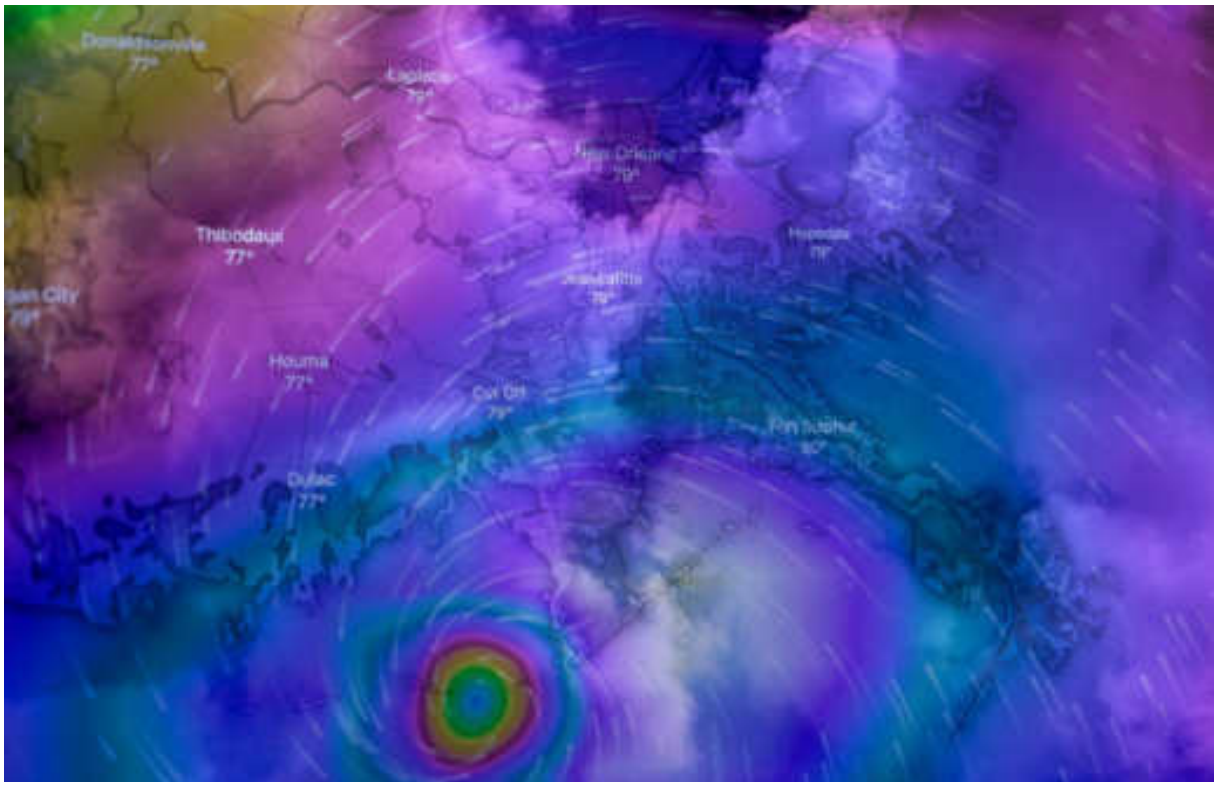
### Summary/Conclusion

Where evidence exists on the *Gender Dimensions and Impacts of CDRFI* it is often anecdotal and data is mainly collected at the output level and largely absent at the outcome and impact level of CDRFI. Moreover, the pockets of evidence that exist relate to very specific cultural and geographical contexts. As such, there is a clear and urgent need to move beyond the anecdotal level in order to gather baseline data and in turn results-related evidence from a wider range of geographic contexts so as to generate further action. Moreover, the reality is that CDRFI-related gender impacts cannot be over generalized and are much more complex. This is because any individual's gender identity intersects with other factors and characteristics including their ethnicity, geographic location, lifecycle stage (e.g. childhood, adolescence, pregnancy or parenthood) and their livelihood strategy (agriculture, entrepreneurship, formal employment, etc.) (InsuResilience 2018, InsuResilience 2019, IDF 2020). Consequently, there is clearly a fundamental need for greater evidence that targets the impact on women versus men more generally. There is also an acknowledged need to gather evidence on the heterogeneous and more specific impacts of climate change, disasters and CDRFI beyond this more generalized focus in order to ensure equitable benefits from CDRFI solutions for all genders and social groups (IDF 2020, InsuResilience 2021a).

With this in mind, members and programmes under the InsuResilience Partnership need to take concrete steps to ensure that MEAL in CDRFI programmes is gender-responsive at all levels.[16] Furthermore, there is an opportunity going forward to create and deploy a technical assistance fund with the aim of supporting the research and collection of learnings and emerging good practices on gender-sensitive and gender-responsive approaches through the creation of a CDRFI gender learning lab.[17]

16 This was highlighted in the InsuResilience Global Partnership's Declaration on Gender, endorsed by its High-Level Consultative Group (HLCG) in September 2020. Further guidance is provided in InsuResilience (2021).

17 This could be similar to the World Bank's Africa Region Gender Innovation Lab (GIL) which focuses on five thematic areas (Agriculture, Private-Sector Development, Property Rights, Social Norms and Youth Employment) and which conducts impact evaluations that assess the outcome of development interventions in Sub-Saharan Africa to generate evidence on how to close the gender gap in earnings, productivity, assets and agency. See more at: https://www.worldbank.org/en/programs/africa-gender-innovation-lab




# Risk Information and Analysis

Author: Florian Waldschmidt[18]

## Problem Framing and Definition

Risk information and its analysis is a complex endeavour with potentially far-reaching implications. Especially when considering climate-risk information and analysis with the aim of producing or improving targeted financial products, investments or insurance solutions, many facets and dimensions need to be considered. Although they are constantly improving, general challenges and concerns in the broad discipline of *Risk Information and Analysis* relate to the quality, transparency and sharing of data and models as well as providing results in a language comprehensible to non-technical decision-makers. And yet various databases and modelling tools have reached maturity and have proven to be key instruments in providing valuable and necessary results for policy and investment decisions. However, further research and evidence is needed to enhance areas like ownership, capacity and application within the countries facing larger shares of the global climate risks, typically located in the Global South. The same is true for more integrative and detailed methods to better target investments and financial products as established tools but the results often tend to remain in their respective environment rather than building on shared standards. This section aims to highlight some exemplary research questions that may be able to improve the practice of climate-risk analyses and closely linked disciplines.

## Quick Impact

*How can risk models, modelling platforms, and tools be made available to and developed with/by risk owners to ensure appropriate and targeted use?*

18 Munich Climate Insurance Initiative

Decision-makers' understanding of climate risk and the corresponding modelling and assessment tools differs across the world. More often than not, the technical knowledge and especially the ownership of risk models, modelling platforms and tools lies within the Global North rather than the Global South. Contrary to this situation, the populations most vulnerable to climate change and its impacts typically reside in the Global South (Moody et al. 2020). There is an increasing availability of (quality) data and more and more sophisticated climate-risk, damage and vulnerability models, and modelling platforms with differing focuses. This leaves decision-makers in the most affected countries and regions in an even more complex situation when it comes to selecting the most suitable models and tools. A dependency on partner institutions therefore emerges in many cases since the technical know-how and the selection or development of models is often not with the risk-owning party. It is hence necessary for risk-owning parties to receive the reports and results of the models and tools applied but also to be much more integrated in the development of models and data collection. They also need to be capacitated to apply and select other available tools appropriately and independently from any third party. Inclusive model development or selection processes further enable decision-makers to ensure interoperability with models and tools already applied to leverage synergies for feeding new and updated results into established analysis tools and frameworks.

In order to allow non-technical ministers, parliamentarians and other decision-makers to make better-informed decisions on the most suitable models and tools, their staff, academics and the private sector need to be capacitated in order to loosen dependency on foreign actors, develop independent local perspectives and translate scientific results into less technical language for non-technical decision-makers.

*How can the combination of remote sensing data and ground/ local data be used to design prototype frameworks for data-scarce environments?*

While global availability and the quality of remotely sensed data increases and researchers and practitioners can observe almost all places of interest, ground and locally sourced data are still hard to come by in many remote places. Great opportunities arise through the application of remotely sensed data since this allows the abstraction and filling of gaps where no local data is available or where local data may be biased. However, the potential for the systematic combination of the two remains underexploited in fields such as the development of prototype frameworks for data scarce environments, i.e. where ground and local data is either not available or not of sufficient quality to validate and test prototype frameworks.[19] Such prototype or standard frameworks would furthermore benefit greatly from leveraging the maximum number of data sources available at ministries, public organizations and potentially the private sector in order to draw the most comprehensive picture possible while providing a high degree of transparency to any potential end-user.

Finally, drawing on such comprehensive prototype frameworks based on remotely sensed and local data for verification and calibration from a wide field, including e.g. typically scarce historical quantitative loss and damage data, asset values or local costs of mitigation and adaptation measures, can be applied in modelling and estimating future damage or the impact and need for investments. It can also serve for rapid post-disaster needs assessment to enable quick and targeted planning once a disaster strikes.

### Persistent Questions

*How can uncertainties be reduced when combining vulnerability and climate modelling?*

As all modelling exercises lead to some degree of uncertainty in the results, improving confidence in the results is an ongoing process. Uncertainty in climate-risk and damage modelling inevitably results in ambiguity for decision-makers, financing bodies and the insurance industry when evaluating and interpreting different investment and financing options. Hence, increasing confidence in models and developing further-reaching combined models provide an improved base for all the involved stakeholders.

Often climate modelling and the assessment of the vulnerabilities of people or other assets is kept separate and only combined in a subsequent step, while the observed hazard remains a driving parameter of the analyses. However, this does not adequately take into account exposure developments arising from changing population patterns, such as migration or population growth, as well as changes in the (local) economy and associated changes of relevant settlement, industrial and agricultural areas over time (A. Jurgilevich et al 2017). Hence, researching and combining several different perspectives of changes in hazard patterns and intensities, as well as changes in exposure patterns and the vulnerabilities of people and assets into single or

19 For an example of combining remotely sensed data and local data, drawn here on the individual and household level, see Baez, Kshirsagar and Skoufias (2019).

combined modelling approaches has the potential to reduce ambiguities brought about by producing an overlay of results instead of analyzing and modelling separate developments and potential interdependencies in a single targeted model.

*How can climate-risk modelling be used and appended to allow for targeted and in-depth analyses of country and sub-national specific circumstances in order to unlock timely and effective recovery phases?*

Climate-risk modelling on a country, regional or local level provides decision-makers with a solid foundation for planning the future, making informed financing and investment decisions on different risk management aspects such as mitigation, adaptation, and risk-transfer solutions. Probable future climatic and socio-economic medium and long-term developments are being analyzed to inform such decisions. However, similar modelling tools may be just as capable of enabling more in-depth analyses of sub-national or sub-regional circumstances to formulate specific profiles tailored to the respective national or local government's recovery and response needs. Local governments and local research institutes need to be capacitated in order to conduct locally-focused analyses enabling the local governments to identify priority adaptation and financing objectives. Systematically combining such locally targeted analyses on the country level therefore provides a higher degree of detail and allows decision-makers to leverage synergies while also taking local priorities into account, in relation to macroeconomic and microeconomic perspectives. Further developing and applying such capacities for a better understanding of local conditions additionally holds the potential for improved forecast-based financing and quicker post-disaster needs assessments, especially when remotely sensed data are made available quickly following an extreme event.[20]

*How can natural resources / environmental assets and nature-based solutions be better integrated in risk analytics, including comprehensive and coordinated valuation of assets and (averted) damage?*

The wealth of evidence and data on value and value proxies, along with data on hazard-related damage and proxies for buildings and infrastructure allows for reasonably precise estimates on probable damage due to extreme events. Cost-benefit analyses for different scenarios, financing

20 For a more focused perspective on post-disaster needs assessment, see for example Jeggle & Boggero (2018).

and insurance products, and other adaptation measures can be conducted on this basis. Contrary to that situation, comparatively little consensus has been built on the integration of natural or environmental resources, and on nature-based solutions and ecosystem-based adaptation measures. Valuing environmental assets and related measures, especially intertemporal, is typically much more complicated than more conventional assets, since their value not only consists of market-driven values but also comprises varying non-market values ranging from contributions to air quality and regulating local climates to cultural and aesthetic values. While such non-market-value components are hard to estimate and have limited direct economic value, they do provide indirect economic value by reducing impacts and increasing people's living standards, thus contributing to their (economic) productivity. Although further research is required to confidently quantify especially long-term benefits of nature-based solutions, it is safe to say that such components are regularly undervalued and not (or only to a limited extent) considered in cost-benefit analyses. Including natural assets in the value and potential damage analyses will shed further light onto where such hitherto 'hidden' assets lie, how they can be protected and more importantly how they can be part of a CDRFI strategy or portfolio. The same is true for the inclusion of nature-based solutions and ecosystem-based adaptation in further-reaching cost-benefit analyses for pre- and post-disaster investment decisions. However, while different valuation methods have their respective standing and value, ranging from willingness-to-pay approaches over replacement value to more comprehensive methods taking multiple ecosystem services into account, a more concise and broadly accepted sub-set of ecosystem and natural-resource focused methods may be able to better respect those non-monetary values, while also adding transparency and comparability of results through an established approach.[21]

### Transformational Evidence

*How to integrate wellbeing metrics/data more directly into climate-risk analysis?*

Data on physical damage and numbers for affected people and death are well researched for many natural-hazard types, already allowing for reasonable climate-risk analyses and subsequent investment decisions. However, as the accepted term 'affected people' demonstrates, little evidence exists on the specific impact of individual disasters on different dimensions of people's wellbeing, including the physical wellbeing of affected people and the impact through reduced access to healthcare, education other social services, reduced disposable income or even unemployment. Measuring and quantifying a local or national social protection landscape, for example in order to estimate the impact of climate change or specific extreme events on people's lives, adds an additional crucial dimension to estimating the cost and benefit of mitigation and adaptation measures (Ford et al. 2018). However, those costs and benefits may be only partially or indirectly economic in nature. Understanding weaker components and key facilities of a government's social protection landscape enables decision-makers to better target their efforts to limit impacts on people by addressing bottlenecks and weak links in the social protection system.

Although existing climate-risk analytics tools are able to perform such analyses with limited adjustments (e.g. by using normalized indices as 'currency' of any given wellbeing dimension rather than USD), more evidence is needed to identify the most suitable wellbeing metrics and gather the corresponding data in order to further enable and mainstream emerging approaches. Data on non-monetary damage levels of service provision remain especially scarce but would prove valuable for modelling future impacts and quantifying their 'true cost' (Moody et al. 2020). Increasing transparency between social and wellbeing science by means of dialogues on integrative multi-disciplinary approaches could support the development of essential evidence to enable successful integration of such people-centric metrics into climate-risk analysis and subsequent investment decisions.

*How can increased collaboration between different modelling communities enhance understanding of the interaction between compounding and cascading risks, and their short and long-term implications?*

Climate change and resulting weather extremes create whole systems of interacting, cascading risks for ecosystems, economies, societies and physical systems. They are all potentially linked and specific to underlying circumstances which may not follow any man-made boundaries. These underlying circumstances can for instance include the fact that the city or region in question was recently affected by some other hazard or even one that was quite similar. The city is thus still recovering and repairing damaged assets and is not yet therefore performing at full capacity, leaving certain assets or population groups more exposed and more vulnerable than usual. Although the multiple possible combinations of such cascading and compounding risks are of key importance to decision-makers, they remain a specific

21 While Ling et al. (2018) provide an exemplary structured insight into the diversity of methodologies, they also showcase the complexity of the matter.

scientific and analytical challenge. In most cases the result is assumptions with differing levels of confidence. Thus, leveraging the specific perspectives and focuses of different modelling communities increases the understanding and acceptance between diverse communities. They include climate change modelling, loss and damage modelling, vulnerability and exposure modelling, and crop and livestock modelling through structured and targeted exchange processes. Better understanding of similar yet different branches of relevant modelling approaches enables better integration of such models.[22] Once similar standards and assumptions are applied, increased transparency, trust and interoperability enable more comprehensive analyses focusing on compounding and cascading risks, which would otherwise be analyzed in separate silos overlooking interdependencies. Further evidence of such integrative approaches can therefore help shape more comprehensive climate-risk analysis for multifaceted climate-risk finance specifically aimed at synergistic impacts rather than targeting just one or a few of several probable hazardous scenarios.

*How can emerging data and modelling technologies such as AI and machine learning, the Internet of Things or big data be utilized to improve CDRFI products?*

Over the past few decades, computing power has become cheaper and cheaper while data availability and quality keeps increasing. Hence, more broadly-based and higher-quality application of remote sensing technologies, including drone and LIDAR technologies, or a higher density of mobile phones and other devices allowing extensive data collection (the Internet of Things), along with new modelling technologies such as artificial intelligence and machine learning become more and more commonplace.[23] While these trends are still in a phase of being established – particularly in the realm of climate risk, it is reasonable to anticipate their potential for capturing more and more scenarios and dimensions. These tools will leverage higher-resolution georeferenced data, increased computing power and enhanced algorithms to tackle questions relating to the interconnectedness of events or socio-economic and wellbeing dimensions. The deployment of improved and more precise data in combination with modelling tools has a strong potential to better inform decisions on mitigation and adaptation investments. The data will be able to capture more complexities and connections between climate change, exposure and vulnerabilities, including intertemporal dimensions. They will scope residual risks that may be better addressed through risk-transfer solutions and more precisely determine trigger points and indices for parametric insurance solutions.

### Summary/Conclusion

This section on the cross-cutting theme of *Risk Information and Analysis* takes a closer look at some known issues that have not yet been fully addressed or are still open such as directing efforts into the building of stronger ties and ownership with policymakers and decision-makers of the most affected regions. This not only relates to knowledge transfer but also to stronger integration within planning, data collection, model and database development, and implementation with the objective of enabling the respective beneficiaries to sustainably make decisions on their actual data, risk assessment and modelling needs in the future. The section further explores ideas on how more intensive collaboration between different disciplinary communities, be it modelling communities or branches of environmental or social/wellbeing science, can lead to better comprehension of each other's viewpoints and differing risk understanding, increased trust, along with interoperability of models and their respective conclusions. Depending on the specific case in question, this would open the door for more integrative chains of analyses leading to more comprehensive, inclusive and targeted results. The use of such integrative modelling and assessment approaches representing multiple disciplines empowers policymakers, implementing agencies and financial institutions to evaluate and target their efforts and investments. Finally, emerging technologies such as hardware, improved application of artificial intelligence and machine learning (partially enabled by more powerful hardware) have the potential to lift these inclusive and more comprehensive approaches to another level. They achieve this by including more and more precise data and applying more advanced prediction models getting closer to identifying the true cost of the risks faced.

Hence, while the risk information and analysis sector has reached some level of maturity, well-known issues that are relatively easy to tackle continue to remain a concern. And yet, advancements in technology as well as new platforms of collaboration can be applied to achieve improvements in current practice for all stakeholders.

22 For further insights on related approaches and limits of current practices, see for example Adger, Brown & Surminski (2018) or Simspon et al. (2021).
23 As shown, for example, by F. Zennaro et al. (2021).

# Resilience Outcomes

Authors: Jennifer Denno Cissé, Sönke Kreft, Architesh Panda[24]

## Problem Framing and Definition

Resilience has become a dominant framing for policies and programmes aimed at reducing vulnerability to extreme weather and natural hazards, promoting climate adaptation, and strengthening the ability of countries, communities and individuals to manage risk. Despite a lack of consensus – among CDRFI stakeholders and within the broader resilience and adaptation space – around the right way to measure resilience, there is a clear role for CDRFI to play in strengthening the resilience of low-income countries, communities and people exposed to climate change, extreme weather and natural hazards. Given the resources that have been dedicated to establishing and expanding CDRFI solutions in the Global South, there is also an expectation that CDRFI will make tangible impacts on resilience in target countries. Hence, resilience is the logical and appropriate framework for understanding the impact of CDRFI solutions on people's ability to manage climate and disaster risk. Resilience framing also provides an opportunity for the CDRFI community to demonstrate the value of CDRFI approaches and to legitimize these approaches as a necessary component of climate adaptation and resilience policies and programmes.

24 Munich Climate Insurance Initiative

There are still many unanswered questions about the most cost-effective and transformative approaches when it comes to resilience strengthening. This section outlines nine evidence priorities to facilitate better understanding and to promote the resilience-strengthening potential of CDRFI solutions. As in other sections, these priorities are categorized as quick impact, persistent issues or transformational evidence depending on the amount of effort and time needed to address the evidence priority and the potential impact of the work.

### Quick Impact

While assessing the evidence frontier for resilience and CDRFI, the authors identified three areas of work where focused research and evidence activities would generate valuable and immediate impacts. These relate to the creation of resilience measurement guidance for CDRFI, bulking up the evidence base on traditionally under-researched CDRFI contexts and the need for additional research on the impact of CDRFI in non-payout situations. By quickly investing in these three quick-impact evidence priorities, the CDRFI community will better position itself to tackle longer-term questions about the resilience-strengthening potential of CDRFI solutions.

*What resilience measurement guidance would support better and more consistent resilience estimation in CDRFI activities?*

While considerable empirical work has been done on resilience measurement, the proliferation of methodologies and resilience definitions has led to evidence that is not comparable and of mixed quality (Barrett et al. 2021). While not specific to resilience measurement for CDRFI, these same challenges can be found specifically within the CDRFI space. While a few actors are beginning to support resilience integration, there is no consensus around best-practice tools to provide guidance specific to CDRFI programmes on how to integrate resilience concepts into programme or solution design, or into MEAL plans. Researchers in closely aligned fields such as agricultural development have highlighted the need for simple tools that facilitate mixed-method MEAL approaches and help practitioners to grapple with complexity (Douxchamps et al. 2017). Similar CDRFI-specific tools should be gender-responsive (Miles and Wiedmaier-Pfister 2019) and build on the accomplishments of qualitative researchers who have developed methods to understand contextual factors such as agency that help to explain resilience (Barrett et al. 2021). In order for these tools to be useful and field-ready, they should be co-created by researchers, policymakers and practitioners (Keating and Hanger-Kopp 2020). They also need to incorporate recent work done on the necessary characteristics of resilience-oriented evaluations (Constas et al. 2021). Resilience measurement guidance and tools for CDRFI activities would be incredibly beneficial moving forward since they would allow comparison of the effectiveness of CDRFI solutions in building resilience across contexts.

*What is the impact of CDRFI on individuals in traditionally under-researched areas, including (peri-)urban contexts and non-agricultural sectors?*

In 2018, the Munich Climate Insurance Initiative provided an overview of impact evaluations in climate-risk insurance projects (Fernández and Schäfer 2018). They identified three important gaps in the evidence literature: gender analysis, non-experimental settings and (peri-)urban contexts. These gaps initially occurred because many of the early CDRFI products were weather index insurance products targeted at small-scale farmers. These evidence gaps remain today because much of the evidence on CDRFI is generated by academics carrying out (quasi-)experimental research[25] in rural, agricultural communities. As a result, the CDRFI community is reasonably knowledgeable about the potential wellbeing impacts of crop insurance in rural Ghana but knows very little about the potential of CDRFI solutions in urban areas or in non-agricultural sectors. Quick evidence investments, especially financial support for MEAL in non-traditional programmes, could help to rapidly expand the evidence base in these under-researched contexts.

*What is the impact of CDRFI in non-payout situations?*

While there is evidence that CDRFI, particularly agricultural insurance, may increase access to credit and also lead to increased agricultural yields (Fernández and Schäfer 2018, Jensen and Barrett 2017), there is a specific need to know how reduced risk due to CDRFI impacts wellbeing in non-payout situations (Tanner et al. 2015), especially at the meso- and macro-levels where this has been less explored. Issues of basis risk (and the absence of a payout following extreme weather) aside, CDRFI solutions have the potential to generate cost-savings at the macro-level, encourage lending and debt forgiveness at the meso-level and promote livelihood investments at the micro-level. More evidence on

25 Experimental research leverages randomization to estimate the causal impact of interventions, while quasi-experimental research uses other methods to estimate causal impacts because randomization is impossible or impractical.

the benefits (and negative consequences) of CDRFI solutions in non-payout situations would allow for a more complete understanding of the potential role of CDRFI in strengthening resilience than an assessment of the benefits derived from payouts alone. This work would support future research on *People and Client-focused Perspectives* (above) as well as on transformational resilience approaches (below).

### Persistent Questions

While the investments indicated above will have a quick impact, there are also persistent questions related to *Resilience Outcomes* that require additional evidence. The authors identified three evidence priorities where research could tackle systemic, long-standing or robustness challenges and evidence gaps related to *Resilience Outcomes*. Important factors for addressing some of the long-standing issues related to CDRFI effectiveness are investments in evidence generation for the impacts of CDRFI on resilience, for complementarities with CDRFI to strengthen resilience and for CDRFI solutions protecting sociocultural and non-economic assets.

*What are the spatio-temporal impacts of CDRFI on resilience?*

The community needs an insight into the impacts of CDRFI on resilience over space and time, especially over the long-term, in order to better understand the cost-effectiveness of CDRFI solutions. To date, there is only very limited empirical evidence specifically about the impact of CDRFI instruments on resilience (e.g. Cissé and Ikegami 2017). Inadequate resilience measurement guidance and insufficient investments in MEAL may be the primary reasons for this scant evidence base. Nonetheless, there is evidence of the potential of CDRFI to contribute to resilience (Surminski et al. 2016). Outside the solutions themselves, CDRFI actors are increasingly supporting resilience by providing risk knowledge and facilitating risk understanding of public-sector decision-makers, particularly city managers (Collier and Cox 2021). In order to expand the evidence base, it is critical that new CDRFI solutions should be accompanied by robust MEAL, including essential funding for these processes (Dazé et al. 2021, Surminski et al. 2016).

*In what context are climate and adaptation finance, DRR and CDRFI complementary in terms of building resilience to climate change and natural hazards?*

In addition to the impact of CDRFI on resilience, another key question relates to the context in which climate and adaptation finance, disaster risk reduction and CDRFI are complementary in terms of building resilience to climate change and natural hazards. Over the past decade, there has been increasing interest in the integration of social protection, disaster risk reduction and climate change adaptation, primarily through the creation of adaptive social protection programmes. In some cases, prevention components of these schemes are promoted through the use of microinsurance (Davies et al. 2013). CDRFI solutions seem to complement the goals of this integration as a matter of course. Investments in climate-resilient infrastructure and CDRFI are also likely to be complementary when it comes to strengthening resilience (Surminski et al. 2016) but evidence is needed to support these claims and provide guidance on the most cost-effective portfolio of resilience investments.

*How does CDRFI undermine or protect sociocultural and other non-economic assets?*

A final persistent challenge relates to the role of CDRFI in protecting or undermining sociocultural and non-economic assets. Increasing the community's understanding of the impacts of CDRFI instruments on holistic wellbeing is challenging for two reasons. Firstly, insurance has traditionally protected the economic value of physical assets. Secondly, much work on disaster resilience focuses on basic human needs and economic wellbeing and has overlooked sociocultural needs (Sou 2019). However, climate change is unfortunately impacting more than just physical assets. Ongoing work on the valuation of ecosystem services must be integrated into discussions about resilience strengthening. In terms of evidence investments, an improved understanding of the importance and value of culture, place, health, biodiversity and other non-economic assets (McNamara et al. 2021) to resilience would help the CDRFI community create innovative solutions to address these non-economic needs.

### Transformational Evidence

Finally, the authors believe certain evidence investments could disrupt current practice and catalyze changes in the landscape in ways that would dramatically increase the impact of CDRFI solutions. These evidence priorities are on transformational resilience approaches, behaviour change and the mitigation of maladaptive effects.

*Which CDRFI approaches reduce vulnerability and lead to increased development impacts?*

CDRFI tools are designed to transfer or manage risk. However, there is some evidence that in addition to facilitating disaster risk management, reducing vulnerability and strengthening resilience, CDRFI solutions may generate

increased development impacts or "co-benefits" (Tanner et al. 2015). For example, a recent randomized control trial in Mozambique and Tanzania demonstrated that agricultural index insurance combined with drought-tolerant seeds increase the resilience of farmers, allowing them to quickly bounce back from drought. Additionally, the experiment discovered a critical experiential learning pathway among farmers who experienced a drought while insured. This led to increased and prolonged uptake of improved technologies, referred to by the authors as "Resilience+" (Boucher et al. 2021). The authors have applied the label of "productive resilience approaches" to those resilience approaches that increase vulnerable people's resilience to climate and natural-hazard risks and produce developmental co-benefits. While these are promising results, more research is needed to indicate how CDRFI programmes can also be designed to maximize development impacts and whether development gains seen at the micro-level can be replicated at the meso- and macro-levels.

*How do behavioural changes influence the transformational impacts of CDRFI?*

Outside the DRF space, insurers are increasingly finding ways to change client behaviour with the aim of reducing risk and consequently cut claims as well. These tactics vary from reminding clients to protect their water pipes in the winter (to avoid burst pipes) to incentivizing exercise through reduced health insurance premiums. Can similar approaches motivate CDRFI clients to modify their behaviour and decrease their risk? Can nudging and boosting approaches redouble the transformational impacts of CDRFI? There is a need for both theoretical and empirical research to identify how CDRFI impacts can be amplified through information sharing, behaviour change communication, and incentivization.

*Are there examples of maladaptive effects of CDRFI and how can these be mitigated?*

Finally, there is some evidence that indemnity insurance can crowd out informal insurance, although index insurance may crowd in these informal mechanisms (Dercon et al. 2014). Nonetheless, resilience-strengthening interventions including CDRFI activities could in some circumstances crowd out community-based support mechanisms and weaken resilience (Béné 2020). Similarly, some adaptation programmes have been found to inadvertently exacerbate or create vulnerabilities (Eriksen et al. 2021). In order to mitigate against maladaptation, CDRFI should listen to marginalized voices and gather evidence on innovative ways to address the root causes of vulnerability (Schipper 2020). Increased investment in MEAL will allow CDRFI actors to identify the negative impacts of their activities, although the community must be more willing to share and learn from failure.

## Summary/Conclusion

Given the role of CDRFI solutions in transferring and managing risk, resilience is the appropriate framework for assessing the impacts of CDRFI approaches. CDRFI has the potential to reduce vulnerability, facilitate climate adaptation and strengthen the resilience of communities exposed to climate change and other natural hazards. CDRFI may even have transformational potential – an ability to jumpstart development pathways while promoting cost-effective disaster risk management. To realize this potential and demonstrate the value of CDRFI approaches for climate adaptation and resilience strengthening, Investments are needed to better measure and understand resilience and holistic wellbeing while avoiding real concerns around maladaptation.

# Evidence Framework

The Evidence Roadmap aims to refocus the CDRFI community on evidence and learning. Building on the evidence priorities presented above, this refocusing will serve to identify and amplify best practice and legitimize CDRFI as a strategic component of adaptation and resilience policies and programmes. The ultimate goal is to increase access to high-quality, cost-effective and sustainable climate and disaster risk management tools for communities exposed to climate-change induced extreme weather and other natural hazards, particularly in the Global South. The following section provides a framework for a roadmap enabling the CDRFI stakeholder community to move forward. By highlighting the importance of norms, actions and investments, the framework serves as a foundation for the way forward discussed in the following chapter.

## Evidence Norms

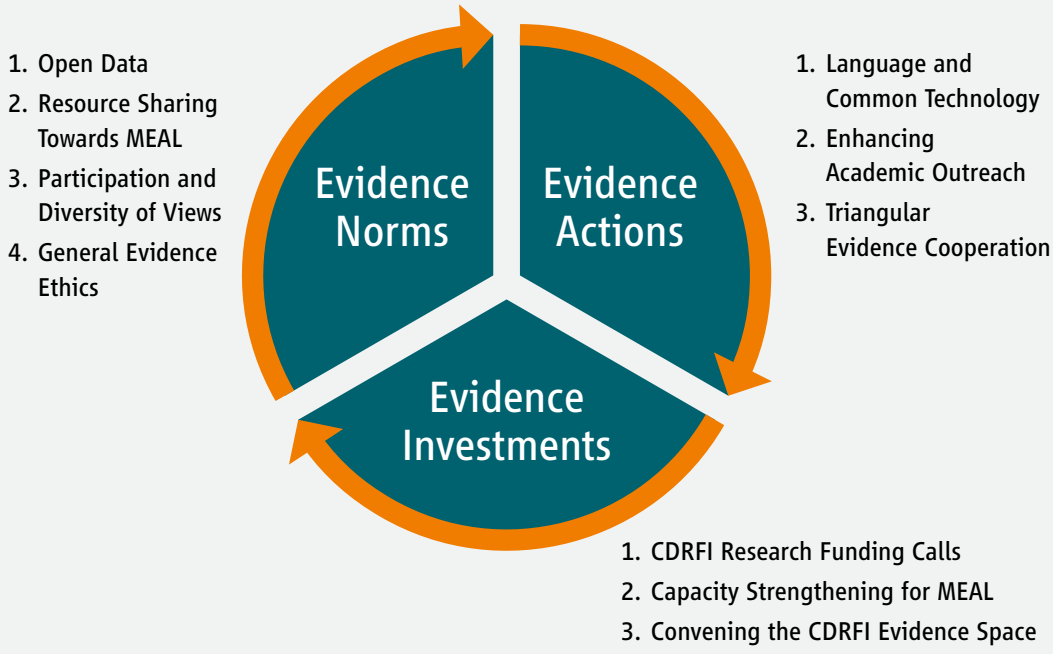
Norms underpinning CDRFI stakeholders' evidence are intended to ensure that the knowledge produced is ethical, accessible, inclusive and well-funded. These norms include the promotion of open data, resource sharing for MEAL, participation and the inclusion of a diversity of viewpoints, and the application of general research ethics.

### Open data

Increasing the role of evidence requires the free flow of and access to information. General risk awareness on all levels is a prerequisite for increasing the demand for CDRFI instruments. Increasing access to operational information

**Figure 5**

## Evidence framework




through open data and open access initiatives is the necessary starting point for the data value chain that enables objective CDRFI instruments.

From the perspective of norms, stakeholders and providers of CDRFI instruments should commit to allowing third party access to their own data, including programme cost information and impact success and failure indicators, while allowing for necessary data protection of individuals. In addition to general access, this includes the individual requirement for data quality management and standards as well as streamlining gender-responsive data approaches.

### Resource sharing towards programme MEAL

Learning within and among CDRFI programmes requires adequate MEAL resource capabilities and investment in learning. Although the importance of knowledge generation is widely acknowledged, in practice MEAL budgets rarely meet the learning needs arising during programme implementation. CDRFI implementers must include adequate resources in programme budgets to ensure support for robust monitoring, evaluation, accountability and programme-related learnings. As a general rule of thumb, implementers should consider dedicating a minimum of 5% of the programme budget for MEAL, although more or less may be needed depending on the programming context.

### Participation and diversity of views

Nuanced and balanced evidence generation and application involves a mixed representation of voices, disciplines and methods. CDRFI actors should facilitate gathering of unbiased research information, including through balancing their own research teams and perspectives (background, discipline, gender).

### General evidence ethics

Enhancing the role of evidence and the status of research within the CDRFI community will require strict application of general research ethics and professional research conduct. All CDRFI actors must put into practice the principles of doing good, doing no harm, trust, personal privacy, dignity and autonomy. This includes aspects of data collection and storage, analysis, reporting and publication of information about research subjects.

## Evidence Actions

Aside from specific actions that stakeholders will undertake to advance evidence and learning in support of the Evidence Roadmap, the CDRFI field would benefit from particular actions that underlie and support CDRFI research and MEAL. These actions include developing a common language and terminology, enhancing academic outreach towards non-academic audiences and supporting triangular evidence cooperation.

### Language and common terminology

Common language, terminology and definitions are a prerequisite to enable science-practitioner interaction and communication. CDRFI includes specific and complex concepts and keywords. Establishment of key terms and consensus towards relevant concepts between all CDRFI stakeholders is a necessary step in order to further the evidence agenda. Gender-responsive and gender-transformational language must be included in this process of consensus-building around language.

### Enhancing academic outreach

Often the academic setup includes incentives directed towards closed-group cooperation. Academic output is judged on the basis of the number of scientific publications, not necessarily the impact on policy or practice. Long peer review processes risk failing to capture critical junctures in the evidence-to-impact relationship, which might be driven by informing at crisis points or other moments of change. Academics should prepare their outputs in policy briefs and other formats without comprehension barriers for non-academic groups so as to reach out to the broader CDRFI community. English is the dominant language in the academic community, yet channelling decisive input into national debates might require making research results available in other languages.

Researchers should also strive to provide their scientific insights via open/online sources including open access journals. Teaching linked to CDRFI research also needs to be accessible, including further expansion of e-learning systems.

### Triangular evidence cooperation

Local and national-level participation in evidence action is important, including perspectives centring on legitimacy of research results but also contextualizing relevant insights with local knowledge. Evidence action in the CDRFI space should include expanded forms of cooperation including the build-up of scientific/non-scientific capacity in developing countries. Ideally, cooperation between researchers and institutions should be viewed as a true partnership with a balanced flow of resources, efforts and benefits, resulting in lasting and positive outcomes.

## Evidence Investments

Finally, the last component of the evidence framework concerns investment. As mentioned above, these three framework components – norms, action and investment – are foundational, and none more so than investment. The investments described below are catalytic and they will permit research and learning around CDRFI to flourish and enhance the sharing and uptake of that learning. These investments are intended for specific CDRFI research funding calls, for capacity strengthening around MEAL and for convening the CDRFI evidence space.

### CDRFI research funding calls

Advancing the evidence agenda will require resources and dedicated efforts. The thematic priorities discussed above give an indication of the evidence priorities that should be targeted. Donors should systematically invest in CDRFI research funding. Crucially, such investments take into account the multitude of evidence actors, including local research capacities. Funding calls should set the right incentives, for example by explicitly encouraging hybrid research/implementation projects and conditioning research funding on the inclusion of local institutions within research consortia.

### Capacity strengthening for MEAL

While they are being implemented, programmes require flexible and timely information that favours ongoing learning and the adjustment of different programme components and choices. There is currently a gap because impact evaluations – unless they incorporate mid-term studies – are often treated as stand-alone research products and not as an indispensable implementation tool by programme managers or public decision-makers.

There is generally a need for a deeper learning culture within DRF programmes. While a few donors and practitioners have robust MEAL departments, all programmes should establish mechanisms and develop capacities on the ground to generate information and knowledge from beneficiaries and practitioners, and

in cooperation with them. Given that not all CDRFI stakeholders have strong MEAL experience, there is – at least in the short-term – a capacity need within programmes and decision-making on these new MEAL requirements. A dedicated capacity strengthening facility or programme could be a central instrument for increasing the role of evidence within CDRFI activities and bridging critical gaps that currently exist including around gender and lack of public accountability in the case of several CDRFI schemes.

### Convening the CDRFI evidence space

The CDRFI evidence agenda requires collaboration between different evidence actors. Such collaboration and exchange demand dedicated platforms, energy and resources. Dedicated interaction between evidence producers and users is required to enhance joint coordination, address complementarity, allow for joint priority setting, avoid duplication and foster an open culture of failing forward (or sharing and learning from mistakes). Donor institutions need to recognize the value of evidence collaboration and invest strategically in such collaborative platforms.

### Specific Evidence Actions of the InsuResilience Global Partnership

The InsuResilience Global Partnership brings together a diverse set of CDRFI stakeholders with a common vision (InsuResilience Vision 2025). Collaboration between these stakeholders will be a key factor in responding to the CDRFI evidence priorities identified in this roadmap. Researchers, civil society and academic partners will play a central role in conducting appropriate studies, many of which may be facilitated by InsuResilience implementing programmes. They can contribute data and expertise, while in turn benefiting from the insights generated. Lastly, public-sector partners such as vulnerable country or donor governments can be important resource partners for this kind of research project.

Collectively and through its institutional 'organs' and established formats, the InsuResilience Global Partnership will undertake the following steps and specific evidence actions:

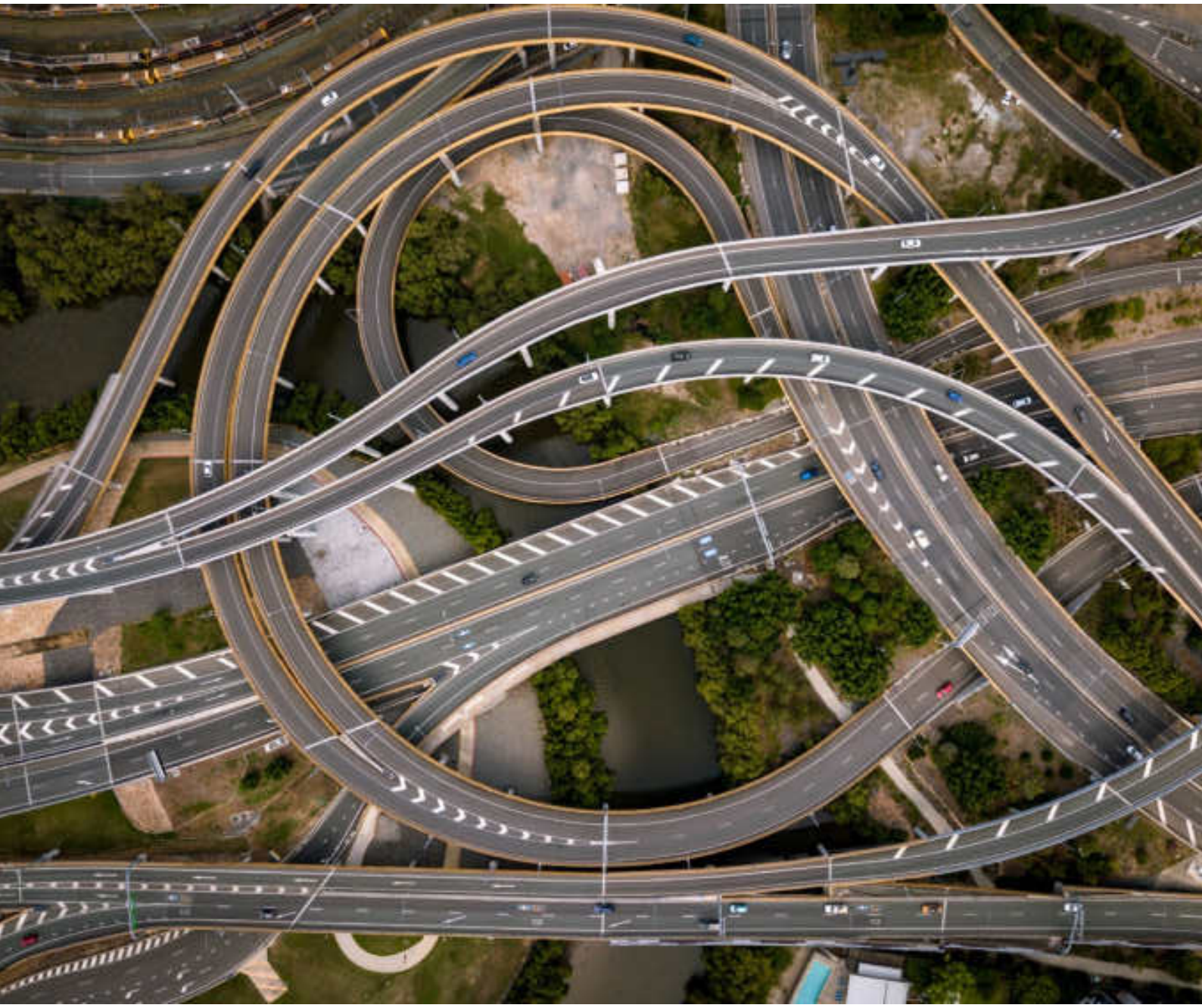
#### › Impact Working Group

This group is the Partnership's central vehicle for dialogue and action around CDRFI evidence and impact. The members include evidence actors from all IGP stakeholder groups. The Working Group supported the drafting of this Evidence Roadmap and will be the main vehicle within the Partnership for driving its implementation. The group will therefore contribute to Convening the CDRFI Evidence Space. It will further promote aspects such as the use of Language and Common Terminology and user-friendly outreach products relevant for CDRFI policy and programming (Enhancing Academic Outreach).

#### › Wider Partnership formats

The Partnership Secretariat will serve as the main interface between the Evidence Roadmap, coordinating with the Impact Working Group and other Partnership organs. Political and funding support for joint evidence actions and specific research projects will be sought from the Partnership's High-Level Consultative Group (HLCG) and individual members. The HLCG may also provide strategic guidance and set specific thematic focuses for prioritized implementation in line with broader Partnership focus topics.* Members of the Partnership's Program Alliance may provide researchers with access to programme data as a basis for conducting research. This will enhance the evidence base and concretely inform improved CDRFI programming. Other Partnership Working Groups, such as the Gender Working Group, will similarly engage closely in answering questions set out under the respective evidence themes. The Partnership's M&E system will provide annual stock-takes for progress in the implementation of the Evidence Roadmap (see Box 1 above) and uptake of research findings. Snapshots of progress will be presented to a Partnership-wide audience at the Annual Forum.

* In 2021/2022, for instance, the Partnership may focus on supporting research in the *Global Risk-Finance Action* theme, specifically with respect to evidence priorities centred on premium and capital support to risk-transfer solutions.



# Next Steps for CDRFI Evidence

Experts have highlighted 43 evidence priorities in this roadmap geared to jumpstart learning while identifying the most promising, impactful and cost-effective CDRFI approaches. However, moving the focus of the community away from pure innovation towards learning requires action: action from donors and governments, action from civil society organizations and practitioners, action from academia and researchers and action from the private sector. Building on the evidence framework of norms, actions and investments as discussed in the previous section, this section details the way forward and outlines how all CDRFI stakeholders can contribute to achieving the vision laid out in this Evidence Roadmap.

## The Way Forward

If they are going to demonstrate value and scale up CDRFI solutions effectively, all CDRFI actors need to promote, implement and advance knowledge actions in CDRFI projects and programmes along all stages of the programmatic cycle. This will contribute to systematically building up the global CDRFI knowledge base. In addition to evidence norms, actions and investments, this roadmap relies on specific action by stakeholders to realize its long-term ambitions:

### Academia

Academic stakeholders and research institutions are the primary actors for innovating scientific methods and standards, indeed the research community has contributed to much of the innovation and current knowledge in the CDRFI space. As researchers move forward, they need to communicate beyond classical disciplinary silos in order to effectively push out the CDRFI evidence frontier. Over the coming years, academic stakeholders also need to engage more intensively in academic exchange and capacity strengthening to support in-country academic expertise. Accordingly, research funders should enable research institutions to engage systematically in the topic of CDRFI evidence.

### Governments

Governments need to advance policymaking and programming by committing to the priorities and actions laid out in the Evidence Roadmap. This includes helping to objectively determine the public value of CDRFI approaches, especially macro-solutions. Committing to evidence in CDRFI requires governments to use evidence in policy design and to speak out about the types of evidence that are the most relevant to their needs.

### Implementing agencies

Adopting a truly evidence-based implementation approach that is in line with the strategic priorities of the Evidence Roadmap will require a paradigm shift within implementing agencies. Organizations need to commit to internal and cross-agency learning and constant programmatic improvements, building on evidence-based approaches. Funding agencies must enable and demand such a shift, and they should encourage and incentivize honest learning in implementation programmes.

### Private sector

As a critical stakeholder in the development and distribution of CDRFI solutions, private-sector entities must propel the shift from innovation to learning, embracing the Evidence Roadmap and its norms, actions and investments. Evidence actions help to improve benchmarking of product parameters towards the needs of users, communicate success, and enhance long-term uptake and scaling of CDRFI products.

### Civil Society Organizations (CSOs)

As the voice of potential clients, civil society actors should commit to evidence-based influence and empowerment of communities through the 'ground-truthing' of CDRFI activities. CSOs that directly contribute to CDRFI solutions should champion evidence norms, actions and investments from programme design to facilitate implementation and MEAL.

## Vision

The CDRFI Evidence Roadmap is a strategic guide to shifting the focus from innovation to learning for the broader CDRFI community. As part of this broad call to action, the InsuResilience Global Partnership and its members – including through collaborative action as part of the Impact Working Group – will act as an amplifier of learning and a pacemaker for further evidence actions in the future. This includes the implementation of specific activities and the development of guidance documents, along with the collection and showcasing of evidence actions that individual actors initiate in response to this roadmap. Working together as an evidence community, CDRFI stakeholders can build an evidence-based future where effective CDRFI solutions are logical and necessary components of policies and programmes designed to accelerate climate adaptation and strengthen the resilience of countries, communities and people exposed to climate change and natural hazards.

# References


Adam, C., & Bevan, D. (2020). Tropical cyclones and post-disaster reconstruction of public infrastructure in developing countries. Economic Modelling, 93, 82–99. https://doi.org/10.1016/j.econmod.2020.07.003

Adger, W. N., Brown, I., & Surminski, S. (2018). Advances in risk assessment for climate change adaptation policy. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *376*(2121), 20180106. https://doi.org/10.1098/rsta.2018.0106

Allen, S. & Paterson, C. (2019). Managing the financial cost of disasters: lessons for IDA from the UK government's approach to risk management of explicit contingent liabilities. Discussion paper. Centre for Disaster Protection. https://static1.squarespace.com/static/5c9d3c35ab1a62515124d7e9/t/5cac9705104c7b755efc7c18/1554814732159/Paper_2_Managing_The_Financial_Cost_of_Disasters.pdf

Baez, J. E. & Kshirsagar, V., & Skoufias, E. (2019). *Adaptive Safety Nets for Rural Africa: Drought-Sensitive Targeting with Sparse Data.* Poverty and Equity Notes 26. World Bank Group. https://openknowledge.worldbank.org/handle/10986/34301

Barrett, C. B., Ghezzi-Kopel, K., Hoddinott, J., Homami, N., Tennant, E., Upton, J. B., & Wu, T. (2021). A scoping review of the development resilience literature: Theory, methods and evidence. *World Development*, *146*, 105612. https://doi.org/10.1016/j.worlddev.2021.105612

Benami, E., & Carter, M. R. (2021). Can digital technologies reshape rural microfinance? Implications for savings, credit, & insurance. *Applied Economic Perspectives and Policy, 13151*. https://doi.org/10.1002/aepp.13151

Benami, E., Jin, Z., Carter, M. R., Ghosh, A., Hijmans, R. J., Hobbs, A., Kenduiywo, B., & Lobell, D. B. (2021). Uniting remote sensing, crop modelling and economics for agricultural risk management. *Nature Reviews Earth & Environment, 2(2),* 140–159. https://doi.org/10.1038/s43017-020-00122-y

Béné, C. (2020). Are we messing with people's resilience? Analyzing the impact of external interventions on community intrinsic resilience. *International Journal of Disaster Risk Reduction, 44*, 101431. https://doi.org/10.1016/j.ijdrr.2019.101431

BMZ, GIZ, International Finance Corporation, Women's World Banking (2017). *Mainstreaming Gender and Targeting Women in Inclusive Insurance: Perspectives and Emerging Lessons. A Compendium of Technical Notes and Case Studies*. https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/gender+at+ifc/resources/women-in-inclusive-insurance

Boucher, S., Carter, M., Flatnes, J. E., Lybbert, T., Malacarne, J., Marenya, P., & Paul, L. (2021). *Bundling stress tolerant seeds and insurance for more resilient and productive small-scale agriculture*. National Bureau of Economic Research. https://doi.org/10.3386/w29234

Boucher, S.R., Carter, M.R., Lybbert, T., Marenya, P., Malacarne, J., Paul, L. (2019). *Innovations for Resilience Two ways in Mozambique and Tanzania*. MRR Innovation Lab Insight 2019-02. https://basis.ucdavis.edu/publication/evidence-insight-innovations-drought-resilience-two-ways-mozambique-and-tanzania

Cabot Venton, C. (2013). *The economics or early response and resilience: summary of findings.* UK Department for International Development (DFID). https://www.gov.uk/research-for-development-outputs/the-economics-of-early-response-and-resilience-summary-of-findings

Cabot Venton, C. (2018). *Economics of resilience to drought in Somalia, Kenya and Ethiopia*. USAID. https://www.usaid.gov/sites/default/files/documents/1867/Summary_Economics_of_Resilience_Final_Jan_4_2018_BRANDED.pdf

Cai, J. (2016). The impact of insurance provision on household production and financial decisions. American Economic Journal: *Economic Policy, 8(2),* 44–88. https://doi.org/10.1257/pol.20130371

Cai, J., & Song, C. (2017). Do disaster experience and knowledge affect insurance take-up decisions? *Journal of Development Economics, 124,* 83–94. https://doi.org/10.1016/j.jdeveco.2016.08.007

Cai, J., Carter, M., de Janvry, A. & Sadoulet, E. (2021). *Sparking Permanent Adoption of Resilience-Building Agricultural Technologies.* MRR Innovation Lab Insight 2021-02. https://basis.ucdavis.edu/publication/evidence-insight-sparking-permanent-adoption-resilience-building-agricultural

Cai, J., de Janvry, A., & Sadoulet, E. (2015). Social networks and the decision to insure. *American Economic Journal: Applied Economics, 7(2),* 81–108. https://doi.org/10.1257/app.20130442

Cai, J., de Janvry, A., & Sadoulet, E. (2020). Subsidy policies and insurance demand. *American Economic Review, 110(8),* 2422–2453. https://doi.org/10.1257/aer.20190661

Carter, M. & Steinmetz, T. (2018). Quality Standards for Agricultural Index Insurance: An Agenda for Action, *State of Microfinance, MunichRE.* https://are.ucdavis.edu/people/faculty/michael-carter/policy-and-research-briefs/

Carter, M. R., Cheng, L., & Sarris, A. (2016). Where and how index insurance can boost the adoption of improved agricultural technologies. *Journal of Development Economics, 118, 59–71.* https://doi.org/10.1016/j.jdeveco.2015.08.008

Carter, M., de Janvry, A., Sadoulet, E., & Sarris, A. (2017). Index insurance for developing country agriculture: A reassessment. *Annual Review of Resource Economics, 9(1),* 421–438. https://doi.org/10.1146/annurev-resource-100516-053352

Casaburi, L., & Willis, J. (2018). Time versus State in Insurance: Experimental evidence from Contract Farming in Kenya. *American Economic Review, 108(12),* 3778–3813. https://doi.org/10.1257/aer.20171526

Ceballos, F., & Robles, M. (2020). Demand heterogeneity for index-based insurance: The case for flexible products. *Journal of Development Economics, 146, 102515.* https://doi.org/10.1016/j.jdeveco.2020.102515

Cissé, J. D., & Ikegami, M. (2016). Does Insurance Improve Resilience? Measuring the Impact of Index-Based Livestock Insurance on Development Resilience in Northern Kenya. http://publications.dyson.cornell.edu/grad/candidates/2016/Dyson-JenCisse-Paper.pdf

Clarke, D. & Dercon, S. (2016). *Dull Disasters? How planning ahead will make a difference*. Oxford University Press.

Clarke, D. & Hill, R.V. (2013). *Cost-Benefit Analysis of the African Risk Capacity Facility*. IFPRI Discussion Paper. https://www.ifpri.org/publication/cost-benefit-analysis-african-risk-capacity-facility

Collier, S. J., & Cox, S. (2021). Governing urban resilience: Insurance and the problematization of climate change. *Economy and Society, 50(2),* 275–296. https://doi.org/10.1080/03085147.2021.1904621

Constas, M. A., Mattioli, L., & Russo, L. (2021). What does resilience imply for development practice? Tools for more coherent programming and evaluation of resilience. *Development Policy Review, 39(4),* 588–603. https://doi.org/10.1111/dpr.12518

Coronese, M., Lamperti, F., Keller, K., Chiaromonte, F., & Roventini, A. (2019). Evidence for sharp increase in the economic damages of extreme natural disasters. *Proceedings of the National Academy of Sciences of the United States of America, 116(43)*, 21450–21455. https://doi.org/10.1073/pnas.1907826116

Davies, M., Béné, C., Arnall, A., Tanner, T., Newsham, A., & Coirolo, C. (2013). Promoting Resilient Livelihoods through Adaptive Social Protection: Lessons from 124 programmes in South Asia. *Development Policy Review, 31(1),* 27–58. https://doi.org/10.1111/j.1467-7679.2013.00600.x

Dazé, A., Farrow, T., & Ledwell, C. (2021). Opportunities for Strengthening Resilience by Integrating Climate and Disaster Risk Finance and Insurance (CDRFI) in National Adaptation Plan (NAP) Processes. https://napglobalnetwork.org/wp-content/uploads/2021/08/napgn-igp-en-2021-integrating-cdfri-in-national-adaptation-plan-processes.pdf

Demirgüç-Kunt, A., Klapper, L., Singer, D., Ansar, S., & Hess, J. (2018). *The global findex database 2017: Measuring financial inclusion and the fintech revolution*. World Bank Group. https://doi.org/10.1596/978-1-4648-1259-0

Dercon, S., Hill, R. V., Clarke, D. J., Outes-Leon, I., & Seyoum Taffesse, A. (2014). Offering rainfall insurance to informal insurance groups: Evidence from a field experiment in Ethiopia. *Journal of Development Economics, 106*, 132–143. https://doi.org/10.1016/j.jdeveco.2013.09.006

Development Initiatives (2019). *The Global Humanitarian Assistance Report 2019.* https://devinit.org/resources/global-humanitarian-assistance-report-2019/

Douxchamps, S., Debevec, L., Giordano, M., & Barron, J. (2017). Monitoring and evaluation of climate resilience for agricultural development – A review of currently available tools. World Development Perspectives, 5, 10–23. https://doi.org/10.1016/j.wdp.2017.02.001

Elabed, G., & Carter, M. (2014). Ex-ante impacts of agricultural insurance: Evidence from a field experiment in Mali. University of California at Davis. https://arefiles.ucdavis.edu/uploads/filer_public/2014/04/25/elabed-impact_evaluation_0422_vdraft2_1.pdf

Elabed. G., & Carter, M. (2015). Compound-risk aversion, ambiguity and the demand for microinsurance. Journal of Economic Behavior & Organization 118, 150-166. https://www.sciencedirect.com/science/article/abs/pii/S0167268115000694

Eriksen, S., Schipper, E. L. F., Scoville-Simonds, M., Vincent, K., Adam, H. N., Brooks, N., Harding, B., Khatri, D., Lenaerts, L., Liverman, D., Mills-Novoa, M., Mosberg, M., Movik, S., Muok, B., Nightingale, A., Ojha, H., Sygna, L., Taylor, M., Vogel, C., & West, J. J.. et al. (2021). Adaptation interventions and their effect on vulnerability in developing countries: Help, hindrance or irrelevance? World Development, 141, 105383. https://doi.org/10.1016/j.worlddev.2020.105383

Erman, A., De Vries Robbe, S. A., Thies, S. F.; Kabir, K.; & Maruo, M. (2021). *Gender Dimensions of Disaster Risk and Resilience: Existing Evidence.* World Bank Group. https://openknowledge.worldbank.org/handle/10986/35202

FAO (2018) *Horn of Africa. Impact of Early Warning Early Action. Protecting pastoralist livelihoods ahead of drought.* http://www.fao.org/emergencies/resources/documents/resources-detail/en/c/1144019/

Fernández, R., & Schäfer, L. (2018). Impact Evaluation of Climate Risk Insurance Approaches: Status Quo and Way Forward. https://collections.unu.edu/view/UNU:6699

Ford, J. D., Pearce, T., McDowell, G., Berrang-Ford, L., Sayles, J. S., & Belfer, E. (2018). Vulnerability and its discontents: The past, present, and future of climate change vulnerability research. *Climatic Change*, *151*(2), 189–203. https://doi.org/10.1007/s10584-018-2304-1

GFDRR & World Bank Group (2021). *Gender-Responsive Disaster Preparedness and Recovery in the Caribbean: Desk Review.* https://openknowledge.worldbank.org/bitstream/handle/10986/35215/Gender-Responsive-Disaster-Preparedness-and-Recovery-in-the-Caribbean-Desk-Review.pdf?sequence=1&isAllowed=y

GFDRR, IRP, World Bank Group, UN Women & the EU (2018). *Disaster Recovery Guidance Series: Gender Equality and Women's Empowerment in Disaster Recovery.* https://www.gfdrr.org/sites/default/files/publication/gender-equality-disaster-recovery.PDF

Ghosh, R. K., Gupta, S., Singh, V., & Ward, P. S. (2021). Demand for crop insurance in developing countries: New evidence from india. *Journal of Agricultural Economics, 72(1),* 293–320. https://doi.org/10.1111/1477-9552.12403

Gigerenzer, G., & Selten, R. (ed.). (2002). Bounded rationality: The adaptive toolbox. MIT Press.

Global Risk Financing Facility (GRiF) (2021). *Literature Review of Evidence on Disaster Risk Finance.* World Bank Group and GFDRR. https://www.globalriskfinancing.org/sites/default/files/2021-01/MEL%20LIt%20Review.pdf

GSMA (2021). *Connected Women: The Mobile Gender Gap Report 2021.* https://www.gsma.com/r/wp-content/uploads/2021/06/The-Mobile-Gender-Gap-Report-2021.pdf

Hallegatte, S., Vogt-Schilb, A., Bangalore, M., & Rozenberg, J. (2017). Unbreakable: Building the resilience of the poor in the face of natural disasters. World Bank Group.

Harris, C. & Jaime, C. (2019). *Thinking impact before instruments in humanitarian disaster risk financing.* Start Network, International Federation of Red Cross Red Crescent Societies, Red Cross Red Crescent Climate Centre. https://startnetwork.org/resource/1-thinking-impact-instruments-humanitarian-disaster-risk-financing

Harris, C. & Swift, L. (2019). *Disaster risk and forecast-based Financing design. A guide to using Household Economy Analysis.* Start Network. https://startnetwork.org/resource/disaster-risk-forecast-based-financing-guide-using-household-economy-analysis

Harrison, G.W., Martinez-Correa, J., Morsink, K., Ng J.M., & Swarthout, T. (2020). Compound Risk and the Welfare Consequences of Insurance. Center for the Economic Analysis of Risk, Robinson College of Business, Georgia State University. https://cear.gsu.edu/files/2020/07/WP_2020_10_Compound-Risk-and-the-Welfare-Consequences-of-Insurance_2020_1209.pdf

Harrison, G. W., & Ng, J. M. (2016). Evaluating The Expected Welfare Gain From Insurance. *Journal of Risk and Insurance, 83(1), 91–120*. https://doi.org/10.1111/jori.12142

Hill, R. V., Campero Peredo, A., & Tarazona, M. (2021). What do we know about preparing financially for disasters? An assessment of the evidence gap. Centre for Disaster Protection. https://static1.squarespace.com/static/5c9d3c35ab1a62515124d7e9/t/6095160e12b4a7370fdafde6/1620383247533/Centre_PB_Paper5_6Mayv2.pdf

Hill, R., Skoufias, E., & Maher, B. (2019). *The chronology of a disaster. A review and assessment of the value of acting early on household welfare.* World Bank Group. http://hdl.handle.net/10986/31721

Hill, R.V., Peredo, A.C. & Tarazona, M. (2021). *The impact of pre-arranged disaster finance: evidence gap assessment.* Centre for Disaster Protection. https://www.disasterprotection.org/evidence-gap-assessment

IFC, AXA, & Accenture (2015). *She for Shield: Insure Women to Better Protect All.* https://www.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/Gender+at+IFC/Resources/2015-SheforShield

Insurance Development Forum (2020). *The Development Impact of Risk Analytics.* https://www.insdevforum.org/wp-content/uploads/2020/12/IDF_Risk_Analytics_21Dec.pdf

InsuResilience & World Bank Group (2021). *A Gender Assessment of the Climate and Disaster Risk Finance and Insurance (CDRFI) in Pacific Islands Countries* (forthcoming).

InsuResilience (2021a). *Step by Step Guidance: A gender-smart approach to monitoring and evaluation (MEAL) of Climate and Disaster Risk Finance and Insurance (CDRFI) Programmes.* https://www.insuresilience.org/wp-content/uploads/2021/08/Guidance_note_gender-smart_approach_to_ME_of_CDRFI_Programmes.pdf

InsuResilience (2021b). *Policy Note: The Nexus between International Gender and Climate and Disaster Risk Finance and Insurance (CDRFI) Frameworks to support with National Action* (forthcoming).

InsuResilience (2018). *Applying a Gender Lens to Climate Risk Finance and Insurance.* https://www.insuresilience.org/wp-content/uploads/2018/11/insuresilience_applygender_181128_web.pdf

InsuResilience (2019). *Integrating Gender Considerations into Different Models of Climate Risk Insurance (CRI).* https://www.insuresilience.org/wp-content/uploads/2019/12/IntegratingGenderConsiderations.pdf

Janzen, S. A., & Carter, M. R. (2019). After the drought: The impact of microinsurance on consumption smoothing and asset protection. *American Journal of Agricultural Economics, 101(3)*, 651–671. https://doi.org/10.1093/ajae/aay061

Jarzabowski, P., Chalkias, K., Clarke, D., Iyahen, E., Stadtmueller, D. & Zwick, A. (2019). *Insurance for climate adaptation: Opportunities and limitations*. Global Center on Adaptation. http://www.insdevforum.org/wp-content/uploads/2020/08/Insurance-for-Climate-Adaptation-Opportunities-and-Limitations.pdf

Jeggle, T. & Boggero, M. (2018). *Post-Disaster Needs Assessment (PDNA): Lessons from a Decade of Experience.* World Bank Group. http://documents.worldbank.org/curated/en/481761539848031116/Post-Disaster-Needs-Assessment-PDNA-Lessons-from-a-Decade-of-Experience.

Jensen, N. D., & Barrett, C. B. (2017). Agricultural Index Insurance for Development. *Applied Economic Perspectives and Policy, 39(2),* 199–219. https://doi.org/10.1093/aepp/ppw022

Jurgilevich, A., Räsänen, A., Groundstroem, F., & Juhola, S. (2017). A systematic review of dynamics in climate risk and vulnerability assessments. *Environmental Research Letters*, *12*(1), 013002. https://doi.org/10.1088/1748-9326/aa5508

Kapp, M. B. (2006). Ethical and legal issues in research involving human subjects: do you want a piece of me? *Journal of Clinical Pathology, 59(4),* 335–339. https://doi.org/10.1136/jcp.2005.030957

Karlan, D., Osei, R., Osei-Akoto, I., & Udry, C. (2014). Agricultural decisions after relaxing credit and risk constraints. *The Quarterly Journal of Economics, 129(2),* 597–652. https://doi.org/10.1093/qje/qju002

Keating, A., & Hanger-Kopp, S. (2020). Practitioner perspectives of disaster resilience in international development. *International Journal of Disaster Risk Reduction, 42,* 101355. https://doi.org/10.1016/j.ijdrr.2019.101355

Laajaj, R. (2017). Endogenous time horizon and behavioral poverty trap: Theory and evidence from Mozambique. *Journal of Development Economics, 127,* 187–208. https://doi.org/10.1016/j.jdeveco.2017.01.006

Ling, M. A., King, S., Mapendembe, A., and Brown, C. (2018). *A review of ecosystem service valuation progress and approaches by the Member States of the European Union.* UNEP-WCMC. https://ec.europa.eu/environment/nature/capital_accounting/pdf/eu_es_valuation_review.pdf

Linnerooth-Bayer, J., Surminski, S., Bouwer, L.M., Noy, I. & Mechler, R. (2018). Insurance as a response to loss and damage?. In R. Mechler, L.M. Bouwer, T. Schinko, S. Surminski, and J. Linnerooth-Bayer (eds.), *Loss and damage from climate change. Concepts, methods and policy options.* Springer Open.

Lybbert, T. J., & Bell, A. (2010). Stochastic benefit streams, learning, and technology diffusion: Why drought tolerance is not the new bt. *AgBioForum 13(1),* 13-24. http://hdl.handle.net/10355/7074

Lybbert, T. J., & Wydick, B. (2018). Poverty, aspirations, and the economics of hope. *Economic Development and Cultural Change, 66(4),* 709–753. https://doi.org/10.1086/696968

Martinez-Diaz, L., Sidner, L. & McClamrock, J. (2019). *The Future of Disaster Risk Pooling for Developing Countries: Where Do We Go from Here?.* Working Paper. World Resources Institute. https://www.wri.org/research/future-disaster-risk-pooling-developing-countries-where-do-we-go-here

Maynard, T., & Ranger, N. (2012). What role for "long-term insurance" in adaptation? An analysis of the prospects for and pricing of multi-year insurance contracts. The Geneva Papers on Risk and Insurance-Issues and Practice, 37(2), 318-339. https://doi.org/10.1057/gpp.2012.10

McNamara, K. E., Westoby, R., & Chandra, A. (2021). Exploring climate-driven non-economic loss and damage in the Pacific Islands. *Current Opinion in Environmental Sustainability, 50,* 1–11. https://doi.org/10.1016/j.cosust.2020.07.004

Miles, K. S., & Wiedmaier-Pfister, M. (2019). Integrating Gender Considerations into Different Models of Climate Risk Insurance (CRI). https://www.insuresilience.org/wp-content/uploads/2019/12/IntegratingGenderConsiderations.pdf

Mobarak, A. M., & Rosenzweig, M. R. (2013). Informal risk sharing, index insurance, and risk taking in developing countries. *American Economic Review, 103(3),* 375–380. https://doi.org/10.1257/aer.103.3.375

Montier, E., Harris, C. & Ranger, N. (2019). *Disaster risk financing in concert: How coordinated disaster risk financing can save more lives.* London: Start Network. https://startnetwork.org/resource/disaster-risk-financing-concerthow-co-ordinated-disaster-risk-financing-can-save-more-lives

Moore, M., Riddell, D., & Vocisano, D. (2015). Scaling Out, Scaling Up, Scaling Deep: Strategies of Non-profits in Advancing Systemic Social Innovation. *Journal of Corporate* Citizenship, 58, 67–84. https://doi.org/10.9774/GLEAF.4700.2015.ju.00009

Morsink, Karlijn and Clarke, Daniel and Mapfumo, Shadreck, How to Measure Whether Index Insurance Provides Reliable Protection (July 18, 2016). World Bank Policy Research Working Paper No. 7744, Available at SSRN: https://ssrn.com/abstract=2811392

NAP Global Network & InsuResilience (2021). *Opportunities for Strengthening Resilience by Integrating Climate and Disaster Risk Finance and Insurance (CDRFI) in National Adaptation Plan (NAP) Processes.* https://www.insuresilience.org/wp-content/uploads/2021/08/napgn-igp-en-2021-integrating-cdfri-in-nap-processes.pdf

Neumayer, E., & Plümper, T. (2007). The gendered nature of natural disasters: The impact of catastrophic events on the gender gap in life expectancy, 1981–2002. *Annals of the Association of American Geographers*, *97*(3), 551–566. https://doi.org/10.1111/j.1467-8306.2007.00563.x

Oliver, K., & Boaz, A. (2019). Transforming evidence for policy and practice: creating space for new conversations. *Palgrave Communications, 5(1),* 60. https://doi.org/10.1057/s41599-019-0266-1

Panda, A., & Surminski, S. (2020*). Climate and disaster risk insurance in low income countries: Reflections on the importance of indicators and frameworks for monitoring the performance and impact of CDRI* (No. 377).; Centre for Climate Change Economics and Policy Working Paper). www.cccep.ac.uk

Rosenzweig, M. R., & Wolpin, K. I. (2000). Natural "Natural Experiments" in Economics. *Journal of Economic Literature, 38(4),* 827–874. https://doi.org/10.1257/jel.38.4.827

Schipper, E. L. F. (2020). Maladaptation: When Adaptation to Climate Change Goes Very Wrong. *One Earth, 3(4),* 409–414. https://doi.org/https://doi.org/10.1016/j.oneear.2020.09.014

Scott, Z. & Clarke, D. (2021). *Predict and protect: G7 solutions for a new approach to crisis risk financing.* Crisis Lookout. https://floodresilience.net/resources/item/predict-and-protect-g7-solutions-for-a-new-approach-to-crisis-risk-financing/

Scott, Z. (2020). *Improving constantly: embedding scrutiny and learning in disaster risk financing.* Guidance Note. Centre for Disaster Protection. http://static1.squarespace.com/static/5c9d3c35ab1a62515124d7e9/t/5fdb450d7bb8683ba29a5e80/1608205582726/Centre_DRF_Paper1_17Dec.pdf

Serfillipi, E., Carter, M., & Guirkinger, C. (2020). Insurance contracts when individuals "greatly value" certainty: Results from a field experiment in Burkina Faso. Journal of Economic Behavior & Organization 180, 731-743. https://www.sciencedirect.com/science/article/abs/pii/S0167268119302379

SHEAR – Science for Humanitarian Emergencies and Resilience (2019) *Research roadmap Forecast-based Financing.* Red Cross Red Crescent Climate Centre and German Red Cross. https://www.climatecentre.org/downloads/files/FbF%20Research%20Roadmap_April2019%20%283%29.pdf

Shirsath, P., Vyas, S., Aggarwal, P., & Rao, K. N., 2019. Designing weather index insurance of crops for the increased satisfaction of farmers, industry and the government. *Climate Risk Management,* https://www.sciencedirect.com/science/article/pii/S2212096318300998

Simpson, N. P. et al. (2021). A framework for complex climate change risk assessment. *One Earth*, *4*(4), 489–501. https://doi.org/10.1016/j.oneear.2021.03.005

Sou, G. (2019). Sustainable resilience? Disaster recovery and the marginalization of sociocultural needs and concerns. *Progress in Development Studies, 19(2),* 144–159. https://doi.org/10.1177/1464993418824192

Stoeffler, Q., Barre, T., & Carter, M. (2016). *Measuring Insurance Quality*. BASIS Brief. https://basis.ucdavis.edu/sites/g/files/dgvnsk466/files/2017-01/Measuring-Index-Insurance-Quality1.pdf

Stoeffler, Q., Carter, M., Guirkinger, C., & Gelade, W. (2020). *The Spillover impact of Index Insurance on Agricultural Investment by Cotton Farmers in Burkina Faso*. National Bureau of Economic Research Working Paper w27564. https://doi.org/10.3386/w27564

Surminski, S., Bouwer, L. M., & Linnerooth-Bayer, J. (2016). How insurance can support climate resilience. *Nature Climate Change, 6(4),* 333–334. https://doi.org/10.1038/nclimate2979

Tafere, K., Barrett, C. B., & Lentz, E. (2019). Insuring well-being? Buyer's remorse and peace of mind effects from insurance. *American Journal of Agricultural Economics, 101(3),* 627–650. https://doi.org/10.1093/ajae/aay087

Takahashi, K., Noritomo, Y, Ikegami, M., & Jensen, M. D. (2020). Understanding pastoralists' dynamic insurance uptake decisions: Evidence from four-year panel data in Ethiopia. *Food Policy*, 101910. https://doi.org/10.1016/j.foodpol.2020.101910

Tanner, T., Surminski, S., Wilkinson, E., Reid, R., Rentschler, J., & Rajput, S. (2015). The Triple Dividend of resilience: Realising development goals through the multiple benefits of disaster risk management. https://odi.org/en/publications/the-triple-dividend-of-resilience/

UN (2015). Resolution adopted by the General Assembly on 25 September 2015: *Transforming our world: the 2030 Agenda for Sustainable Development.* https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E

UN (2016). *Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction.* https://www.preventionweb.net/files/50683_oiewgreportenglish.pdf

UN (2017). Resolution adopted by the General Assembly on 2 February 2017 on 71/276. *Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction*. https://www.preventionweb.net/files/resolutions/N1702972_en.pdf

UN Women (2020). *Review of Gender-Responsiveness and Disability-Inclusion in Disaster Risk Reduction in Asia and the Pacific.* https://asiapacific.unwomen.org/-/media/field%20office%20eseasia/docs/publications/2020/10/ap-drr-sendai-report-final-s.pdf?la=en&vs=3742

Vasilaky, K., Diro, R., Norton, M., McCarney, G., & Osgood, D. (2020). Can education unlock scale? The demand impact of educational games on a large-scale unsubsidised index insurance programme in Ethiopia. *The Journal of Development Studies, 56(2),* 361–383. https://doi.org/10.1080/00220388.2018.1554207

Ward, P., Spielman, D. J., Ortega, D., Kumar, N., & Minocha, S. (2015). Demand for complementary financial and technological tools for managing drought risk, *Economic Development and Cultural Change* 68 (2), 607-653. http://dx.doi.org/10.2139/ssrn.2591563

Weingärtner, L., Pforr, T. & Wilkinson, E. (2020) *The evidence base on anticipatory action.* World Food Programme. https://www.wfp.org/publications/evidence-base-anticipatory-action

Wilkinson, E., Weingärtner, L., Choularton, R., Bailey, M., Todd, M., Kniveton, D. & Cabot Venton, C. (2017). *Forecasting hazards, averting disasters. Implementing forecast-based early action at scale*. ODI. https://odi.org/en/publications/forecasting-hazards-averting-disasters-implementing-forecast-based-early-action-at-scale/

World Bank Group (2018). *Disaster risk insurance: A primer. Core principles and operational framework.* World Bank Group. https://www.financialprotectionforum.org/publication/disaster-risk-finance-a-primercore-principles-and-operational-framework

World Bank Group (2017). Sovereign catastrophe risk pools (English): A brief for policymakers. http://documents.worldbank.org/curated/en/603121502870773583/A-brief-for-policy-makers

World Bank Group (2021a). 'The Impacts of Disaster Risk on Sovereign Asset and Liability Management'. Equitable Growth, Finance and Institutions Insight. https://openknowledge.worldbank.org/handle/10986/36256

World Bank Group (2021b). *Women Business and the Law 2021.* https://www.worldbank.org/content/dam/sites/wbl/documents/2021/02/WBL2021_ENG_v2.pdf

Zennaro, F., Furlan, E., Simeoni, C., Torresan, S., Aslan, S., Critto, A., & Marcomini, A. (2021). Exploring machine learning potential for climate change risk assessment. *Earth-Science Reviews*, *220*, 103752. https://doi.org/10.1016/j.earscirev.2021.103752

**Published by**
**Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH**

**Registered office**
Bonn and Eschborn, Germany

**Editors**
Munich Climate Insurance Initiative:
Jennifer Denno Cissé, Sönke Kreft
InsuResilience Secretariat:
Janek Toepper, Daniel Stadtmueller

**Copy Editing**
Katrin Kohl

**InsuResilience Secretariat**
Friedrich-Ebert-Allee 32+36
53113 Bonn, Germany
secretariat@insuresilience.org
www.insuresilience.org

As of October 2021

**Design and layout**
kippconcept gmbh, Bonn

**Photo Credits**
**GIZ:** Thomas Imo (p. 30);
**unsplash.com:** Brandon Nelson (Cover);
Vidar Nordli-Mathisen (p. 10); Defika Hendri (p. 15);
Seungwon Choo (p. 20); NASA (p. 23); Amol Sonar (p. 28);
Brian McGowan (p. 32); Nandhu Kumar (p. 37);
Cytonn Photography (P. 41); John Lockwood (p. 45);
Misbahul Aulia (p. 34); **iStock:** TISHA85 (p. 16);
Dennis Diatel Photography (p. 26)