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THE ROLE OF INSURANCE IN INTEGRATED DISASTER & CLIMATE RISK MANAGEMENT: EVIDENCE AND LESSONS LEARNED

REPORT NO. 22

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Felicity Le Quesne, Jennifer Tollmann, Matthias Range, Kehinde Balogun, Michael Zissener, Daniela Bohl, Maxime Souvignet, Sandra Schuster, Sabrina Zwick, Jennifer Phillips, Branko Wehnert and Soenke Kreft

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http://www.climate-insurance.org/projects/advancing-climate-risk-insurance-acri/

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Acronyms

ACRI+	Advancing Climate Risk Insurance Plus
ARC	African Risk Capacity
BMUB	Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (Germany)
CADENA	El Comité de Ayuda a Desastres y Emergencias Nacionales (Mexico)
CAT DDO	Catastrophe Deferred Drawdown Option
CCRIF	Caribbean Catastrophe Risk Insurance Facility
DRFI	Disaster Risk Financing Instrument
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EENIP	Extreme El Nino Insurance Product
ERVO	Early Recovery Vouchers
FONDEN	El Fondo Nacional para el Desarrollo Nacional (Mexico)
GDP	Gross Domestic Product
GIZ GmbH	Deutsche Gesellschaft für Internationale Zusammenarbeit
HSNP	Hunger Safety Net Programme (Kenya)
IBLIP	Index-Based Livestock Insurance Project (Mongolia)
IBRD	International Bank for Reconstruction and Development
ICRM	Integrated Climate Risk Management
IMF	International Monetary Fund
INGO	International Non-Governmental Organisation
MCII	Munich Climate Insurance Initiative
MFI	Microfinance Institution
MiCRO	Micro-insurance Catastrophe Risk Organisation
NGO	Non-Governmental Organisation
PCRAFI	Pacific Catastrophe Risk Assessment and Financing Initiative
PIC	Pacific Island Country
RCT	Randomised Controlled Trial
SME	Small and Medium Enterprise
SST	Sea Surface Temperature
WFP	World Food Programme

Abstract

Insurance has an important role to play in disaster and climate risk management. This role is well-recognised in terms of response and recovery, where the rapid and predictable pay-out and resulting effect of smoothing of the fiscal impacts of shocks can be highly valuable. More recently, there has been increased emphasis on the question of whether, and how, insurance can contribute to the management of residual risk, risk preparedness and risk prevention?

However, insurance is no panacea. Its contribution to risk reduction and resilience depends upon the quality of the insurance tool and whether it has been designed to respond efficiently to the needs of the policyholder(s) or final beneficiaries. It is not a cost-effective approach for managing all types of risk. If designed poorly or targeted inappropriately, insurance may not contribute meaningfully to risk reduction or greater resilience in all cases. Indeed, in some cases poorly-thought-through insurance schemes may result in increasing vulnerability and/or exposure.

Therefore, it is essential that insurance is incorporated within an integrated approach to disaster and climate risk management, where its role in relation to each element of risk management is determined through risk assessment and identification of risk layers. Furthermore, strategies to manage risk such as insurance should be combined with efforts to reduce the drivers of risk; this is particularly important for building resilience among the poor.

This paper reviews the empirical evidence relating to when and how insurance can contribute to disaster and climate risk management. Aspects explored include the contribution of insurance to relating to, or even creating the macro-conditions for, resilience to disasters in terms of public finance, economic growth and good governance; the contribution of insurance to risk prevention, preparedness, response and recovery; and the factors that influence the provision of insurance by companies and governments, and uptake of insurance by governments and households. Findings and conclusions from the empirical review are provided, and links are drawn with the key concepts of risk layering and Integrated Climate Risk Management (ICRM).

1. Introduction

There has been a dramatic increase in the economic cost of environmentally induced disasters, from around $25 billion per year in the 1980s to $175 billion in 2016 (Baur and Parker, 2015; Munich Re, 2017). Multiple concurrent trends in the last century such as climate change, population growth and globalisation of supply chains are driving increases in exposure and vulnerability to climate-related disasters at a global level.

Previously, approaches to managing these disasters had focused almost exclusively on response and were detached in theory and practice from activities that influenced societal vulnerability and exposure. More recently, these approaches have been replaced by a more integrated view also including climate risk. Integrated approaches call for comprehensively addressing the various dimensions associated with risk emergence, risk management and the manifestation of disasters.

The Advancing Climate Risk Insurance Plus project[1] is demonstrating the relevance of such an integrated approach, called Integrated Climate Risk Management, across different sectors, scales and contexts. ACRI+ is supporting capacity-building, awareness-raising and institutional-strengthening in the diverse settings of the renewable sector in Barbados, the small and medium enterprise (SME) sector in Morocco, the agricultural sector in Ghana and in the urban development context in China. The project develops solutions for each context based upon a comprehensive risk analysis and the resulting appreciation of the gaps in capacity, resources and knowledge that could allow natural hazards to become disasters. For instance, in Morocco ACRI+ is targeting SMEs due to their critical role in the country's economic development

1 ACRI+ is implemented by MCII and GIZ and financed by BMUB and is part of the Promoting Integrated Mechanisms for Climate Risk Management and Transfer programme (ICRM), implemented by GIZ.


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and their vulnerability to environmentally induced disasters and climate change. The project is promoting a package of different measures, including support for climate adaptation measures based on a detailed assessment of supply-chain vulnerability, risk awareness through communication tools and dialogue processes, and training for the private sector on adaptation to climate change. Climate risk insurance fits within this broader package and is being introduced for risks with low frequency and high intensity, in line with a risk layering approach.

Insurance is now widely recognised as an important tool for developed as well as developing countries when implementing an integrated disaster and climate risk management approach (the focus of this paper being on developing countries). The role of insurance is recognised in the Sendai Framework for Disaster Risk Reduction and has emerged as an important topic in global policy conversations – for instance, the 5th Global Platform for Disaster Risk Reduction (DRR) in May 2017 included a Special Session on Risk Transfer and Insurance. The insurance industry has been highly active in these conversations, including through industry-led think-tanks such as the Geneva Association and multi-stakeholder platforms such as the Insurance Development Forum. Additional perspectives and experiences are offered by donors, NGOs and academia.

The significant visibility and anticipation associated with disaster and climate risk insurance has not yet been matched by sufficient empirical evidence on what works and what does not – and indeed, what criteria to apply when incorporating insurance within disaster and climate risk strategies. This is partly a reflection of the emergent nature of many of the relevant initiatives, where insufficient time has passed to allow for robust evaluation.

This paper is a timely effort to assess the state of empirical evidence and analyses relating to whether, how and in which circumstances insurance can contribute to integrated disaster and climate risk management.

The main research question addressed in this paper is: "What have we learned from disaster and climate risk insurance approaches that could provide lessons learned and good practices for the integration of insurance into comprehensive risk management approaches in developing countries?" The question was approached first through a literature review, with the literature retrieved from various journals. In addition, grey literature from organisations and direct submissions by members of the organising team for the Special Session on Risk Transfer and Insurance at the 5th Global Platform for DRR were incorporated into this study.

The paper is aimed at individuals or institutions who are interested in learning more about climate risk insurance, potentially taking into account their own programming, investment needs or policy decisions. The readership is expected to be primarily individuals from a development or climate change background who want to understand more about insurance. It will also be useful to those from an insurance background seeking to understand the state of discussion relating to the industry's role in integrated disaster and climate risk management.

The paper is structured as follows: Section 2 describes some of the key characteristics of insurance and provides the background for the rest of the paper; Section 3 discusses evidence on how insurance contributes to integrated disaster and climate risk management, focusing on the dynamics at the macro-economic and political levels, and the themes of prevention, preparedness, response and recovery (Section 3 also covers some of the challenges that may constrain the ability of insurance to contribute to risk management and risk reduction); Section 4 explores factors affecting the uptake of insurance from the perspective of insurers, governments and individuals; and Section 5 considers best practices, trade-offs and key considerations when incorporating insurance into an integrated disaster and climate risk management approach – this includes risk layering, policy trade-offs and the need to consider the drivers of risk in parallel to the management of risk.

2. Linking risk transfer with disaster risk management: conceptual framework

This section describes the conceptual framework for integrated disaster and climate risk management that will be referred to in this paper. It also reviews some important concepts and characteristics that help in understanding different types of insurance schemes. The topics covered are:

- → Integrated disaster and climate risk management
- → Characteristics of insurance

Integrated disaster and climate risk management

Disaster Risk Management (DRM) is the application of disaster risk reduction policies and strategies to prevent new disaster risks, the reduction of existing disaster risks and the management of residual risk, thereby contributing to the strengthening of resilience and the reduction of losses from disaster (United Nations GA, 2016).

Disasters are defined by UNISDR as a "… serious disruption of the functioning of a community or society … causing losses and impacts that exceed the community or society's ability to cope using its own resources …".[2] The main idea behind DRM is to focus on managing the risks that turn hazards into disasters. Over the last two decades, it has come to replace the previous paradigm of disaster and emergen-

2 See https://www.unisdr.org/we/inform/terminology; http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/what-is-a-disaster/

cy management, which focused on the management of disaster events as opposed to the risk of their occurrence (IPCC, 2012).

DRM is typically understood as comprising a number of areas:

- Prevention of disasters and of new disaster risks
- Management of the remaining ('residual') risk
- Preparedness for inevitable disaster impact
- Response to a disaster in order to protect people and assets and mitigate losses
- Rebuilding and reconstructing the affected area in line with the principle of "building back better"

It is widely accepted that the risk management process should be continuous and embedded within broader development policymaking and activities (GIZ, 2016; Taylor, 2016; UNISDR, 2015). Integrated approaches to disaster and climate risk management see the various components of DRM mentioned above as overlapping. Their relationship is not linear, in that the components do not flow directly into one another and may occur in parallel.

Integrated approaches also emphasise the links between disaster and climate risk management and the broader processes of resilience building, climate adaptation and sustainable development.

Figure 1 (p.15) depicts one way of conceptualising integrated disaster and climate risk management. It refers to the Integrated Climate Risk Management approach developed by GIZ and MCII through the ACRI+ project. The outer circle shows the five areas of DRM. The middle circle provides more detail on the areas of the DRM cycle and the main inputs at each stage. Resilience, in the centre, represents a cross-cutting aspect that contributes to and benefits from the achievement of integrated disaster and climate risk management.

Figure 1 (p.15) mentions ex ante and ex post finance. Respectively, these terms refer to measures implemented prior to and subsequent to a disaster occurring. Examples of ex ante measures are accumulated reserves, precautionary savings, contingent credit, and risk transfer approaches such as insurance. Examples of ex post measures are budget re-allocations, loan conversions and borrowing. In general, ex ante mechanisms are recognised as having a distinct advantage over ex post financing measures in that they can support disaster risk reduction and prevention, as opposed to just recovery and response (UNISDR, 2015b).

Ex ante financing can help to manage residual risk as well as finance risk prevention measures. Residual risk is inevitable, as it is neither cost-effective nor technologically feasible to eliminate all risks. The question of what type and degree of risk should be prevented or reduced, as opposed to retained and managed, is influenced by both objective conditions such as technological capacity and by subjective decisions relating to what is an acceptable level and type of risk for a society to face (United Nations GA, 2016). In the context of climate change and widespread climate variability, new forms and degrees of risk are continuously emerging, which are difficult to predict in many cases. The management of residual risk relates closely to the terminology of loss and damage adopted by the United Nations Framework Convention on Climate Change.

Risk transfer is a form of ex ante financing that involves shifting risk to a third party, and in doing so reduces the financial exposure of enterprises, individuals and governments. In the case of formal insurance mechanisms, risk is ceded to an insurance or reinsurance company in exchange for a premium payment.

The role of risk transfer and insurance in DRM has typically focused on the response and recovery stages. However, more recently attention has focused on possible contributions of risk transfer and insurance to the risk prevention and preparedness

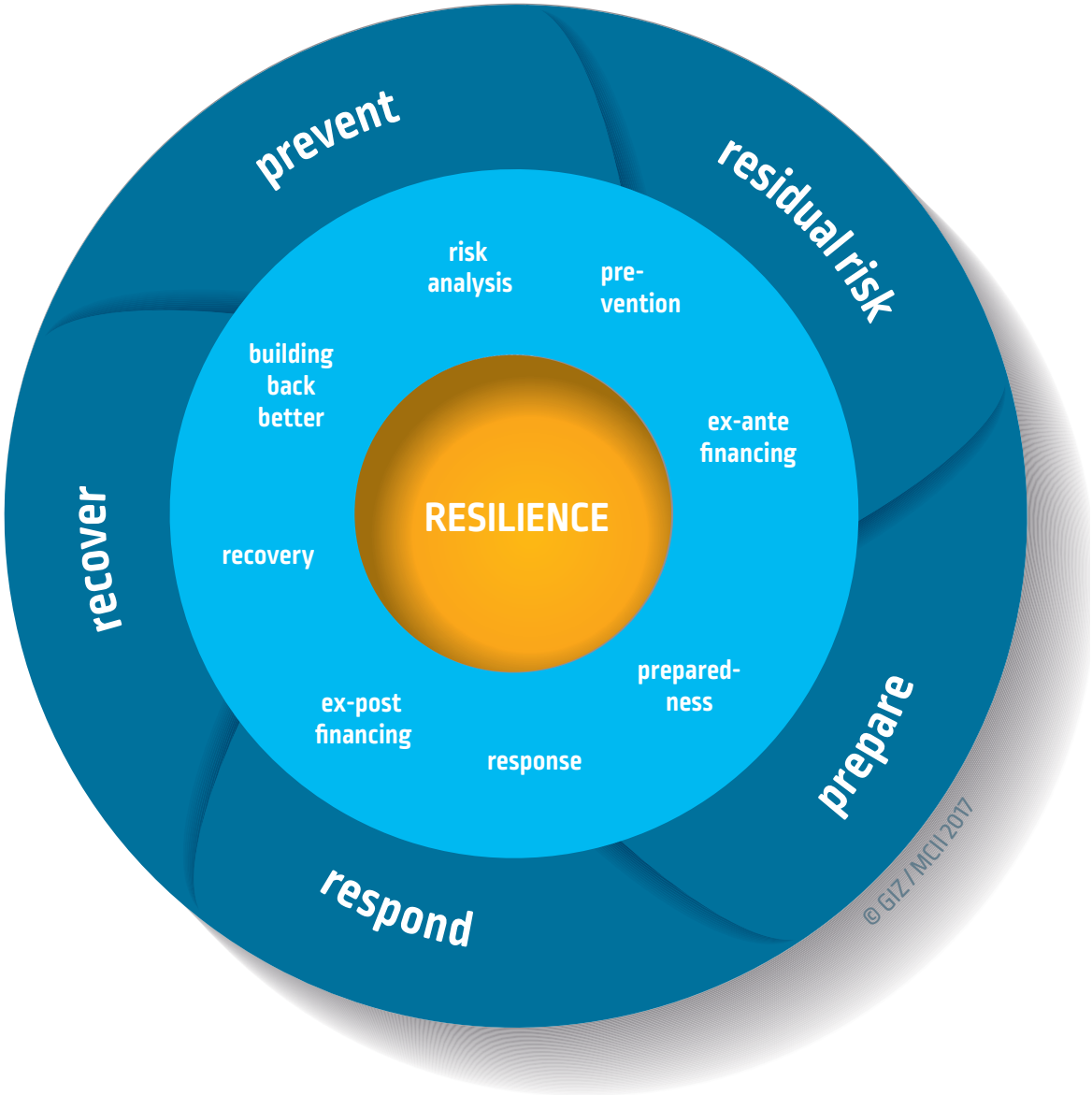

Figure 1: Integrated climate and disaster risk management (GIZ/MCII 2017)

stages, as well as the management of residual risk, risk reduction and resilience building strategies. ACRI+, for example, works with local stakeholders to consider the role that insurance can play in relation to the different areas of DRM – which is anticipated to not only strengthen DRM but also improve the effectiveness of insurance as a tool for building societal resilience to disasters.

Characteristics of insurance

This section explains some of the main characteristics of insurance products. Understanding the variation across these characteristics is important for appreciating the role of insurance in an integrated disaster and climate risk approach. Detailed information about the main types of insurance products is presented in Annex 1.

Who provides insurance?

Insurance typically relies on the involvement of the public and private sectors in both developed and developing countries. The division of responsibilities between the public and private sectors will, however, vary according to context.

Private insurance is widely available in developed countries but is limited or absent in many developing countries for a range of reasons influenced by insurability and commercial viability. In general, the presence of an insurance industry depends upon the existence of an enabling policy, and regulatory and legal environment. Governments have a critical role to play in establishing this environment and addressing any market and regulatory imperfections such as information asymmetries and low-level risk awareness among individuals (Mahul and Stutley, 2010).

In addition to creating enabling conditions, governments may need to take the lead in addressing systemic risk, seeking the necessary support to engage with international reinsurance markets, establishing multi-country and regional risk pooling initiatives and delivering pro-poor insurance solutions (Schaefer and Waters, 2016). Many successful insurance schemes are built on public-private partnerships. INGOs, NGOs, cooperatives, mutuals, multilateral and bilateral organisations and development banks are also prominent actors in risk insurance – see Golnaraghi and Khalil (2017) for an assessment of the stakeholder landscape in climate risk management.

With governments playing a central role, over the last decade a number of multilateral initiatives have been created to raise awareness and facilitate the implementation of climate risk management capacities at international, regional and local levels (Golnaraghi and others, 2016).

Subsidisation is a key issue for insurance. In general, subsidisation rates are higher in high-income countries than middle- and low-income countries. However, evidence from high-income countries does not suggest that subsidies are a precondition for high insurance penetration, as countries which have strong traditions of unsubsidised named peril crop insurance and livestock insurance, such as Argentina and Germany, show high levels of penetration (Mahul and Stutley, 2010).

Rates of subsidisation vary greatly between different types of insurance products – tending to be higher for index-based schemes – as well as between different countries and sectors.

Research in this area appears to have focused mainly on agricultural insurance schemes. Mahul and Stutley (2010) review agricultural insurance schemes in 65 countries (developed and developing), and find that almost two-thirds provide substantial premium subsidies. In their review of 39 agricultural insurance schemes operating in developing countries, Hess and Hazell (2016) show that of the index-based options,

subsidisation is lowest in contract farming and input supplier schemes, and highest in credit-linked, direct and safety-net insurance schemes. Subsidisation rates in the latter scheme are 80 per cent on average.

While subsidisation rates are generally lower in middle- and low-income countries, there are exceptions: the few agricultural index-based schemes in middle- and low-income countries which have achieved implementation on a large scale have done so only through heavy subsidisation. In India, nearly one quarter of agricultural households participate in index insurance markets, and government subsidies account for 60-75 per cent of premium costs (Isakson, 2015).

Subsidisation is also an important topic in the case of macro-insurance: one report on the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI) stated that a $30 million to $40 million donor contribution would be required to continue and extend the programme for five years or more (Pacific Islands Forum Secretariat, 2014).

Who is being insured?

One way to categorise types of insured parties is to focus on geographical scale. The following categories are adapted from Schaefer and others (2016), drawing also on ACT (2016), UNFCCC (2008) and Warner and others (2013).

- **Micro-level insurance** is provided to individuals, households and SMEs. Policies are bought at the local level from a variety of types of institution, and pay-outs are received directly by policyholders. Micro-insurance schemes are extremely diverse – indeed, one of the purported advantages of micro-insurance is the potential to tailor insurance products to meet the needs of individuals, including the poor. Compared to other disaster response mechanisms operating at the micro level, a key distinguishing feature of micro-insurance is that individual policyholders are legally entitled to compensation instead of being suppliants.

- **Meso-level insurance** operates through meso-level institutions including local authorities, regional financial institutions, associations and cooperatives. It typically involves a reinsurer making pay-outs to these institutions, which then go on to distribute services to individuals. Meso-level institutions are able to aggregate risk, whereby the diversification of risk profiles and economies of scale allow for reduced premium costs. For insurance companies, this approach provides them with access to a pre-established network. From the perspective of beneficiaries, the established presence of policyholders in the local area improves their chances of receiving pay-outs relatively quickly. Meso-insurance schemes demand significant capacity from the policyholders – particularly in terms of financial literacy and operational ability.

- **Macro-level insurance** is provided to governments, either as sovereign entities or through multinational risk pools. A potential advantage of macro-level schemes is that they can reach a large number of people within a short period of time, depending on the mechanism used for transferring the pay-out to the final beneficiaries and the quality of fiduciary management. The same benefits of risk aggregation described for meso-insurance are also relevant to macro-level insurance, whether operating within a single country or in the form of multi-country risk pool. Indeed, a key reason behind the creation of existing multi-country risk pools in the Caribbean, Pacific and Africa was to help member governments access reinsurance markets by packaging their risk with that of others, hence presenting a more appealing offering to the private sector. Risk pooling can open up opportunities for innovative financial products that might not be available otherwise – for instance, the $20 million swap between the International Bank for Reconstruction and Development

(IBRD) and the Caribbean Catastrophe Risk Insurance Facility (CCRIF) was the first transaction to enable developing countries to use a derivative transaction to access the capital market to insure against environmentally induced disasters (Ghesquiere, 2007). However, risk pools come with substantial technical demands. Furthermore, capacity-building is likely to be necessary with governments and other key stakeholders in many vulnerable countries. Given these prerequisites, it is important to bear in mind that financial transactions at this scale are not always an appropriate solution for managing and reducing risk in all cases.

What are the main characteristics of insurance schemes?

There is a wide variety of items that can insure against climate risk, and an insurance scheme may cover single or multiple perils. Agricultural micro-insurance schemes, for instance, can be applied to crops, livestock, credit, inputs, revenue, bloodstock, forestry and greenhouses (Hess and Hazell, 2016). At the other end of the scale, multinational risk pools are most commonly associated with weather insurance (e.g. droughts, typhoons, floods), although not exclusively. For instance, the African Risk Capacity (ARC) is intending to market outbreak and epidemic insurance from 2018[3] (though ARC is not the first to develop these types of insurance product – Munich Re and Swiss Re have already done so).

A related question is how losses in the selected area are valued? Common approaches are based upon foregone income, asset values or expenditure. Each choice could result in a variety of outcomes and strongly affect the impacts of the insurance scheme for the policyholder (see discussion about Chantarat and others [2017] in Section 3).

Insurance pay-outs can be in cash or in kind, and can be delivered through a wide variety of distribution channels, including safety-net schemes, financial institutions, cooperatives, organisations/employers, mobile networks, utilities, post offices, healthcare providers, retailers and directly. For agricultural insurance, contract farming is another option (Hess and Hazell, 2016; Merry and others, 2014).

Insurance schemes can be structured in various ways, with a key variable being the type of pay-out mechanism. Two of the most prominent types of insurance schemes are described in Box 1 (see p.19).

As indemnity and index insurance are currently the most common types of schemes with significant potential for scaling-up, they are the focus of this paper. However, there are other types of insurance schemes, including the following:

- Alternative risk transfer tools such as catastrophe bonds and sidecars transfer risks or portions of risks to capital markets. While the World Bank is supporting some developing countries in exploring catastrophe (CAT) bonds, their use is very limited – in terms of the significant demands of human, technical and financial capacity.
- Hybrid tools combine insurance with other types of policies or approaches – for instance, Early Recovery Vouchers (ERVOs) provide eligible households with an insurance policy but can be conditional on those households participating in risk reduction and resilience building measures. These types of scheme are being piloted at various scales in China, Peru, Mexico and other countries.

3 See http://www.africanriskcapacity.org/2016/10/31/outbreak-epidemic/

BOX 1. INDEMNITY AND INDEX INSURANCE

Indemnity insurance involves calculating the value of a claim by measuring the degree of damage to the insured asset soon after the event occurs. Indemnity insurance is widely used in established insurance markets of developed countries and covers a range of perils, either through single-peril or multi-peril schemes. There are fewer examples in developing countries.

Index insurance is where the pay-out is determined by what is a proxy (index) rather than the actual damage to the asset. Indexes may be direct, such as a livestock mortality index, or indirect, such as a weather or area-yield index. Index insurance is prominent in developing countries – mainly for flood, drought and earthquake risk, and rainfall variability risk, at the meso and macro levels, but increasingly at the micro level too (Hess and Hazell, 2016; Mahul and Stutley, 2016). Two of the largest index insurance schemes in the world are the Chinese Agricultural Scheme and India's National Agricultural Insurance Scheme, which cover around 160 million and 15.9 million policyholders respectively (Hess and Hazell, 2016). The characteristics of index insurance make it particularly suitable for contexts where technical capacity is limited and where there are scarce alternatives for mitigating the impacts of disasters. Compared to indemnity-based schemes, index-based insurance can have lower transaction costs and quicker payments. This is due to the fact that pay-outs are no longer based on individual loss assessments but can be disbursed based on a trigger signal which is provided by a certain predefined risk passing a predefined threshold. However, index insurance suffers from the problem of basis risk – which is the risk of the pay-out differing from the actual value of the loss incurred, due to its derivation from a model rather than an actual assessment.

3. The role of insurance within disaster and climate risk management: review of evidence

As described in Section 2, integrated approaches to climate and disaster risk management encompass the analysis, reduction and transfer of disaster risk as well as strengthening preparedness, recovery and response mechanisms (GIZ, 2016).

This section reviews the evidence relating to whether, how and under what conditions insurance can contribute to the various components of integrated approaches. It covers the following topics:

- → Macro-level dynamics: public finance, economic growth and good governance
- → The relationship between insurance, prevention and preparedness
- → The relationship between insurance, response and recovery
- → Challenges to implementing insurance in a manner that contributes to integrated disaster and climate risk management

3.1 Macro-level dynamics

Public finance and economic growth

Disasters caused by natural hazards can place significant pressure upon public finances, with major fiscal implications in the short-term and wider long-term implications for development. Risk transfer offers the possibility of not only easing the immediate fiscal burden, but also reducing or avoiding long-term costs to public financial stability, economic growth and human development. Should a disaster occur, the insurance pay-out frees up public resources that would have otherwise been channelled towards response and recovery for other productive investments or further risk-reducing efforts (FSD Africa and CENTRI, 2017).

Paying regular premiums before a disaster occurs enables a policyholder to avoid or reduce ad hoc expenditure in a highly volatile post-disaster environment. This has been shown to have beneficial consequences for budget planning at the household, enterprise and government level, as demonstrated by the research of Baur and Parker (2015) with regards to the economic impacts of disasters, and insurance, upon the public finances of Uruguay. In 2012 Uruguay was pushed into a deficit when a drought forced the government to purchase electricity on the international spot market. In order to reduce its future exposure, and hence a major source of annual budget uncertainty, the state-owned hydro-electric power company entered into a weather and oil price risk transaction. The scheme used rainfall data and oil prices for settlement and compensated for the combined risk of drought conditions and energy price increases. The World Bank facilitated the $450 million transaction, working with the global reinsurance market.

However, evidence is not conclusive on the cost-effectiveness of regular premium payments compared with other DRFI options over the medium to long term. This is partly due to the difficulty of obtaining a counterfactual. Premiums have a significant opportunity cost which is influenced significantly by contextual factors – and depending on that cost (whether objectively verified or perceived), other DRFIs may be more attractive and potentially more appropriate than insurance.

Some research suggests that insured losses can not only help in avoiding harm to economic growth, but can also have actual positive effects for GDP growth in the medium-term by deploying long-term capital into the real economy (Von Peter and others, 2012).[4] In general, the presence of an insurance industry can facilitate economic development by reducing interest rates (through lowering default probabilities and making investments with long-term horizons), and modifying the level and allocation of individual and aggregate savings, leading to a more optimal allocation of capital (ILO, 2016).

However, it should be noted that economic growth does not necessarily correlate with reduced exposure to disasters. Indeed, disaster losses represent an increasing burden on economies and public finances in both developed and developing countries. At the global level there is a trend towards more risk taking: between 1970 and 2010 the global population grew by 87 per cent, but the population living in cyclone-prone coastlines grew by 192 per cent. Exposure of GDP to tropical cyclones increased from 3.6 per cent to 4.3 per cent over the same period (Benson and Clay, 2004; Hallegatte, 2013).

Analysis shows that while higher incomes mean greater ability to invest in measures to prepare for and safeguard against disasters, they are also linked to more risk-taking behaviour. Kellenberg and Mobarak (2007) suggest that 'peak exposure' comes in the GDP per capita range of $4,000-$7,000, where households have sufficient income to pursue more risky income generation activities but do not have a sufficiently high willingness to pay for investments in protection and mitigation. This underscores the importance of an integrated approach to

4 GDP growth measures flows (investment for reconstruction) not stocks (destruction of physical capital). GDP growth is not intended to be an indicator for wellbeing – the research recognises that disasters invariably diminish the wellbeing of the affected population even if growth rebounds (Von Peter and others, 2012).

risk management, where resilience and risk reduction are perceived as crosscutting elements and objectives.

Good governance

There is evidence to suggest that being party to an insurance contract can spur transformation in the way that countries manage risk (Schaefer and Waters, 2016). This can occur by encouraging risk reduction, catalysing risk assessment, and driving more structured decision-making processes around the management of ex ante risk, and potentially improving the quality and efficiency of disaster risk governance. These perspectives highlight the critical role that public financial management and public policy play in delivering effective risk reduction and risk management beyond the financing instruments themselves.

This is an area of scarce research: despite apparent potential, there is very limited empirical evidence of an operational link between risk transfer and risk reduction (Schaefer and Waters, 2016; Surminski and Oramas-Dorta, 2014). While the arguments and findings below represent significant early findings, there are many unanswered questions. For instance, it is not clear under what conditions insurance will contribute to risk reduction at the macro level, as opposed to either making little impact or even incentivising risk-creating behaviour such as moral hazard?

Dercon and Clarke (2016) observe that, in the case of sovereign disaster risk insurance, it is not necessarily the insurance products themselves that catalyse improvements in DRM, but rather the associated requirement for the insured government to be in accordance with the principles and processes of insurance. One example could be the way in which, by observing this requirement, governments have to change the way they respond to the incentives that voters tend to provide to politicians in relation to disasters, which can be suboptimal in terms of good governance. Research shows that voters punish politicians for the occurrence of disasters caused by natural hazards but reward them for the allocation of post-disaster aid (Boudreau, 2016; Clarke and others, 2015). For instance, Fuchs and Rodriguez-Chamussy (2014) analyse the impact of insurance pay-outs on voter behaviour in Mexico's 2006 presidential election, and estimate that the incumbent party garnered 8 per cent more votes in places where indemnity payments had been made prior to the election.

In such cases, voting behaviour creates suboptimal incentives for politicians – specifically to find ways to channel funds that benefit their own voting record but may not be in the interests of disaster risk reduction. Insurance can address these incentives by getting parties – including governments – to commit ex ante to a set of rules and procedures that will be followed in the case that a disaster caused by a natural hazard occurs. This gives politicians less room to manoeuvre, creates a standard against which non-compliant behaviour can be measured and provides more clarity to the public about what to expect.

Insurance solutions can make disaster and climate risk more transparent (UNISDR, 2015b), as rules and transparency compel the government to behave in a certain way or be punished by voters. More generally, they can provide a way for governments to commit to systems and rules for spending money, take measures against fraud and leakage and consolidate public policymaking. These impacts are particularly significant in situations of weak functionality and credibility of national relief and public financial institutions.

Dercon and Clarke (2016) argue that the "credible pre-disaster planning" required by some insurance contracts could transform the efficacy and impact of disaster response by removing ambiguity about who owns the risk, who needs to respond, and how it is financed. They refer to Mexico's Fund for National Disasters (FONDEN) as an example of a rules-

based system where the roles and actions of the federal government, state governments and the private sector are all agreed in advance.

Boudreau (2016) provides preliminary evidence suggesting that FONDEN has disciplined politicians in light of the incentives provided by voters. In their assessment of Mexico's CADENA programme (the Ministry of Agriculture's catastrophic fund), De Janvry and others (2016) argue that, by design, the programme disciplines the responses of state governments to weather shocks.

General criteria of good governance are likely to influence the impact of risk upon DRM and risk reduction. These criteria include transparency, accountability, responsiveness, rule of law, and the degree and nature of participation. For instance, the research of Von Peter and others (2012) on the aftermath of the New Zealand earthquake in 2010 shows that in this case policyholders' certainty that they would receive a pay-out was sufficient for them to immediately start rebuilding, even prior to actually receiving the pay-out. This outcome depends upon a range of factors, including individuals' trust of the insurance scheme and belief that the government will fulfil its commitment as de-factor insurer of last resort. It also depends upon their financial resources prior to receiving the pay-out.

Some insurance schemes explicitly demand that certain minimum conditions of planning and governance for DRM are met – such as the African Risk Capacity, which requires potential risk pool members to produce an operations plan specifying how they will use a potential pay-out. The planning process is intended to be country-owned and in line with national policies and systems – and additionally it must show compliance with ARC's principles, which include time-sensitivity, use for protecting livelihoods, and six month duration for activities. Governments are encouraged to utilise the funds to scale-up existing programmes and improve targeting and gains in speed.

While currently there appears to be limited rigorous evidence of the impact of ARC's operations planning requirements on the quality of national DRM for risk pool members, it is certainly possible that such approaches could catalyse the transformation in risk governance described in this section. However, as noted previously, the technical capacity demands of sovereign and multinational risk pooling schemes are substantial – particularly in ensuring that the pay-out is used in a manner that contributes ultimately to greater resilience among exposed populations.

3.2 Prevention and preparedness

Forecast-based insurance

Making insurance pay-outs according to forecasted hazards is a potential function of index insurance. This is an important possibility, as it would mean the pay-out could finance risk prevention and risk reduction, hence avoiding or significantly mitigating the chance that the eventual hazard will manifest as a disaster.

The Extreme El Nino Insurance Product (EENIP) in Peru was the world's first forecast-based insurance coverage, triggered by extreme increases in Pacific Sea Surface Temperature (SST) that occur during El Nino years. The SST indicator is observed months before the onset of heavy rainfall on land, thus triggering pay-outs and providing policyholders with the liquidity (as well as advance information) to take measures to reduce the impact of the eventual weather event. No systematic evidence appears to exist in relation to its impacts on disaster risk reduction. In general, evidence relating to the impacts of such schemes for integrated disaster risk management is limited (and indeed these types of schemes are currently rare).

Data generation and sharing of risk information

Risk assessment, a core function of insurance approaches, requires the identification of hazard potential, exposure and vulnerability (Warner and others, 2012). The tools, analysis and data involved are of high value to governments in designing policies for DRM and climate change loss and damage, and also for individuals and businesses. Indeed, the ICRM approach sees risk analysis to be a critical first step in the DRM cycle (see Figure 1, p. 15).

Further, the insurance industry can contribute to the standardisation of available data, which further supports analysis and action. For instance, the PCRAFI has stimulated the development of one of the most comprehensive collections of geospatial data for Pacific Island Countries (PICs), as well as the most developed historical disaster archives for the Pacific region (United Nations ESCAP, 2015). Moreover, local insurance companies have expressed interest in utilising the risk models generated by the PCRAFI – which could indicate the expansion of meso- and micro-insurance provisions in the region (Pacific Islands Forum Secretariat, 2014).

However, there are several steps that need to be accomplished in between data generation and the application of the data and its analysis by exposed entities to reduce risk.

One consideration is the fact that the information is not always available for public use. Insurers often charge a fee for accessing the information that they generate and maintain as part of their business model. Governments, too, could potentially restrict the information they disclose for reasons of sensitivity or because information-sharing channels are poorly maintained. As policyholders, the poor in particular are likely to be unwilling or unable to pay for access to information. Thus, there is a role for governments or other intermediaries to ensure this information reaches the most vulnerable, likely as a public good.

A further consideration is that the information generated for use in insurance models is unlikely to be comprehensible to policyholders, in terms of the metrics and terminology used, and the scale and referred to time period. An example of an initiative to improve accessibility and relevance of risk information is the Africa Risk View, designed for ARC countries.[5] The tool enables risk modelling at the national level, customisable to the country in question.

There are examples of schemes which incorporate capacity-building and informational exchange along with insurance products. The Indonesian Rice Crop Insurance programme, in coordination with local governments and the Ministry of

5 See http://www.africanriskcapacity.org/2016/10/31/africa-riskview-methodology/

Agriculture, incorporated training components on using climate and weather information for rice farming, as part of its capacity development scheme (Hess and Hazell, 2016). Similarly, a contract-farming-based weather index insurance initiative run by PepsiCo in India also offers technical advice on production practices and weather information and advisories via text message in order to enable farmers to reduce their vulnerability to disasters (Hazell and others, 2010).

Mandatory conditions

Risk aggregators, such as meso- and macro-level institutions and insurance companies, often mandate compliance with particular criteria as a condition of offering cover.

In Iceland and most Swiss Cantons, insurance coverage of flood risk is mandatory for all residential and commercial buildings. With the introduction of the Turkish Catastrophe Insurance Pool, the Government of Turkey declared that it would no longer support private residents in reconstructing their homes after an earthquake unless parts of their losses were insured. An important objective of the pool was to improve enforcement of building codes for seismic risk; they were stringent in their design, but poorly enforced (GFDRR, 2011). A further example of mandatory conditions is the ARC operations planning process, described earlier on.

However, while mandatory conditions can directly contribute to risk reduction and substantially reduce the likelihood of moral hazard, they may result in excluding from insurance those without the resources to implement the conditions required.

Financial incentives to reduce risk

An important feature of insurance is its potential to provide financial incentives for risk prevention and risk reduction. By pricing risk, and translating that price into premiums charged to policyholders, insurance provides an important price signal that can raise risk awareness and incentivise risk-reducing behaviour (Golnaraghi and others, 2016). Some insurance schemes offer reduced premiums on the basis of risk reduction efforts – such as India's Weather-Based Crop Insurance Scheme, which offers lower premium rates for farmers who undertake soil and water conservation measures on the assumption that these measures help to decrease their vulnerability to flooding and drought (Hess and Hazell, 2016).

The poorest individuals, however, may not be able to respond to the price incentive of risk-based premiums, which negates the risk reduction function and raises important questions about the fairness of a scheme that charges the highest fee to the most vulnerable, who in turn are often the poorest (Surminski and Oramas-Dorta, 2014). The trade-off between affordability and risk-based pricing is also a key concern in high-income countries with established insurance markets – with flood insurance in the U.S. and the U.K. being a good example from the last few years (Golnaraghi and others, 2016). A further discussion on the distinction between insurance schemes based on the principle of equity, and those based on the principle of efficiency, is in Section 5.

3.3 Response and recovery

Rapid response

A widely cited advantage of insurance is its rapid pay-out function, providing badly needed liquidity soon after a disaster has struck (though this feature is not exclusive to insurance, noting for instance Catastrophe Deferred Drawdown Options [CAT DDOs]). Further, it provides transparency and assurance of the amount of money received in a pay-out and on how and when it will be delivered. Timeliness and reliability are two features that may be critical in stalling a rollback in development gains and preventing vulnerable non-poor people from slipping below the poverty line. Whether insurance delivers on this potential depends firstly on the nature of the policy (and in the case of index-based schemes, the clarity and quality of the index) and the capacity of the insurance company – and, secondly, in cases of meso- and macro-insurance, upon the speed at which cash delivered in the premium payment is converted into disaster response activities.

At the macro and meso levels, at-risk individuals are not direct recipients of insurance pay-outs. How the pay-out to the policyholder translates into benefits felt by individuals depends on decisions relating to the form of the transfer, targeting and the broader policy objective. Literature assessing the relative success of different types of pay-out mechanism at the sovereign level in contributing to risk reduction and/or improved resilience at the individual level is scarce: independent reviews of ARC and the CCRIF have observed that they are weak in their ability to systematically monitor the link between pay-outs to governments and individual wellbeing or risk reduction (Clarke and others, 2014). There is, however, a wide literature on the various types of delivery mechanisms that could be linked with insurance pay-outs. For instance, see OPM (2016) on shock-responsive social protection systems, and Young and Maxwell (2013) on delivery of food aid.

The modalities of cash and food transfers are common to both the delivery of assistance to households affected by disasters, and to social protection to chronically poor households – hence, they represent a common tool that could potentially support a smooth transition between assistance in normal times and during a crisis. Recent research has emphasised the advantages of income-support schemes/social-safety-net programmes as opposed to delivery of humanitarian aid in-kind, for reasons including transparency, cost-effectiveness and speed (Dercon and Clarke, 2016). However, the design of 'shock responsive' social protection systems is not without challenges. For instance, an evaluation of Kenya's Hunger Safety Net Programme (HSNP) highlighted the risk of political interference in targeting decisions during emergency scale-ups (OPM, 2016). A further challenge relates to the ability of different actors through the government system to cooperate effectively.

Poverty reduction and strengthening resilience at the household level

Evidence suggests that insurance can contribute to greater financial stability, development opportunity and coping capacity for vulnerable individuals and households. Insurance has been widely acknowledged as a tool for inducing farmers to increase their productivity – see Box 2 for a discussion.

An important finding mentioned in Box 2 is that insurance incentivises households to undertake activities that are more profitable, but also more risky. While it is generally acknowledged that risk-taking reinforces economic growth at the macro level (e.g. Hallegate, 2013), at the micro level there appears to be less certainty about the relationship between risk exposure and development or wellbeing – in particular, the question of whether the greater risk exposure will be mitigated by the greater resilience linked with higher incomes. In much of the literature, the 'higher risk' counterpart of the 'higher profit' outcome is not questioned – but this is to ignore

BOX 2. THE RELATIONSHIP BETWEEN INSURANCE AND HOUSEHOLD PRODUCTIVITY

Evidence shows that uninsured poor households react to the anticipation of negative shocks by refraining from undertaking profitable but risky activities, instead investing in technologies with a low rate of return. This tendency can hold poor households permanently at the risk of poverty traps (Chantarat and others, 2017; Elabed and Carter, 2014; Karlan and others, 2014). Insurance can change this by reducing the financial repercussions of volatility, with implications for households' ability to plan, save and invest – potentially in more resilient and profitable livelihood opportunities (Schaefer and Waters, 2016).

Elabed and Carter (2014) study the impact of insurance on the agricultural decision-making of cotton-farming households in Mali. They find that offering insurance resulted in a 15 per cent increase in the area of cotton planted, and a 14 per cent increase in the expenditure of seeds per hectare. These findings are similar in theme to a variety of other case-based investigations. Cai and others (2015) find that increased insurance adoption led to an increase in sows in Southwest China. In their research with farmers in northern Ghana, Karlan and others (2014) find that the binding constraint to larger agricultural investment is insured risk: "when provided with insurance against the primary catastrophic risk they face, farmers are able to fund resources to increase expenditure on their farms". They show that insurance, compared to cash grants, leads to significantly larger investment and riskier production choices. Overall cultivation expenditures increased 13 per cent over those of uninsured farmers. Similarly, Cole and others (2013) find that insurance caused households to shift agricultural investments to the production of higher-risk cash crops. Mobarak and Rosenzweig (2013) find similar risk-taking behaviour among rice farmers in India, who in response to rainfall insurance were more likely to plant higher-risk, higher-return rice varieties with a lower drought resistance.

important implications for risk and resilience. Isakson (2015) points out that intensive agriculture, which generates more profits compared to subsistence or small-scale agriculture, can contribute to the simplification of agricultural landscapes and biodiversity loss, which strips crop systems of their resilience to weather-related disasters. Reeves (2016), too, observes that there is nothing inherent to insurance that prevents it from incentivising maladaptation and entrenched vulnerability. He refers to the bundling of insurance products with modern agricultural inputs as an example.

A further point to make is that insurance schemes may exclude the very poor. In their study of the impacts of a livestock insurance scheme upon pastoralists in northern Kenya, Chantarat and others (2017) find that the group that benefits the most are the vulnerable-but-non-poor (whose herd size is just above the critical poverty threshold). In their case, the insurance creates an effective safety net that protects them from falling into a poverty trap after a drought. However, in the case of the poorest herders, their assets are too small relative to the critical threshold, such that the depth of their vulnerability cannot be altered by insurance alone. Similarly, research on poor farmers in India has shown that insurance pay-outs are unlikely to be sufficient for farmers to escape the cycle of debt into which they are locked. The pay-outs are linked to the value of their crops, but the root of the vulnerability is the fact that the market value is lower than their production costs (Reeves, 2016).

3.4 Challenges

It has already been mentioned that risk transfer solutions could be detrimental to risk reduction, if not properly structured and incorporated within an integrated approach to climate risk management (IPCC, 2012; ACRI+, 2017). Some of the main challenges and concerns are discussed below.

Design of the tool

The functionality and impact of insurance is partly determined by how well the insurance product is designed. In addition to the speed at which the pay-out occurs, other key elements that are determined by how the insurance tool is designed include its accuracy in valuing either risk or damage, the discipline required by the parties to the insurance contracts, and the extent to which it is designed in accordance with the needs of the target population.

Financial expertise is critical in designing an insurance scheme, not just on the side of the insurer but also for the insured party whose input to and understanding of the tool is essential. The availability of the financial expertise needed to design the instrument, and the degree to which this expertise is acknowledged in the planning process, are important considerations. In developing countries, such expertise can be very constrained.

Lack of adequate financial expertise on the part of the insured party was a point raised in the mid-term evaluation of a meso-level scheme called the Micro-insurance Catastrophe Risk Organisation (MiCRO) in Haiti. MiCRO acted as a reinsurer to the borrowers from a local microfinance institution (MFI) that served female entrepreneurs throughout Haiti. The evaluation cited a variety of shortcomings including misunderstanding of the risk context, lack of financial literacy and failure to accurately correlate risk models with losses on the ground (IFC, 2014).

Chantarat and others (2017) illustrate how the question of what a scheme is designed to insure can significantly influence outcomes for policyholders. In the case of a livestock insurance scheme in northern Kenya, the focus of their study, they observe that insuring lost assets is more appropriate than insuring lost income, particularly for herders operating near the poverty line. The loss of livestock can have impacts far bigger than immediate income lost: if herd size falls below a certain level, herd dynamics bifurcate and stock wealth collapses, with disastrous implications for future income. Further, the coping mechanisms that herders undertake can disrupt future income opportunities.

Moral hazard and adverse selection

Moral hazard refers to the possibility that insured parties will be more careless and take greater risks because they are protected, thus increasing the potential of claims on the provider (Financial Times Lexicon). Moral hazard is one of the primary risks associated with indemnity insurance. While one of the key potential advantages of index insurance is the avoidance or mitigation or moral hazard by referring to an objective trigger, it may still occur depending on the choice of indicator(s) in the index and indicator. Moral hazard raises risk, as by taking fewer preventative actions (or acting to induce a disaster) a policyholder increases his or her risk exposure. A large amount of research has been conducted on moral hazard in the agricultural insurance market, and has found that its likelihood depends on individual insurance market characteristics such as the degree of asymmetrical information and the risk aversion of individuals (Hudson and others, 2014).

A further problem that can obstruct insurance instruments from functioning efficiently is adverse risk selection, where the majority of the policy value is held by individuals facing a high level of risk. However, it should also be noted that in some cases insurance schemes are specifically targeted at those carrying high levels of risk, and as such they purposely distort market forces through adverse selection – this is particularly likely in cases where the focus is poverty reduction.

Benefits relative to costs

The opportunity cost of premium payments is an important factor conditioning the impact of risk transfer upon the vulnerability of policyholders.

For very poor households, premiums can delay their progress out of poverty by limiting their investment potential (Chantarat and others, 2017). Research suggests that insurance may not be financially sustainable even for households with capital just above a critical asset threshold: Kovacevic and Pug (2010) found that for these households the probability that they would collapse to a low-level equilibrium increases with the introduction of insurance, as the premium payments reduce the ability to create growth.

A further relevant issue is the return on the payment and – for index insurance schemes – basis risk is a key consideration here. The existence of basis risk means that index insurance products may not reduce risk at all, and in fact could leave a policyholder worse off following a disaster given the opportunity cost of her premium payments. This risk is particularly high if the risk profile of an individual has unique aspects compared to others in the policy coverage area (idiosyncratic risk), or if the index is inaccurate.

Until recently there have been few efforts made to measure the size of basis risk and how it affects the impact of pay-outs. Morsink, Clarke and Mapfumo (2016) propose new indicators to help answer the questions over whether insurance provides reliable coverage of the losses it was designed to insure against and if it provides coverage for losses that are important in terms of livelihood impacts. The first indicator assesses the basis risk of the insured peril; the second indicator compares claim pay-outs to actual losses suffered to agricultural production.

There are examples of DRM initiatives that have developed mechanisms to offset or reduce the impacts of potential basis risk associated with index insurance. For instance, the MiCRO programme in Haiti (see above) combined parametric insurance based on weather and seismic indices along with a basis risk component which MiCRO retained rather than passing on to clients. Mexico's FONDEN also allows for drawing upon other financial resources in cases where basis risk prevents pay-out from insurance mechanisms. These approaches are in line with the concept of risk layering, described in Section 5.

A further issue that conditions the benefits compared to the costs, from the perspective of individual recipients, is the nature and effectiveness of the mechanism used for distributing pay-outs.

Weakening informal risk-sharing schemes

While there are many cases of informal mechanisms working effectively to reduce and transfer risk, generally their ability to do so is incomplete – particularly in responding to aggregate shocks. This leads exposed farmers to choose low risk and lower-yield production methods, asset portfolios and crops instead of riskier but more profitable alternatives (Cai and others, 2015; Mobarak and Rosenzweig, 2013; Morsink and others, 2016). It has been suggested that formal insurance could complement informal insurance mechanisms by, for instance, providing cover for aggregate shocks. In turn, informal insurance could help to address some of the gaps or challenges faced by formal insurance – for instance, mitigating the potential impacts of downside basis risk on vulnerable households.

In theory at least, formal and informal insurance can complement and operate alongside one another – they may address different risks and provide different benefits. However, research has shown how the opposite may occur, such that informal schemes are crowded out. For instance, Attanasio and Rios-Rull (2000) analyse data from the PROGRESA programme in Mexico, a large welfare initiative that provides transfers to rural households. They find that the effect of government transfers is a reduction in the size of private transfers among households – which strengthens the predictions of their model simulation where informal support systems may break down due to the introduction of a formal insurance scheme, even if they cover different risks.

Some members of the informal system may be made worse off through the introduction of the formal scheme, even if it is voluntary, as some members could withdraw from the informal scheme leaving the existing members with less protection. Also, informal insurance schemes are often deeply ingrained into the social fabric of a community, such that their breakdown has implications beyond household budgets. As discussed previously, research suggests that the benefits of formal insurance may elude the very poor. Schemes may exacerbate inequalities within communities, which would also damage the socio-economic relations underpinning informal risk-sharing schemes.

There is only limited evidence from developing countries regarding this type of adverse impact in the case of insurance. There is a stronger body of evidence relating to the similar impacts of introducing formal social-safety-net programmes, which may be transferable. However, an important point to recognise is that the relationship between informal and formal schemes is likely to be highly contextual – as are the approaches to managing that relationship. Attanasio and Rios-Rull (2000) emphasise that a key implication of their research is for governments considering insurance schemes to recognise that such schemes do not occur in a vacuum. They must consider the effects of such schemes upon incentives to participate in private arrangements and upon the social and economic fabric of communities more generally.

BOX 3: GENDERED DIMENSIONS OF INSURANCE

Overall, there appears to be limited research that specifically explores gendered dynamics of insurance and risk reduction. The available evidence suggests that women could play a key role in maximising the risk reduction outcomes of insurance – but emphasises that schemes will need to be carefully designed to enable this. Without specific gender targeting there is a risk that insurance schemes could shift the balance of decision-making power and resources towards the male head of the household. This is likely given that insurance policies tend to be taken out in a single individual's name (with costs for adding additional people), and that some insurance schemes require land ownership or bank accounts, to which women disproportionally lack access.

The evaluation of Oxfam's and the World Food Programme's (WFP's) HARITA programme found that female-headed households (which were among the poorest evaluated) reported particularly significant impacts, including some of the greatest productivity gains, increases in agricultural investments and decreases in "sharecropping out" (the practice of renting land to tenants for 50 per cent of yield, which is frequently practised due to lack of oxen or human capacity to farm their own land). In a similar vein, an evaluation of the effectiveness of a disaster micro-insurance product called Afat Vimo in India found that women in the community in question were more receptive than men to the benefits of micro-insurance – and therefore encouraged efforts to engage with women's groups to sell insurance (ACT, 2016).

4. Dynamics influencing the provision and uptake of insurance

This section discusses factors affecting the availability of insurance and the willingness of at-risk parties to participate in insurance contracts. The topics covered are:

- → Provision of insurance by insurance and reinsurance companies
- → Uptake and provision of insurance by governments
- → Uptake of insurance by households

4.1 Insurance and reinsurance companies

From the perspective of insurance and reinsurance companies, a key consideration is the insurability of the risk. This consideration is particularly significant in relation to disaster and climate risks – where insured losses are not independent but correlated, where data availability and quality can be limited, and where asymmetric information can lead to adverse selection and moral hazard (Golnaraghi and others, 2016). Risk pools are often too small to offset these fundamental challenges to the insurance business model.

Insurable risks are those risks that, according to one widely cited study, meet the nine criteria set for an efficient operation of insurance (Berliner, reproduced in Biener and Eling [2012]): five actuarial criteria (randomness of loss occurrence, manageable maximum possible loss, moderate average loss per event, large loss exposure, not excessive information asymmetry); two market criteria (affordability and cost recovery of the insurance premium and acceptable cover limits); and two societal criteria (sufficient public policy framework and legal restrictions).

Research collectively reveals a wide range of problems with meeting those criteria – not only in developing countries, but also in developed countries where insurers are struggling to factor climate change into insurance risk models and growing risks are putting pressure on premiums (Surminski, 2014). The insurability of progressive perils poses particular challenges, as their impacts on losses build up gradually over time and are difficult to isolate from other perils (Morsink and others, 2016).

The legal and regulatory framework of the jurisdiction in question is a strong conditioning factor for insurers' assessments of their ability to manage their risk exposures and hence of insurance supply (FSD Africa and CENTRI, 2017). Enforceable contracts that insurers (and policyholders) can trust, as well as guidelines for insurance licensing and operations, are critical for the engagement of insurers in a given market (Schaefer and others, 2016). While specific regulatory requirements will change depending on the market segment and scale in question, the general components of an insurance regulatory framework are likely to include authorising laws (including licensing), solvency and risk management regulation, corporate governance regulation, reinsurance regulations and intermediary regulation. Insurers will also want to see basic rule-of-law conditions fulfilled, which generally support commercial operations (IDF).

If information on data on hazards and exposure is not already available, the company will consider whether there is a commercial case for acquiring the data itself. In many cases the costs will be prohibitively high – although, index insurance can mitigate this concern as its sole reference is an independently verifiable index.

Other considerations include the size of the transaction costs involved, the size of the client base and value of their assets and, in the case of public-private partnerships, the likelihood that partners will deliver and fulfil their responsibilities. It is common to see international financial institutions playing the role of intermediaries in macro-level insurance transactions, for instance the World Bank's role in Uruguay's weather risk transaction and in both the CCRIF and PCRAFI.

4.2 Governments

Political viability

The degree to which politicians support formal insurance schemes – particularly in relation to whether and how such schemes deprive them of the political capital that can arise from manipulation of post-disaster allocations – will be influenced by the incentive structures upheld through policy and regulation, transparency of information relating to the use of public expenditures, and media discourse (Dercon and Clarke, 2016; De Janvry, 2015).

In the case of index insurance schemes, downside basis risk presents a significant challenge to governments' political credibility and capital. It is hard to justify the use of taxpayer money on premiums to an insurance scheme that potentially would not pay out in the case of a disaster, as illustrated by the Solomon Islands' withdrawal from the PCRAFI scheme on the grounds that the scheme had failed to pay out following two disasters (earthquake and flooding), although neither qualified as an eligible event according to the insurance contract (UNESCAP, 2015). This is also possibly a factor contributing to changes in the ARC risk pool.

Multinational risk pools present specific political considerations. Governments may be concerned about relinquishing some of their sovereign decision-making power through intergovernmental schemes, or wary of 'management capture' by supra-national entities set up to manage schemes (Dornan and Cain, 2014). Further lessons learned from the PCRAFI confirm that risk pooling requires strong discipline and coordination among participating countries (Pacific Islands Forum Secretariat, 2014).

Cost-benefit analysis

Insurance is not necessarily the most cost-effective option for governments. It appears to be particularly suitable for financing immediate post-disaster needs following low-frequency, high-impact events (Baur and Parker, 2015; Clarke and others, 2015; Dercon and Clarke, 2016). In such cases, research on sovereign-level insurance indicates that it makes financial resources more readily available and at a lower long-term cost (Clarke and others, 2015).

However, the literature appears to suggest that insurance is unlikely to be the most appropriate choice for responding to either high-frequency, low-impact events, or for the bulk of reconstruction costs following any event. Bevan and Adam (2015; cited in Dercon and Clarke, 2016) apply a macroeconomic model developed by the IMF to Jamaica's tropical cyclone risk. They find that an ex post tax-financed reconstruction of public assets would be more cost-effective than insurance, even though it would lead to slower restoration of the capital stock. Their argument is that potential shocks are not large relative to national income – and smoothing the cost of the shock over time at the national level is more cost-effective than insurance.

Other types of ex ante and/or ex post measures are more cost-effective in the case of high-frequency, low-impact disasters. Contingent credit facilities, an ex ante agreement that guarantees credit for disaster recovery and reconstruction, can support a timely and efficient financial response and have been employed in countries like Lao PDR and Viet Nam. Multi-year reserves can cover frequent, small-scale disasters, as employed by the Marshall Islands for instance (UNESCAP, 2015).

The opportunity cost of premium payments and availability of smart subsidies also influence cost-benefit analysis. There are many other potential investments that a government could make while taking into account risk management and risk

reduction. These include shock-responsive social safety nets, alternative-livelihood programmes, contingency funds and infrastructure that could enable rapid response. Even within a single insurance scheme there are more specific opportunity costs, such as to decide on the extension of the scope of coverage as opposed to reaching specific disadvantaged target groups, who might receive higher payments.

As mentioned above, these different policy options come with different political (and electoral) implications. Political incentives can skew cost-benefit analyses based on logics of efficiency and value for money. The case of ex post humanitarian aid for disaster response is a case in point. While several authors observe that post-disaster aid relief leads to a slow recovery, low value for money, and political manipulation of funding allocations (e.g. Clarke and others, 2015), research also shows that the availability of aid appears to reduce incentives for purchasing insurance. People living in disaster-prone areas (and therefore their governments) expect financial aid after major disasters – and perceive little reason to adopt an alternative option for which they have to pay (Lucas, 2015).

Additional considerations include the cost of putting in place the policy and regulatory standards required by insurers, and the fact that the time taken to do so may exceed a single political term; the technical capacity of the government and its prior experience with financial tools in general and insurance in particular; and the availability of the skilled professionals required to negotiate and implement the insurance contract.

4.3 Individuals and households

As Cole and others (2013b) observe, a fundamental aspect of success for a market-based approach to risk diversification is that consumers make good decisions about whether to purchase products.

A wide body of research confirms that willingness to pay for insurance is typically well below the actuarially fair price. Index insurance schemes in developing countries have seen very limited uptake (e.g. Gaurav and others, 2011), which is surprising given the high expectations for index schemes in the literature.

Affordability and reliability

Several studies find that affordability and liquidity are key factors influencing the uptake of insurance by farmers.

Karlan and others (2014) find that while many farmers appear to recognise the value of insurance in general, substantially fewer farmers (less than 20 per cent) are willing to purchase the product at market price. This is in line with McIntosch and others (2013), who found that 62 per cent of farmers expressed interest in buying an insurance product but, when provided the terms of an actual product, demand was lower and significantly influenced by the availability of subsidies. Casaburi and Willis (2017) undertook a Randomised Controlled Trial (RCT) in a contract farming scheme in Kenya to test a product in which the buyer of the crop offers insurance and deducts the premium from farmer revenues at harvest time. They found that take-up was 67 per cent higher than under a standard insurance contract requiring an upfront payment of the premium, and so confirm that liquidity constraints are an important driver of insurance take-up, particularly for poor farmers. Offering a discount on insurance with up-front payment did not increase demand, which leads them to

suggest that timing might even be a stronger determinant of demand than price.

As discussed in Section 3.4, premium payments represent a significant opportunity cost for poor households. Some meso and sovereign schemes are free to individual beneficiaries, such as Mexico's CADENA programme, though research does not appear to be available showing whether, and to what extent, the lack of premium payments influenced the impacts of those schemes.

The degree of basis risk is also identified as a key influence upon individual decisions to purchase agricultural insurance (Hess and Hazell, 2016). Mobarak and Rosenzweig (2013) found that there was a decrease of 6.4 per cent in farmer demand for every kilometre of distance to the rainfall station.

Bundling insurance with financial and non-financial services is a potential means of increasing its perceived value among potential customers and more effectively meeting their needs (ACT, 2016). Bundling with credit can ease liquidity constraints and contribute to an improved take-up of insurance and is appealing for insurers as it can reduce the default risk on their lending portfolio. The evidence on bundling, however, is not conclusive as in some cases credit acts as a substitute for insurance (Matul and others, 2013). Also, there are certain risks with bundling. For instance, the purchasers are not properly informed and will not fully understand the terms and function of the various products they are buying.

The R4 programme funded by Oxfam and the World Food Programme supports insurance along with improved resource management through asset creation, livelihoods diversification, micro-credit and savings. The programme does appear to improve the resilience of farmers and communities, in terms of food-security outcomes, increased assets and group solidarity (Oxfam and WFP, 2015). Another important characteristic of R4 is that it allows low-income farmers to exchange work for insurance instead of paying premiums. The programme experienced more demand for its work-for-insurance offer than the budget would allow them to provide, which appears to confirm the significance of affordability in conditioning insurance uptake (Oxfam and WFP, 2014). While the experience of R4 is instructive, its multi-faceted nature means that it is difficult to attribute outcomes to the insurance component. Also, the in-kind approach to premium payment is conditional upon the premium cost being borne by entities other than the beneficiary, which raises questions about its sustainability and may reduce transferable lessons to insurance schemes that have a different financial model.

The role of trust and psychology in insurance purchase decisions

Research has shown that individuals have a tendency to underestimate the true probability of disaster risk and how it relates to them, which translates into a societal tendency to under-insure against catastrophic risk. The same outcome is also explained by a shortage of information about the true nature of risk. For insurance in particular, loss aversion and narrowframing may deter people from purchasing policies. For example, farmers may think that the rain will be good and they will receive no benefit from the product (Gaurav and others, 2011). Research on the determinants of demand for micro-insurance find that trust is a key issue. This is discussed in Box 4 (p. 40).

Strategic behaviour

The public demonstrates a tendency for strategic behaviour in selecting its response to disaster risk. Awareness that the state has a responsibility – and in many cases, functioning mechanisms – to provide assistance to them, free of charge, can be a disincentive for individuals to purchase further assistance

BOX 4: THE ROLE OF TRUST IN INDIVIDUAL DECISIONS TO PURCHASE INSURANCE

Trust is a factor in explaining decisions, particularly in cases where individuals or businesses are required to pay their insurance premium upfront without receiving any potential benefit (as is the case with most micro-insurance). They are concerned about whether a payment will ever be received – and in many contexts, policyholders would have limited legal recourse should they not receive a payment in a situation where they expected one. This perception may be strengthened by previous bad experiences with financial products, such as witnessing mismanagement or fraud. Cai and others (2015) carry out an RCT to explore the demand-side dynamics of subsidized insurance for sows in southwestern China. They find that endorsement from a trusted third party about the insurance policy significantly increases take-up of insurance policies, in a context where lack of trust of government-sponsored insurance products is a significant barrier to farmers' willingness to participate in the insurance scheme. Cole and others (2013b) show that a pay-out of 1,000 rupees increases the probability that rural farming households in Gujarat, India, will purchase insurance in the next year by 25-50 per cent, controlling for crop losses. The effect is stronger when more individuals in a village receive a pay-out. Karlan and others (2014), reaching a similar conclusion in their research with farmers in northern Ghana, observe the irony that while insurance offers its largest benefit for low-probability high-loss events, rare pay-outs harm demand; this is something that could be addressed, at least in part, through educating people on the nature of insurance mechanisms.

privately. This is less relevant in the case of indirect insurance schemes, where the payment is received by an intermediary rather than the final beneficiary.

Education and financial literacy

There is a range of evidence showing that individuals with low financial (and climate) literacy are less likely to participate in insurance markets. Insurance products are complicated: rainfall index insurance, for example, maps rainfall distribution over an entire growing season to a single payment vector using a metric (mm) that is unfamiliar to many farmers (Gaurav and others, 2011). Hence, several researchers have attributed weak demand for formal insurance to the inability of potential policyholders to understand the nature of the product and assess the most rational option for reducing their exposure.

Cole and others (2013) compare the levels of education of farmers enrolling in rainfall insurance in India, and find that literate farmers were 15 percentage points more likely to take up rainfall insurance and use it to plant cash crops. In a previous pilot, Cole and others (2011) had found that participation in education programmes on rainfall insurance more than doubled the uptake of rainfall insurance. Gaurav and others (2011) research the consequences of offering financial education to micro-insurance policyholders in Gujarat, India, on their purchase decisions. The effect of the financial literacy training was evaluated using an RCT, in which half the sample was offered training. The study found that the financial education module significantly increased demand for the insurance product (by 5.3 per cent).

Information-sharing and capacity-building would seem, in this case, to be an obvious solution. An evaluation of the effectiveness of a disaster micro-insurance product called Afat Vimo in India, following Cyclone Phailin's impact in Odisha state, found that the work undertaken with communities by one of the partners in the insurance programme to reduce information asymmetry and speed up claim verification was an important factor in its success (ACT, 2016).

Other research has focused on more ambitious efforts to inculcate behavioural change in potential policyholders. Isakson (2015) refers to the pedagogical campaigns funded by insurance brokers, among others, to instil a 'culture of insurance' in areas where they have identified a high perceived need for insurance but low willingness to pay. In Ethiopia, one game used as part of the campaign is attributed with increasing uptake of insurance by one third – and in Peru, more than half of the 500 participants of a game, all cotton producers, shifted to the high-return activity, both borrowing money and purchasing insurance.

The presence of informal risk-sharing schemes

Whether informal risk-sharing schemes are present in a community or society, and the extent and functioning of those schemes, can condition demand for formal insurance. Mobarak and Rosenzweig (2013) examine the impact of the existence of caste-based informal risk-sharing networks in India on the uptake of rainfall insurance in Tamil Nadu, Andhra Pradesh and Uttar Pradesh. In these regions, pre-existing risk-sharing networks often provide coverage against household-specific losses (crop loss) and sometimes even against aggregate rainfall shocks, when other caste members are engaged in non-agricultural occupations. They find that informal systems have a different impact depending on whether they also cover aggregate shocks.

In cases where informal systems cover aggregated rainfall shock, farmers are less likely to purchase insurance. In cases where informal systems cover only household-level risks, farmers are more likely to purchase insurance than in the areas devoid of informal systems as they feel that they can afford the inherent basis risk of index insurance. Furthermore, in villages with a rainfall station (i.e. no basis risk), household demand for index insurance is not affected by the extent to which the informal network is able to indemnify idiosyncratic risk.

5. Implications for integrated approaches to disaster and climate risk management

Sections 3 and 4 show that insurance can contribute to DRM under certain conditions – and indicate that insurance by itself is not a panacea for achieving effective disaster risk management and disaster risk reduction at a societal level. At-risk parties, whether they are individuals, businesses or governments, must decide when insurance is appropriate and what other tools to use when it is not. This section reviews some of the big questions and possible approaches that may be relevant to these decision-making processes and to the design of integrated climate risk management.

Insurance is not a standalone solution for DRM

To begin with, not all perils can be insured against. Climate change is presenting substantial challenges to the insurability of already-priced risks (for instance, causing large increases in loss occurrence linked to heatwaves or floods), and also presents risks that cannot currently be insured, such as desertification (see Silver and Dlugolecki, 2009).

Furthermore, under-insurance is likely to remain a problem given that insurance products are complicated to understand, and given mistrust, strategic behaviour and other factors discussed in Sections 3 and 4.

Even if it were hypothetically possible to insure all risks, there is clear evidence showing that insurance is not always the most appropriate tool for risk reduction – and emphasising that insurance needs to be embedded in an integrated approach to risk management (ACRI+, 2017; Golnaraghi and others, 2016).

The appropriateness of insurance for addressing a given risk will be assessed based on a number of criteria, including the frequency and severity of the hazard itself, the opportunity cost of the premium payment, and the availability of alternative mechanisms for managing the risk. If insurance is considered an appropriate tool for responding to the risk in question, the next step is to consider what type of insurance product. Insurance products are designed differently depending on various circumstantial considerations, varying from objective considerations about the nature of the hazard, to socio-economic criteria such as the average income and education level of the recipients, to the strategic and policy objectives of the government or other intermediary.

The literature clearly shows that a given type of insurance product is not equally valuable to everyone. Poor people are likely to be excluded from commercial insurance products, for example, and so if insurance is to reach them it must be designed differently (Schaefer and Waters, 2016).

The appropriate role and design of insurance should be determined through a risk layering approach

A strong conclusion in the literature on contemporary disaster risk management is that various risk financing instruments should be included within an overall strategy to achieve integrated climate risk management. The process should involve "identifying the various layers of disaster risk, who bears each level of risk, and the possible risk transfer instruments available to each layer" (Miller and Keipi, 2005).

Figure 2 (p. 45) provides an illustration of risk layering: it suggests that for risks that happen often but whose impacts are less severe, prevention and risk reduction activities may be the most cost-effective. Some degree of risk will be retained in all cases – and for more severe and less frequent risks, it may be cost-effective to transfer some of that residual risk through insurance and reinsurance mechanisms. In many cases, risks can be transferred to cooperative/mutual insurance schemes, commercial insurers and reinsurers – but for major risks governments will likely have to take responsibility, and financing instruments will likely include both ex post and ex ante funding mechanisms, as well as mitigation investments (Mahul and Stutley, 2010).

An integrated approach could even include different types of insurance mechanism with varying objectives and characteristics (Baur and Parker, 2015) – for instance, at the micro level households and SMEs may choose to use index insurance complemented with informal risk transfer, which can help to further manage the remaining basis risk. See Box 5 (p.46) for examples of risk layering in practice.

Risk layering aligns with an integrated approach to disaster and climate risk management, as it demands a holistic approach to understanding risk and the development of adapted solutions to fit circumstances. Integrated approaches such as ICRM complement risk layering by providing details on the different areas of DRM (prevention, preparedness, addressing residual risk, response, recovery) whose objectives, timing and policy implications differ.

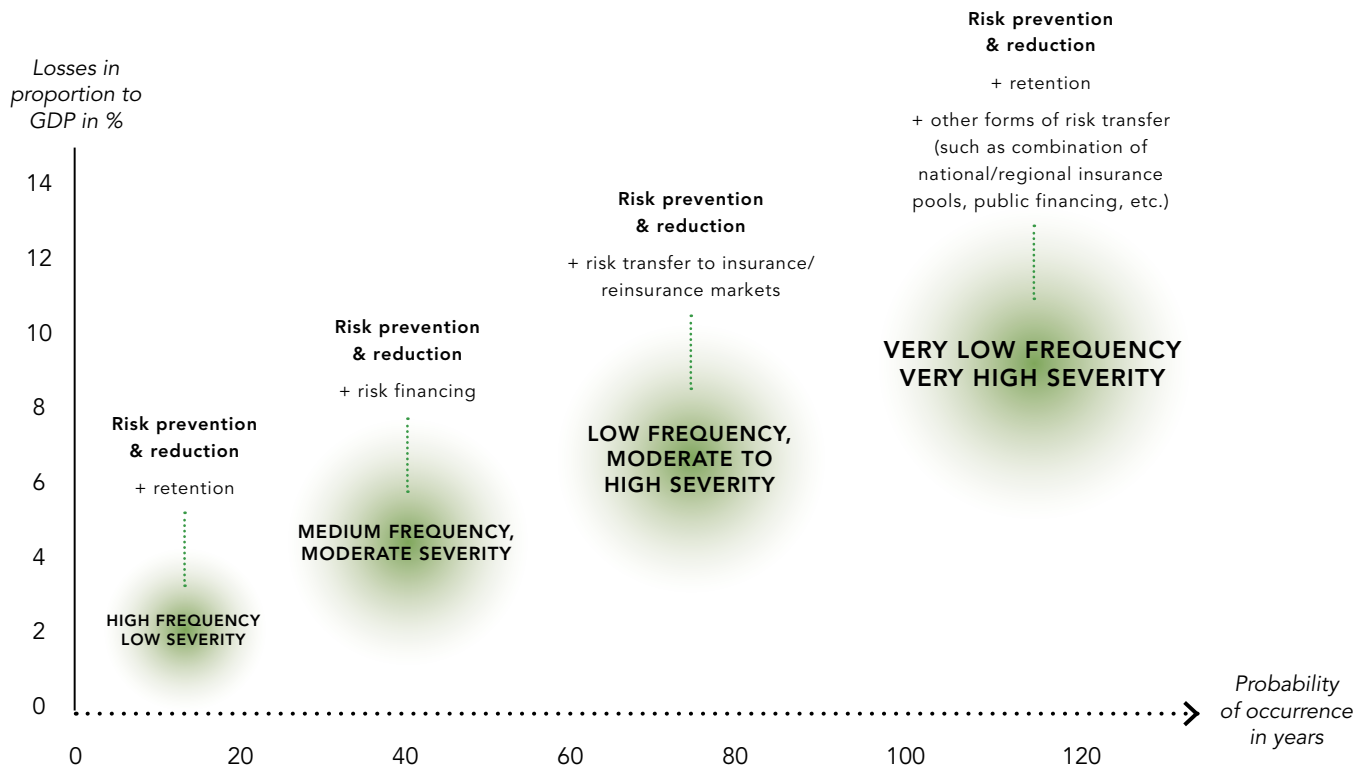

Figure 2: Risk layering (Warner and others, 2013)

BOX 5. RISK LAYERING APPROACHES

Mongolia's Index-Based Livestock Insurance Project (IBLIP) has a format where herders take out commercial insurance to cover themselves against small losses, with larger losses covered by a social safety net funded by the transfer of risk at the government level to private insurance and reinsurance markets. Schaefer and Waters (2016) observe that this model has been highly successful. A further example is Mexico's FONDEN, which has three main components at the federal level: a risk retention vehicle that allows the government to budget for the costs produced by frequent disasters, a reinsurance programme that leverages budget funds to purchase coverage for severe and infrequent disasters, and a parametric layer of cover that provides immediately emergency funds if a major and severe disaster occurs. The Government of Uruguay has been collaborating with the World Bank to develop a series of risk financing options within an overall strategy for managing risks to its energy supply. In addition to the weather and oil price risk transaction, an oil-hedging programme was implemented in 2016 to manage the risks of an oil price hike (World Bank, 2016).

Risk layering, and more broadly integrated approaches to disaster and climate risk management, are demanding in terms of policy and planning capabilities. The Zurich Flood Resilience Alliance (Mechler and others, 2014) and others have sought to comprehensively present and comparatively assess the available decision-making tools in support of DRR, which provide useful references. Yet there is still no robust methodology that could help governments compare the options for utilising budgeting and financial instruments in a consistent, comprehensive way – hence making it difficult for them to answer such questions as "How much reliance should be placed on emergency reallocations of funds away from other parts of our budget to finance disaster losses?", and "How can we evaluate proposals for risk transfer products such as disaster insurance or catastrophe insurance? (Clarke and others, 2016).

The selection of appropriate tools for delivering integrated disaster and climate risk management is inevitably a political exercise

Decisions will need to balance timeliness, accuracy and cost (Dercon and Clarke, 2016). There is also the matter of deciding which risks should be reduced, and which should be retained. It is likely that trade-offs will arise. Some of the relevant trade-offs that may arise in relation to insurance specifically are discussed below.

EQUITY VS EFFICIENCY IN RISK-BASED PRICING

From the perspective of tool design, efficiency relates to whether prices accurately reflect the degree of risk being insured: the higher the risk, the higher the premium. The assumption is that applying a risk-based premium would motivate the insured party to engage in risk-reducing

behaviour and could ideally lead to an overall reduction of their exposure. However, from the perspective of fairness and equity, it is not acceptable that those who are most vulnerable to risk should have to pay the highest premiums. This is underlined by the common finding that those most exposed to risk are also characterised by poverty, social and political marginalisation, and limited social capital. If an objective of the risk reduction exercise is to target the poorest, and to help them move away from poverty traps, then the evidence suggests that insurance should be firmly integrated within a broader risk reduction programme, likely 'bundled' with other aspects such as credit provision and social protection. The focus would be on community-based (not-for-profit) mechanisms rather than premiums-based instruments.

MAXIMISATION VS DISTRIBUTIONAL FAIRNESS

There is a potential trade-off between risk transfer schemes that maximize poverty reduction outcomes and those that follow strict principles of distributional fairness.

Chantarat and others (2017) simulate optimal targeting of premium subsidisation to East African herders, in terms of poverty reduction outcomes. Their results imply that the optimum scheme would provide insurance for free to the non-poor who are likely to fall back into poverty in the long-run, insurance to vulnerable non-poor groups at actuarially fair premium rates, and insurance with no subsidies to the poorest and the most secure. This approach achieved the greatest gains in terms of mean herd size increases and decreases in the asset poverty headcount. One alternative approach to targeting would be to follow the principle of distributional fairness, such that, for instance, those with herd sizes below a certain threshold received free insurance provision. A simulation of this approach found that less than half of the results of the optimal scheme described above were achieved.

However, this targeted subsidy approach is likely to be very expensive and demanding of financial and human resources. Avoiding the additional cost of creating new mechanisms is partly why there is an interest in using social protection measures for DRM.

COST-EFFECTIVENESS VS COMMITMENT FUNCTION

There is a potential balance to be struck between cost-effectiveness and ability to achieve cost-benefits, such as risk reduction. De Janvry (2015) observes that while in some cases sovereign reserves may be more cost-effective than insurance (as discussed above), the ability of insurance to incentivize risk reduction actions may mean it is perceived as more valuable. However, as mentioned earlier, there is very little evidence of insurance schemes actually inducing risk-reducing behaviours (though the theoretical potential is widely acknowledged). The impact of schemes like ARC, where risk reduction is explicitly built into insurance contracts, is yet to be measured.

Risk transfer cannot substitute for risk reduction

In all cases, it is preferable to avoid risks entirely than to transfer them. Literature has demanded that attention be paid to the social determinants of risk and cautions against the presentation of risk as an inescapable feature of human life that needs to be managed while its root causes are ignored.

In the context of climate change, where insurers are struggling to incorporate forecasts into loss models and balance affordable premiums with accurately priced risk, it is essential to tackle root causes in parallel with the management of manifestations (Surminski, 2014). This is as true in developed countries as it is in developing countries. Climate change could increase the annual costs of flooding in the U.K. almost 15-fold by the 2080s under high emissions scenarios, but risk reduction policies – including controlling development in

floodplains and increasing investment in flood defences – could limit the rising costs to a possible four-fold increase (ABI, 2005).

Evidence also suggests that insurance fails to tackle the root causes of vulnerability: while it may contribute to building resilience to disasters, it is highly likely that additional interventions will be needed to ensure the foundations for resilience are in place.

An evaluation of the predecessor to Oxfam's and WFP's R4 programme, HARITA, found that while on average households experienced a higher level of wealth and better access to credit at the end of the project cycle, farmers observed that the project had not delivered long-term, transformative impacts. Such impacts, they said, would require support in accessing irrigation and diversification of income (Oxfam and WFP, 2014). The impact evaluation of R4 in Senegal found that while an improvement in organisational capabilities and feelings of in-group solidarity could be attributed to the programme, there remained a lack of effective mechanisms to generate group responses to unexpected shocks. Interventions to nurture this organisational capacity were needed (Oxfam and WFP, 2015).

Taylor (2016) takes a historical approach to the index-based livestock insurance scheme in Mongolia, explaining how risk was redistributed during the transition away from collectivisation. New land rights regimes weakened the central principle of reciprocity over pasture and engendered competition for access, resulting in a widening of inequality between those herders with access rights and those without – and within a context of risk privatisation. Risk was produced and distributed as a function of the new capitalist economic system, and he argues that it is short-sighted to ignore these necessarily political roots when considering risk management.

Da Costa (2013) observes that risk is caused by the investment decisions and policies of governments and businesses, who then take out policies to insure themselves and their populations against the consequences. Focusing on the case of India, Da Costa (2013) argues for policies that address risk causes instead of merely managing symptoms. In India, this would involve widespread irrigation, as well as reversing the initiatives introduced to retract social banking and encourage privatisation of common lands.

The key message underlying these studies is that while risk transfer has a role to play in DRM, it cannot substitute for the social and ecological foundations of security (Isakson, 2015). As anticipated by the concept of ICRM, risk transfer is one element in a dynamic process of planning, implementing and adapting to build societal resilience to disasters and climate change.

6. Conclusion

The evidence reviewed in this paper has indicated that insurance can contribute to disaster risk management under certain conditions. If insurance is introduced without meeting those conditions, it may have no impact upon the resilience of the intended beneficiaries – or actually reduce their resilience to disasters.

These conditions relate to the context within which the scheme is introduced, the design of the insurance tool, and how effectively it responds to the broader risk management objective. Insurance schemes designed with poverty reduction in mind must take into account specific design principles, such as those listed by Schaefer and Waters (2016). While insurance can be designed to work for the poor, evidence suggests its value is limited in improving the situations of the poorest. For them it is far more important to address the structural barriers that prevent them from meeting the basic requirements for flourishing – such as possibility to receive fair prices for their goods and the right to own land.

The contribution of insurance to DRM is likely to be maximised if insurance is incorporated into an integrated disaster and climate risk management approach. Through an integrated approach it is possible to identify opportunities for insurance to contribute to all areas of disaster risk management – management of residual risk, risk prevention, and disaster preparedness, response and recovery. Risk layering, cost-benefit analysis and other tools can be undertaken through an integrated approach in order to determine when, and in what form, insurance is appropriate.

A key conclusion of this paper is the need for a stronger evidence base about how and under what circumstances insurance can effectively be included in an ICRM approach. This review finds that the majority of empirical research relating to the link between insurance and disaster risk management in developing countries is case-study based and focuses on factors conditioning uptake and impacts on response and recovery.

The link between insurance as part of an integrated approach to disaster and climate risk management is under-studied. Further, available evidence focuses mainly on the agricultural sector, particularly agricultural micro-insurance schemes. Important areas for climate risk insurance where evidence gaps are particularly clear include multinational risk pools and critical infrastructure.

The Special Session on Risk Transfer and Insurance at the 5th Global Platform for DRR called for robust, honest evaluations of what worked and what did not for risk transfer and insurance initiatives – and the evaluations should be shared (UNISDR, 2017). Initiatives that could contribute to this evidence base are proliferating. ACRI+, for instance, will provide a useful perspective on the prospects of insurance across different sectors such as renewable energy, critical infrastructure and small- and medium-sized enterprises, and more generally will provide empirical evidence about how integrated approaches to disaster and climate risk management play out in practice.

Annex 1: Overview of insurance and risk transfer tools[6]

Name of tool	Category	Description	Application examples	Advantages	Challenges
Indemnity insurance: **(a) Single Peril** **(b) Multiple Peril**	**Traditional insurance**	Insurance in which the claim is calculated by measuring the degree of damage to the insured asset soon after the event occurs.	Many examples in the developed countries, including hail insurance, flood insurance and multi-peril agricultural insurance. Limited examples in developing countries, mainly from big government schemes in Latin America (e.g. ProAgro Brazil and Mexico).	Indemnity based on actual damage. Established distribution pathways. Proven scalability	High transaction costs, including moral hazard and adverse selection. High barriers to entry in some cases, so excludes vulnerable population groups.
a) Area-yield **(b) Weather-indexed** **(c) NDVI/ satellite-based**	**Index insurance**	Pay-out calculated according to what is usually an independently verified proxy (index), rather than the actual damage to the specific asset.	Limited examples in both developed and developing world. But pilots are increasingly common in developing countries, with the following schemes operating at scale: (a) The Indian National Agriculture Insurance Scheme. (b) The Ghana Agricultural Insurance Pool. (c) Kenya and Ethiopia Index-Based Livestock Insurance.	Lower transaction costs than indemnity insurance. Less demanding of institutional capacity, monitoring capacity and financial literacy than indemnity insurance.	Weak farmer demand and first-mover problems. Basis risk. Insufficient public investment in necessary infrastructure (i.e. weather stations, etc.). Not a 'profitable' form of risk transfer so would have to be substantially reliant on government or donor funding.

6 This table is not exhaustive. Schemes that are closely linked to those listed here include government insurance programmes and scalable 'shock responsive' social protection schemes (see OPM 2016).

Name of tool	Category	Description	Application examples	Advantages	Challenges
Natural Catastrophe Bonds	**Alternative risk transfer tools/ insurance-linked securities (ILS)**	Securities that transfer natural catastrophe (re)insurance risks to the capital market	Many examples in developed regions. World Bank's MultiCat programme facilitated CAT bonds for sponsors including the Government of Mexico. Additionally, Munich Re recently expanded its third-party capital ILS investor base for catastrophe bond issues.	For investors: relatively high returns and low correlation with other asset classes means promise of diversification. For sponsors: CAT bonds allow access to a much bigger pool of capital, and longer coverage periods, than conventional re-insurance.	Significant barriers to entry for developing country governments e.g. lack of familiarity with reinsurance and CAT bonds; lack of resources to deal with complex legal documentation and high transaction costs; limited or non-existing modelling of disaster exposure; other political disincentives linked to insurance (see elsewhere in the paper).
Sidecars	**Alternative risk transfer tools (ILS)**	Securities that transfer a quota-share portion of the risk to the outside investors in the capital market. Generally have a limited lifespan and used to capture the increase in rates after a major catastrophe.	Many examples of this in (re)insurance companies. Munich Re recently expanded its third-party capital ILS investor base for collateralised sidecar issues (Eden Re II sidecar).[7]	For investors: relatively high returns and low correlation with other asset classes means promise of diversification, while the quota-set-up limits the extent of the risk. For insurers: sidecars allow access to a much bigger pool of capital, the limited lifespan offers quick access to capital and the quota-system allows for splitting up of larger risks.	Significant barriers to entry for developing country governments (see above). No focus on vulnerable populations.
Weather Derivatives	**Alternative risk transfer tools (ILS)**	Intermediation services that provide options on weather indices (i.e. a rainfall index) for specific sectors.	Weather derivatives have become common in the U.S. and other developed countries, linked to performance of specific industries or sectors (i.e. agriculture). However, there have been efforts to build the weather derivatives market in developing countries, one of the first being in Malawi to protect maize protection from drought (rainfall index).[8]	Can be used at a sector or company level. Enables access to financial markets. Can allow better planning and budgeting at the national and company level.	Significant barriers to entry for developing country governments (see above). No necessary focus on vulnerable populations. Requires pre-existing weather index.

7 See http://www.artemis.bm/blog/2017/03/15/munich-re-expands-its-ils-investor-base-broadens-sidecar-lines/
8 See http://documents.worldbank.org/curated/en/549461468188946567/Weather-derivative-in-Malawi-mitigating-the-impact-of-drought-on-food-security

Name of tool	Category	Description	Application examples	Advantages	Challenges
Early Recovery vouchers[9]	**Hybrid tool**	Early recovery vouchers (a) provide eligible households with an insurance policy guaranteeing immediate disaster payments in cash following disasters caused by natural hazards and (b) can be conditional on recipient households participating in risk reduction and resilience building measures.	ERVO-like schemes are being piloted in China, Peru, Mexico's CADENA system.	Specifically target poor households to ensure direct and timely assistance. Have resilience building measures as a precondition to receiving the vouchers. Can be integrated into existing safety-net and cash-transfer programmes, especially for the identification of eligible households. Lower basis risk than Index-Based Insurance, as it focuses on high covariate risk and can be used for entire regions regardless of economic sector.	Not a 'profitable' form of risk transfer so would have to be substantially reliant on government or donor funding. The challenge of finding an appropriate index with a low basis risk for the recipient households
Informal risk pooling	**Alternative risk transfer tools**	Informal risk transfer tools in the form of community risk pools.	Informal caste-based risk pools in India.	Highly tailored to existing institutions, norms and practices of communities. Wide scope – can insure against aggregate risks as well as idiosyncratic risks (though far less common). Flexible.	Unlikely to insure against aggregate risks.

9 Deutsche Gesellschaft für Internationale Zusammenarbeit (2016). Innovations and Emerging Trends in Agricultural Insurance. How can we transfer natural risks out of rural livelihoods to empower and protect people? Bonn/Eschborn. Kuhn, Saskia; Hess, Ulrich; Hazell, Peter 2016-07.

Bibliography

Action on Climate Today. ACT on Knowledge, No. 4: Disaster microinsurance. Action on Climate Today programme. New Delhi, 2016. Available from http://www.opml.co.uk/sites/default/files/ACT_knowledge_4.pdf

Advancing Climate Risk Insurance Plus. *Extreme Weather Events and Risk Transfer*. Bonn and Eschbornm: GIZ and MCII, 2017.

Association of British Insurers (ABI). Financial Risks of Climate Change. Summary Report, 2005. Available at: http://insurance.lbl.gov/documents/abi-climate.pdf

Attanasio, O., and J. Rios-Rull. Consumption smoothing in island economies: Can public insurance reduce welfare? *European Economic Review*, vol. 44, No. 7, 2000.

Baur, E., and M. Parker. Building financial resilience – the role of risk transfer for sovereign disaster risk management. *Planet @ risk*, vol. 3, No. 1, 2015.

Benson, C., and E. Clay. Understanding the Economic and Financial Impacts of Natural Disasters. Disaster Risk Management Series, No. 4. Washington DC: World Bank, 2004.

Biener, C., and M. Eling. Insurability in Microinsurance Markets: An Analysis of Problems and Potential Solutions. *The Geneva Papers on Risk and Insurance – Issues and Practice*, vol. 37, No. 1, pp. 77-107, 2012. Available from https://link.springer.com/article/10.1057/gpp.2011.29

Boudreau, L. Discipline and disasters: The political economy of Mexico's Sovereign Disaster Risk Financing Program. FERDI Policy Brief, No. 128, 2016. Available from https://www.

researchgate.net/publication/308675381_Discipline_and_disasters_The_political_economy_of_Mexico%27s_Sovereign_Disaster_Risk_Financing_Program

Cai, H., and others. The effect of microinsurance on economic activities: evidence from a randomized field experiment. *The Review of Economics and Statistics*, vol. 97, No. 2, pp. 287-300, 2015.

Cai, J. The Impact of Insurance Provision on Households' Production and Financial Decisions, 2012. Available from https://mpra.ub.uni-muenchen.de/46864/1/MPRA_paper_46864.pdf

Casaburi, L., and J. Willis. Time vs State in Insurance: Experimental Evidence from Contract Farming in Kenya. Working Paper, 2016. Available from https://basis.ucdavis.edu/sites/g/files/dgvnsk466/files/2017-03/CasaburiWillis.pdf

Chantarat, S., and others. Welfare Impacts of Index Insurance in the Presence of a Poverty Trap. *World Development* (article in press), 2017.

Clarke, D., and L. Wren-Lewis. Solving Commitment Problems in Disaster Risk Finance. In *Disaster Risk Finance as a Tool for Development: A Summary of Findings from the Disaster Risk Finance Impact Analytics Project*. Global Facility for Disaster Reduction and Recovery (GFDRR)/World Bank, 2016.

Clarke, D., and others. Overview of operational framework. Sovereign DRFI Impact Appraisal Project: Overall methodology. Paper 1, 2014. Available from https://www.gfdrr.org/sites/gfdrr.org/files/New%20Folder/Overall%20Methodology_Paper1.pdf

Clarke, D., and others, eds. *Disaster Risk Financing and Insurance: Issues and results*. Report on workshop held at FERDI on June 4 and 5. GFDRR, 2015. Available from http://www.ferdi.fr/sites/www.ferdi.fr/files/publication/fichiers/ferdi-recueil_drfi-site2.pdf

Clarke, D., and others. Evaluating Sovereign Disaster Risk Finance Strategies: A Framework. In *Disaster Risk Finance as a Tool for Development: A Summary of Findings from the Disaster Risk Finance Impact Analytics Project*. GFDRR/World Bank, 2016.

Cole, S., and others. Marketing Complex Financial Products in Emerging Markets: Evidence from Rainfall Insurance in India. *Journal of Marketing Research*, vol. 48, pp. 150-162, 2011. In combination with Cole, S., and others. *Marketing Rainfall Insurance in India*. Poverty Action Lab, 2017.

Cole, S., and others. How Does Risk Management Influence Production Decisions? Evidence from a Field Experiment. Harvard Business School Working Paper, 2013. In combination with Cole, S., and others. *Impact of Rainfall Insurance on Farmer Behaviour in India*. Poverty Action Lab, 2017.

Cole, S., and others. Dynamics of Demand for Index Insurance: Evidence from a Long-Run Field Experiment. *American Economic Review*, vol. 104, No. 5, pp. 284-90, 2013b.

Da Costa, D. The 'rule of experts' in making a dynamic microinsurance industry in India. *The Journal of Peasant Studies*, vol. 40, No. 5, 2013.

De Janvry, A. Quantifying through Ex Post Assessments the Micro-Level Impacts of Sovereign Disaster Risk Financing and Insurance Programs. World Bank Finance and Markets Global Practice Group/GFDRR, 2015. Available from https://openknowledge.worldbank.org/bitstream/handle/10986/22239/Quantifying0th0d0insurance0programs.pdf?sequence=1&isAllowed=y

De Janvry, A., and others. Weather Index Insurance and Shock Coping: Evidence from Mexico's CADENA Program. In *Disaster Risk Finance as a Tool for Development: A Summary of Findings from the Disaster Risk Finance Impact Analytics Project*. GFDRR/World Bank, 2016.

Dercon, S., and D. Clarke. *Dull Disasters: How planning ahead will make a difference*. Oxford: Oxford University Press, 2016.

Dornan, M., and T.N. Cain. Regional Service Delivery among Pacific Island Countries: An Assessment. *Asia & The Pacific Policy Studies*, vol. 1, No. 3, pp. 541-560, 2014.

Elabed, G., and M. Carter. Ex-ante Impacts of Agricultural Insurance: Evidence from a Field Experiment in Mali, 2014. Available from https://arefiles.ucdavis.edu/uploads/filer_public/2014/08/29/impact_evaluation_0714_vdraft.pdf

FSD Africa and CENFRI. Funding the Frontier: The Link between Inclusive Insurance Market, Growth and Poverty Reduction in Africa, 2017. Available from http://cenfri.org/documents/microinsurance/2017/Funding%20the%20frontier.pdf

Fuchs, A., and L. Rodriguez-Chamussy. Voter Response to Natural Disaster Aid: Quasi-Experimental Evidence from Drought Relief Payments in Mexico. Policy Research Working Paper, No. 6836. World Bank, 2014. Available from https://openknowledge.worldbank.org/bitstream/handle/10986/17723/WPS6836.pdf?sequence=1&isAllowed=y

Gaurav, S., and others. Marketing Complex Financial Products in Emeging Markets: Evidence from Rainfall Insurance in India. Microinsurance Innovation Facility Research Paper, No. 1. Geneva: International Labour Organisation, 2011. Available from http://www.ilo.org/public/english/employment/mifacility/download/repaper1.pdf

Ghesquiere, F., and O. Mahul. Sovereign Natural Disaster Insurance for Developing Countries: A Paradigm Shift in Catastrophe Risk Financing. Policy Research Working Paper, No. 4345. World Bank, 2007. Available from https://openknowledge.worldbank.org/bitstream/handle/10986/7331/wps4345.pdf?sequence=1&isAllowed=y

GIZ GmbH. *Promoting Integrated Climate Risk Management and Transfer: At a Glance*, 2016.

Global Facility for Disaster Risk Reduction. *Turkish Catastrophe Insurance Pool: Providing Affordable Earthquake Risk Insurance*. Risk Financing and Insurance Case Study, 2011.

Golnaraghi, M., and others. *An Integrated Approach to Managing Extreme Events and Climate Risks: Towards a Concerted Public-Private Approach*. Zurich: The Geneva Association – International Association for the Study of Insurance Economics, 2016. Available from https://www.genevaassociation.org/sites/default/files/research-topics-document-type/pdf_public//20160908_ecoben20_final.pdf

Golnaraghi, M., and P. Khalil. *The Stakeholder Landscapes in Extreme Events and Climate Risk Management.* Zurich: The Geneva Association – International Association for the Study of Insurance Economics, 2017. Available from https://www.genevaassociation.org/sites/default/files/research-topics-document-type/pdf_public//stakeholder-landscape-in-eecr.pdf

Hallegatte, S. An exploration of the link between development, economic growth and natural risk. World Development Report 2014, Background Paper, 2013.

Hazell, P., and others. *The potential for scale and sustainability in weather index insurance for agriculture and rural livelihoods.* Rome: WFP/International Fund for Agricultural Development, 2010. Available from https://www.ifad.org/documents/10180/32647150-6e8a-41f3-8642-404768cfc99f

Hess, U., and P. Hazell. *Innovations and Emerging Trends in Agricultural Insurance. How can we transfer natural risks out of rural livelihoods to empower and protect people?* Bonn/Eschborn: Deutsche Gesellschaft für Internationale Zusammenarbeit, 2016.

Hudson, P., and others. Moral hazard in natural disaster insurance markets: empirical evidence from Germany and the United States. Working Paper, No. 2014-07. Philadelphia: Wharton School, University of Pennsylvania, 2014. Available from http://opim.wharton.upenn.edu/risk/library/J2017LE_Natural-Disaster-Insurance-Markets.pdf

Insurance Development Forum (IDF). Promoting resiliency to natural catastrophes: the critical legal, regulatory and policy architecture. Draft paper.

Intergovernmental Panel on Climate Change. *Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*. Cambridge: Cambridge University Press, 2012.

International Financial Consulting. Mid-Term Evaluation of the Performance of the Operations of MiCRO in Haiti. Evaluation Report, 2014. Available from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/485959/Mid-term-eval-perf-oper-micro-Haiti2-annexes.pdf

International Labour Organization. Insurance and economic development: Growth, stabilization and distribution. Briefing Note. Impact Insurance Facility/International Labour Organization, 2016. Available from http://www.impactinsurance.org/sites/default/files/ILO_IIF_Briefing%20Note_14_EN.pdf

Isakson, S.R. Derivatives for Development? Small Farmer Vulnerability and the Financialization of Climate Risk Management. *Journal of Agrarian Change*, vol. 15, No. 4, pp. 569-580, 2015.

Karlan, D., and others. Agricultural Decisions After Relaxing Credit and Risk Constraints. *Quarterly Journal of Economics*, vol. 129, No. 2, pp. 597-652, 2014. In combination with Karlan, D., and others. *Examining Underinvestment in Agriculture: Returns to Capital and Insurance Among Farmers in Ghana*. Poverty Action Lab, 2017.

Kellenberg, D., and A. Mobarak. Does rising income increase or decrease damage risk from natural disasters? *Journal of Urban Economics*, vol. 62, pp. 788-802, 2008. Available from http://faculty.som.yale.edu/mushfiqmobarak/papers/rising%20income.pdf

Kovacevic, R., and G. Pug. Does insurance help to escape the poverty trap? A ruin theoretic approach. *Journal of Risk and Insurance*, vol. 78, No. 4, pp. 1003-1028, 2010.

Lucas, B. *Disaster risk financing and insurance in the Pacific*. GSDRC Applied Knowledge Services, 2015. Available from https://assets.publishing.service.gov.uk/media/57a08968ed915d3cfd000226/HDQ1314.pdf

Mahul, O., and C. Stutley. *Government Support to Agricultural Insurance: Challenges and Options for Developing Countries*. Washington DC: International Bank for Reconstruction and Development/World Bank, 2010. Available from https://openknowledge.worldbank.org/bitstream/handle/10986/2432/538810PUB0Gove101Official0Use0Only1.pdf?sequence=1&isAllowed=y

Matul, M., and others. Why people do not buy microinsurance and what can we do about it. Microinsurance Paper, No. 20. Geneva: International Labour Organisation, 2013. Available from http://www.ilo.org/public/english/employment/mifacility/download/mpaper20_buy.pdf

McIntosh, C., and others. Productivity, credit, risk and the demand for weather index insurance in smallholder agriculture in Ethiopia. *Agricultural Economics*, vol. 44, pp. 319-417, 2013. Available from https://gps.ucsd.edu/_files/faculty/mcintosh/mcintosh_publications_productivity.pdf

Mechler, R., and others. Making Communities More Flood Resilient: The Role of Cost Benefit Analysis and Other Decision-support Tools in Disaster Risk Reduction. White Paper. Zurich

Flood Resiliance Alliance, 2014. Available from http://opim.wharton.upenn.edu/risk/library/ZAlliance-decisiontools-WP.pdf

Merry, A., and others. Microinsurance Distribution Channels: Insights for Insurers. Impact Insurance Paper, No. 33. Geneva: International Labour Organization, 2014. Available from http://www.impactinsurance.org/publications/mp33

Miller, S., and K. Keipi. Strategies and Financial Instruments for Disaster Risk Management in Latin America and the Caribbean. Inter-American Development Bank, 2005. Available from https://publications.iadb.org/bitstream/handle/11319/4835/Strategies%20and%20Financial%20Instruments%20for%20Disaster%20Risk%20Management%20in%20Latin%20America%20and%20the%20Caribbean.pdf?sequence=1

Mobarak, M., and M. Rosenzweig. Informal Risk Sharing, Index Insurance, and Risk Taking in Developing Countries. *American Economic Review*, vol. 101, No. 3, pp. 375-380, 2013. In combination with Mobarak, M., and M. Rosenzweig. *Formal Rainfall Insurance for the Informally Insured in India*. Poverty Action Lab, 2017.

Morsink, K., and others. How to Measure Whether Index Insurance Provides Reliable Protection. Policy Research Working Paper, No. 7744. World Bank, 2016. Available from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2811392

Munich Re. Natural catastrophe losses at their highest for four years, 2017. Press release. Available from https://www.munichre.com/en/media-relations/publications/press-releases/2017/2017-01-04-press-release/index.html

Oxfam and World Food Programme. *Managing Risks to agricultural livelihoods. Impact Evaluation of the HARITA Project in Ethiopia (2009-2012),* 2013. Available from https://www.oxfamamerica.org/static/media/files/Oxfam_America_Impact_Evaluation_of_HARITA_2009-2012_English.pdf

Oxfam and World Food Programme. *Rural Resilience in Action: Preliminary results of the impact evaluation for the R4 rural resilience initiative in Senegal (2013-2015)*, 2015. Available from http://documents.wfp.org/stellent/groups/public/documents/communications/wfp284835.pdf?_ga=2.48517734.1956121926.1498496194-1482821014.1498227220

Oxford Policy Management. *Shock-Responsive Social Protection Systems research: Literature review.* Oxford, 2016. Available from http://www.opml.co.uk/sites/default/files/Shock_responsive_social_protection_Literature%20review_EN.pdf

Pacific Islands Forum Secretariat. Strengthening Economic Linkages: Climate Financing and Disaster Risk Reduction: Pilot Country Experiences with the Pacific Catastrophic Risk Insurance Pilot. Paper for the Forum Economic Ministers Meeting and Forum Economic Officials Meeting, 8-11 July, 2014, Solomon Islands. World Bank, 2014. Available from http://www.forumsec.org/resources/uploads/attachments/documents/2014FEMM.08_Pacific_Catastrophe_Risk_Insurance_Pilot.pdf

Reeves, J. Ten concerns about climate and disaster insurance schemes – and one rights-based alternative. ActionAid blog post, 24 May, 2016. Available from http://actionaid.org/2016/05/ten-concerns-about-climate-and-disaster-insurance-schemes-and-one-rights-based-alternative

Reisinger, A., and others. Australasia. In *Climate Change 2014: Impacts, Adaptation and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press, and New York, pp. 1371-1438, 2014.

Schaefer, L., and others. Making Climate Risk Insurance Work for the Most Vulnerable: Seven Guiding Principles. Munich

Climate Insurance/UNU-EHS Publication Series. Policy Report, 2016, No 1. United Nations University, 2016. Available from https://collections.unu.edu/eserv/UNU:5830/MCII_ProPoor_161031_Online.pdf

Schaefer, L., and E. Waters. *Climate Risk Insurance for the Poor & Vulnerable: How to effectively implement the pro-poor focus of InsuResilience*. Munich Climate Risk Insurance Initiative, 2016. Available from http://collections.unu.edu/eserv/UNU:5956/MCII_CRI_for_the_Poor_and_Vulnerable.pdf

Silver, N., and A. Dlugolecki. The Insurability of the Impacts of Climate Change. Paper presented at the GIRO conference, Edinburgh, October 2009.

Surminski, S. Taking a risk on the weather. *Financial World*, Feb/Mar, pp. 49-51, 2014. Available from http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2016/02/49-53-Surminski-Kool.pdf

Surminski, S., and D. Oramas-Dorta. Flood insurance schemes and climate adaptation in developing countries. *International Journal of Disaster Risk Reduction*, vol. 7, pp. 154-164, 2014.

Taylor, M. Risky Ventures: Financial Inclusion, Risk Management and the Uncertain Rise of Index-Based Insurance. In Zarembka, P., and S. Soederberg, eds. Risking Capitalism, *Research in Political Economy*, vol. 31, pp. 237-266, 2016. Available from https://www.researchgate.net/publication/309333544_Risky_Ventures_Financial_Inclusion_Risk_Management_and_the_Uncertain_Rise_of_Index-Based_Insurance

United Nations Economic and Social Commission for the Asia Pacific. Discussion Paper: Third International Conference on Financing for Development, Addis Ababa, Ethiopia, July, 2015. Bangkok, 2015. Available from http://www.unescap.org/sites/default/files/9-ESCAP-Financing%20Disaster-July2015_share_2.pdf

United Nations Framework Convention on Climate Change. Mechanisms to manage financial risks from direct impacts of climate change in developing countries. Technical paper, 2008. FCCC/TP/2008/9. Available from http://unfccc.int/resource/docs/2008/tp/09.pdf

United Nations General Assembly. *Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction*, 2016. Available from http://www.preventionweb.net/files/50683_oiewgreportenglish.pdf

United Nations Office for Disaster Risk Reduction. *Making Development Sustainable: The Future of Disaster Risk Management.* Global Assessment Report on Disaster Risk Reduction. Geneva, Switzerland: United Nations Office for Disaster Risk Reduction, 2015. Available from http://www.preventionweb.net/english/hyogo/gar/2015/en/gar-pdf/GAR2015_EN.pdf

United Nations Office for Disaster Risk Reduction. Working Session on Disaster Risk Transfer and Insurance. Issue Brief for the UN World Conference on Disaster Risk Reduction, 2015b. Available from https://view.officeapps.live.com/op/view.aspx?src=http%3A%2F%2Fwww.wcdrr.org%2Fwcdrr-data%2Fuploads%2F888%2FOFFICIAL%2520ISSUE%2520BRIEF_Working%2520Session%2520-%2520Disaster%2520Risk%2520Transfer%2520and%2520Insurance.docx

United Nations Office for Disaster Risk Reduction. Working Session on Risk Transfer and Insurance for Resilience: Key messages, 2017.

Von Peter, G., and others. *Unmitigated Disasters? New Evidence on the Macroeconomic cost of Natural Catastrophes.* Bank for International Settlements, 2012. Available from http://www.bis.org/publ/work394.pdf

Warner, K., and others. Insurance solutions in the context of climate change-related loss and damage. Policy Brief, No. 6. Munich Climate Insurance Initiative/UNU-EHS Publication Series, 2012. Available from http://collections.unu.edu/eserv/UNU:1835/pdf10573.pdf

Warner, K., and others. Innovative insurance solutions for climate change: how to integrate climate risk insurance into a comprehensive climate risk management approach. Report No. 12. GIZ GmbH and MCII. Bonn: United Nations University Institute for Environment and Human Security, 2013. Available from http://collections.unu.edu/eserv/UNU:1850/pdf11484.pdf

World Bank. Case Study: Managing Exposure to Oil Price Volatility in Uruguay. World Bank Treasury, 2016. Available from http://treasury.worldbank.org/bdm/pdf/Uruguay-Oil-Hedge-Case-Study.pdf

Young, H., and D. Maxwell. Participation, political economy and protection: food aid governance in Darfur, Sudan. *Disasters*, vol. 37, No. 4, pp. 555-578, 2013.

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The United Nations University (UNU) is a global think-tank and the academic arm of the UN. The mission of the Institute for Environment and Human Security (UNU-EHS) is to carry out cutting edge research on risks and adaptation related to environmental hazards and global change. The institute's research promotes policies and programmes to reduce these risks, while taking into account the interplay between environmental and societal factors.

About MCII

The Munich Climate Insurance Initiative (MCII) is the leading innovation laboratory on climate change and insurance. It was launched over 10 years ago in response to the growing realization that insurance-related solutions can play a role in adaptation to climate change, as advocated in the Framework Convention and the Kyoto Protocol. MCII, through its unique set-up, provides a forum and gathering point for insurance-related expertise on climate change impacts. The Initiative brings together insurers, experts on climate change and adaptation, NGOs and researchers intent on finding effective and fair solutions to the risks posed by climate change, as well as sustainable approaches that create incentive structures for risk and poverty reduction. MCII is hosted by the United Nations University Institute for Environment and Human Security (UNU-EHS) in Bonn, Germany.

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