



Adaptation to Climate Change: Linking Disaster Risk Reduction and Insurance

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Preface

This paper is an initial attempt to consider the role in adaptation of insurance and related risk sharing and risk transfer methods, in the context of a comprehensive approach to risk reduction and risk management.

The Bali Action Plan, which was agreed by Parties to the UNFCCC in Bali, Indonesia, December 2007 as the basis for developing a new international agreement on climate change, states that adaptation requires consideration of “risk management and risk reduction strategies, including risk sharing and transfer mechanisms such as insurance”, as well as “disaster reduction strategies”.

Subsequently, at the fourteenth session of the Conference of the Parties in Poznan, Poland, December 2008, an official UNFCCC workshop was held on these issues, where Parties expressed their views on the usefulness of disaster risk reduction measures and insurance in advancing adaptation. Many points and questions were raised in relation to the role of insurance and on the specific insurance proposals presented at the workshop.

One key question is whether, and how, insurance-related mechanisms could contribute as a risk reduction policy and thereby could lead to reduced disaster risks and reduced losses, particularly for developing countries and vulnerable groups.

Following informal conversations at Poznan between members of the United Nations International Strategy for Disaster Reduction Secretariat (UNISDR) and the Munich Climate Insurance Initiative (MCII), a group of interested experts were invited to quickly contribute their input to the present document, with a view to answering the question above as well as more generally providing information to assist Parties in their deliberations on these matters over 2009.

The paper offers a preliminary analysis, produced in the short time required to provide a timely input to the June 2009 negotiations in Bonn. It is the work of the authors alone, as a group, and does not necessarily represent the policies or views of the UNISDR or MCII or their partner organizations. It is neither conclusive nor comprehensive, but we hope it will provide a useful contribution to the ongoing conversation on the role of insurance in adaptation and reducing disaster risk.

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UNISDR

Executive summary

Development gains are increasingly at risk from a number of pressures, including climate change. In specific locales around the globe, adverse changes are already being observed in the amount, intensity, frequency and type of precipitation, resulting in drought, floods and tropical storms. Disaster risk is growing as a result of unplanned urbanisation, persistent poverty and ecosystem degradation. These risk drivers will be exacerbated by climate change. Losses from climate-related hazards are rising and currently account for about 100 billion dollars per year.¹ Changes in the climate threaten to undermine the resilience of poorer countries and their citizens to absorb loss and recover from disaster impacts, such as through decreases in agricultural productivity, water and energy stress, and increasing incidence of disease. This combination of increasing hazard risk and decreasing resilience makes climate change a global driver of disaster risk that will increase the impact of disasters on the poor.

To address expected losses, the United Nations Framework Convention on Climate Change (UNFCCC) Parties have identified both disaster risk reduction strategies and risk transfer mechanisms including insurance as potential elements in a new climate agreement. This paper addresses the potential role of insurance in reducing disaster risk and thus advancing adaptation.

For centuries, insurance and other risk transfer mechanisms have been used to manage risks that would be too large for people and companies to bear on their own. By transferring some exposure to third parties with more stable financial basis in exchange of a premium, insurance has historically facilitated entrepreneurship and economic growth in developed countries. Evidence is emerging that if properly designed, insurance can also be useful in reducing risk.

Risk transfer tools like insurance have the potential to be useful to the poor in managing the disaster risks posed by climate change as well. Index-based micro-insurance, for example, is providing low-income households with financial coverage for climate risks in Bolivia, Malawi, India, Mongolia, Sudan and Ethiopia. Caribbean Island States have recently formed the world's first multi-country index-based catastrophe insurance pool. These experiences indicate that insurance – with coordinated public and private action and some international support – has the potential to provide a layer of security to vulnerable people and countries facing climate change. To date, however, there is insufficient experience demonstrating that traditional insurance can assist the poor to escape poverty through investment in higher risk, higher yield activities. Moreover, while some schemes have tried to embed insurance within a disaster risk reduction framework, current micro-insurance programmes do not have direct links and incentives to reduce disaster losses.

Insurance has limitations: it does not prevent the loss of lives or assets. It is not always the most appropriate option to manage risks, in terms of cost-effectiveness or affordability. With climate change, insurance tools will be challenged to cover increasingly frequent and intense events. Furthermore, traditional insurance may not be the appropriate tool for longer term foreseeable risks like sea-level rise and desertification. In such cases, other measures including basic investments in risk reduction make more sense. Insurance on its own is not the solution. Insurance could fail to reduce risk and to advance adaptation unless it is implemented along with disaster risk reduction measures.

Encouraging experience in developed countries shows that collaboration between the insurance industry and the public sector can promote risk reduction as follows:

- *Awareness raising and risk education:* Insurers and government can partner to make available risk data and information systems.
- *Risk pricing:* By accurately pricing risk, insurers can incentivise risk reducing decision making.
- *Enabling conditions and regulation of insurance programmes:* Through legislation, financial oversight and monitoring, government can provide incentives for insurance to promote risk-reducing activities.

- *Direct financing of risk reduction measures:* Insurers can invest directly in risk reduction measures to avoid large compensation claims.
- *Risk reduction as a prerequisite for insurance:* As a prerequisite for coverage, insurers can require that policy holders undertake specific disaster risk reduction measures.

The paper concludes that if appropriately embedded among risk reduction measures and with the right incentives, insurance has important potential to reduce disaster risk and advance adaptation. In order to realise that potential, the paper also identifies some considerations for designing insurance programmes that promote risk reduction. These include careful planning and close coordination in the implementation of insurance with disaster risk reduction measures; raising community risk awareness; investing in the gathering and dissemination of risk information; government regulation to ensure a longer term focus on risk reduction from insurers; and government regulation to ensure insurer solvency, licensing and insurance distribution.

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1. Introduction

UNFCCC Parties identified in the Bali Action Plan² the negotiation elements for an agreement to be reached at their fifteenth Conference of the Parties (COP-15). Among other elements for adaptation, the Bali Action Plan calls for “Risk management and risk reduction strategies, including risk sharing and transfer mechanisms such as insurance” as well as “Disaster reduction strategies and means to address loss and damage associated with climate change impacts in developing countries that are particularly vulnerable to the adverse effects of climate change”.

This paper addresses two of these elements—disaster risk reduction and insurance—to provide climate change negotiators with further background to assist their decision making regarding the role of insurance in reducing disaster risk and thus as a potential tool for adaptation.

The increase of disaster risk

Disaster risk is growing as a result of unplanned urbanisation, persistent poverty and ecosystem degradation. These risk drivers will be exacerbated by climate change. Over the last two decades (1988-2007), 76 percent of all disasters were hydrological, meteorological or climatological in nature.³ These accounted for 45 percent of the deaths and 79 percent of the economic losses caused by natural hazards. Population growth combined with more people living in hazardous areas will also increase risks over time, including the number of fatalities and asset damage. The Intergovernmental Panel on Climate Change (IPCC) attributes increasing drought and heavy precipitation (the latter often leading to floods) in some regions, as well as extreme temperatures across the globe, to climate change. It is virtually certain that these trends will continue in the future. The Stern Report⁴ points out that the earliest and most damaging impacts of climate change are likely to be caused by the expected increase in severity of extreme weather. These events burden developing countries disproportionately. Nine out of ten deaths from disasters in the last 25 years occurred in developing countries.⁵ Today the need is greater than ever to manage weather-related risks in ways that support adaptation of the most vulnerable to a changing climate.

1.1 Disaster risk reduction is a core component of adaptation

Disaster risk can be reduced through systematic efforts to analyse and manage the causal factors of disasters, reducing exposure to hazards, lessening vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events. Disaster risk reduction measures are, therefore, thoroughly appropriate to help counteract the added risk arising from climate change.

A comprehensive approach to reduce disaster risks is set out in the United Nations-endorsed Hyogo Framework for Action 2005-2010: Building the Resilience of Nations and Communities to Disasters⁶, whose expected outcome is “the substantial reduction of disaster losses, in lives and the social, economic and environmental assets of communities and countries.” A great variety of policies and measures are useful to reducing disaster risk and promoting adaptation to climate change. These include:

Strong institutional basis for implementation: requires fostering political commitment and community participation to reduce disaster risk, and developing or strengthening the institutional, legislative and operational mechanisms for disaster reduction. It involves integrating disaster risk reduction into development planning and decentralizing responsibilities where necessary. It also calls for assessing human and financial needs, and allocating the necessary resources.

Risk knowledge and early warning: requires the collection and use of data on disaster risks, and hence the development and maintenance of capacities and infrastructure to observe, analyse and forecast hazards, vulnerabilities and disaster impacts. It requires developing early warning systems that are people-centred, well integrated into decision-making processes and effectively disseminated.

Awareness raising and education: requires information-sharing systems and services, promoting dialogue and cooperation among scientific communities and practitioners, including disaster risk reduction in school curricula, and developing training and learning programmes on disaster risk reduction at a community level, for local authorities and targeted sectors. Finally, it requires strengthening research capacity and engaging the media to raise awareness.

Addressing underlying risk factors: requires the sustainable use and management of ecosystems, land use and natural resources, and integrating disaster risk reduction strategies and climate change. It calls for promoting food security for resilience, integrating disaster risk reduction planning into the health sector and promoting safe hospitals. Protecting critical public facilities and implementing recovery schemes and social safety nets is also necessary. It also involves promoting income diversification options, promoting financial risk sharing mechanisms and establishing public-private partnerships. Finally, it requires integrating disaster risk considerations in land-use planning and building codes, and incorporating disaster risk assessment in rural development plans.

Disaster preparedness for effective response: requires a plan and programme to assess and strengthen existing policy, technical and institutional capacities including those for management and coordination; mechanisms for the coordination and exchange of information and early warnings; contingency planning and response readiness, such as evacuation and standby arrangements for the provision of essential services and supplies; and the periodic review, rehearsal and modification of the plan. Finally, it requires the allocation of necessary financial resources including an emergency fund.

Financial risk sharing mechanisms and insurance

Among the many measures presented above, the Hyogo Framework calls for financial risk sharing mechanisms,⁷ which include a variety of instruments such as catastrophe bonds, weather or index-based derivatives, micro-insurance and traditional disaster insurance. Risk transfer tools including insurance do not reduce risk as such, they smooth consumption and lessen the financial and economic impacts caused by hazard events. Risk transfer tools including insurance may or may not reduce risk.

Insurance may fail for a variety of reasons: as a result of an ineffective legal system to enforce insurance contracts, strong exposure by a population to risk, incomplete risk information and high transaction costs.⁸ In part as a result of such failures, there is controversy regarding the use of insurance as a risk management tool in developing countries.

Moreover, there is insufficient experience demonstrating that traditional insurance can assist the poor to escape poverty and reduce vulnerability through investment in higher risk, higher yield economic activities. While some schemes have tried to embed insurance within a disaster risk management framework, current micro-insurance programmes lack direct links and incentives to reduce direct losses from disasters. Given that national resources are limited, investing in the development of a risk transfer instrument necessarily involves the opportunity cost of investing in other measures. For this reason it is important that decisions regarding any risk transfer tool are based on clear understanding of its benefits and limitations. A primary misunderstanding is that insurance is a “silver bullet” for risk management and adaptation. In fact insurance will fail to reduce risk and to advance adaptation unless it is implemented along with disaster risk reduction measures. In addition, it must be clear insurance scheme requires a steady stream of premium income to cover future payouts.

Investing in disaster risk reduction measures, such as raising community risk awareness to reduce vulnerability and enforcing building codes, is a first step toward adaptation. This paper provides an initial analysis of the potential for insurance to enable adaptation if implemented among the array of risk reduction measures. The paper explores some cases that have explicitly linked disaster risk reduction and insurance although much more is still to be learned through experience, consultation and discussion. This paper attempts to provide some interim information to meet the quick pace of the climate change negotiations.

Box 1 Risk transfer tools—an introduction⁹

Catastrophe risk financing frameworks must be highly specialised to the type of coverage required and the local risk and social conditions. Broad types of catastrophe risk financing include:

(Traditional) Insurance

Insurance is a contractual transaction that guarantees financial protection against potentially large loss in return for a premium; if the insured experiences a loss, then the insurer pays out a previously agreed amount. Insurance is common across most developed countries and covers many types of ‘peril’, for example, many homeowners buy fire and theft insurance to protect their property and in some countries car owners are required to purchase automobile liability insurance.

Micro-insurance

Micro-insurance is characterised by low premiums or coverage and is typically targeted at lower income individuals who are unable to afford or access more traditional insurance. Micro-insurance tends to be provided by local insurance companies with some external insurance backstop (e.g. reinsurance). Micro-insurance can cover a broad range of risks; to date, it has tended to cover health and weather risks (including crop and livestock insurance). Weather insurance typically takes the form of a parametric (or indexed-based) transaction, where payment is made if a chosen weather-index, such as 5-day rainfall amounts, exceeds some threshold. Such initiatives minimise administrative costs and moral hazard and allow companies to offer simple, affordable and transparent risk transfer solutions. One of the largest micro-insurance schemes, the Weather-based Crop Insurance Scheme, was established by the Government of India and currently protects more than 700,000 farmers against drought.

Reserve fund

Catastrophe reserve funds are typically set up by governments, or may be donated, to cover the costs of unexpected losses.

Risk pooling

Risk pools aggregate risks regionally (or nationally) allowing individual risk holders to spread their risk geographically. Through spreading risks, pooling allows participants to gain catastrophe insurance on better terms and access collective reserves in the event of a disaster. An example is the Caribbean Catastrophe Risk Insurance Facility (CCRIF), which allows Caribbean governments to purchase coverage for earthquake and/or hurricane. The CCRIF was able to secure US\$110 million of reinsurance capacity in addition to its own reserves.

Insurance-linked securities

Insurance-linked securities, most commonly catastrophe (cat) bonds, offer an avenue to share risk more broadly with the capital markets. Cat bonds are issued by the risk holder (usually a government or insurance company) and trigger payments on the occurrence of a specified event. This event may be a specified loss or may be a parametric trigger, such as the wind speed at a location. In 2006, the Government of Mexico issued a cat bond (the Cat-Mex bond) that transfers earthquake risk to investors by allowing the government to not repay the bond principal if a major earthquake were to hit Mexico.

2. Does insurance help developing countries reduce risk today?

Countries worldwide are looking for ways to manage risks, especially those related to or made worse by climate change. Insurance is widely used by individuals and organisations across most industrialised countries as one of a package of measures to manage risks (some examples are provided in section three). The use of insurance is now also expanding in developing countries, particularly in emerging economies, and many wonder whether insurance could help developing countries reduce the risks of extreme events, which have such devastating impacts on national economies, human welfare, and the development process. This section examines potential risk reduction benefits and the current role of insurance in developing countries.

2.1 Potential risk reduction benefits for developing countries

Insurance can provide tangible and intangible benefits that reduce risks and that are of particular importance for developing countries. These benefits include:

Building resilience

With little or no access to formal insurance mechanisms for disasters, the poor are forced to self insure, depleting their assets when disaster strikes and being forced into even deeper poverty. Mechanisms like social safety nets, risk sharing or pooling programmes, and insurance tools could help smooth household incomes when shocks occur. This smoothing effect can help low-income households avoid sacrificing longer-term investments in health, education, and livelihood assets when natural hazards occur.¹⁰

Providing timely financial liquidity

Insurance does not directly prevent or reduce the risk of damage or loss; however, the financial liquidity provided by insurance in the case of a disaster can reduce some of the indirect effects of damage, such as human suffering, loss of livelihoods assets and set-backs to development. Insurance solutions help reduce the burden on the public purse to restore public and private infrastructure and services following a natural hazard event.

Helping to reduce longer-term indirect losses

Related to the point above, it is sometimes pointed out that insurance helps reduce longer-term indirect losses. Prompt payouts facilitate more rapid reconstruction of key infrastructure upon which macro economies depend (such as bridges, roads, ports), as well as helping communities and households recover more quickly and reduce longer-term consequences that can accompany disasters—including homelessness and livelihood loss, illness and increasing poverty.

As compelling as these benefits sound, does current experience in developing countries confirm that insurance spawns risk reduction there? The following subsection examines the limited (but growing) role of insurance tools in developing countries today, with a few examples of programmes where risk reduction and insurance go hand in hand.

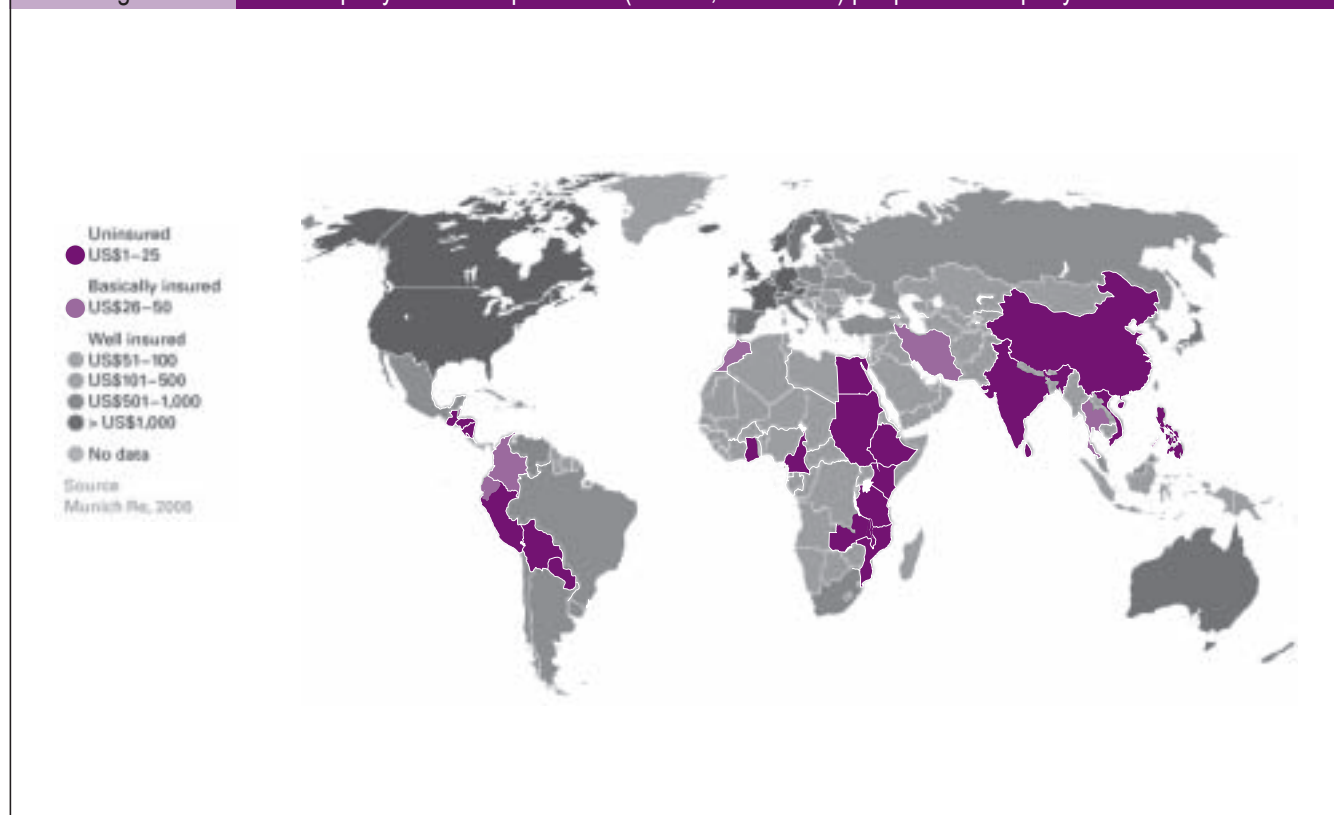
2.2. The role of insurance in developing countries today

Today insurance covers only around 3 percent of disaster losses in developing countries, compared to 40 percent in the industrialised countries.¹¹ Figure 1 below shows that some of the world's most populous developing countries have almost no insurance coverage, or no data is available in these countries. In developing countries, insurance is most common in the commercial and industrial sectors and higher income groups. In the non-life industry, the bulk of premium volumes come from the motor sector, with property insurance a relatively low proportion (e.g., 20 percent in India). The penetration of agricultural insurance in developing countries is also low despite the sector's economic importance, with premiums accounting for only 0.01 percent of GDP.¹² Catastrophe insurance has particularly limited availability. In addition, insurance has low penetration among lower income groups, due to its general lack of affordability.

Insurance sector information does indicate, however, that there is potential for growth, and many new markets are emerging. Premium volumes are now growing rapidly in the emerging market economies: 7.5 percent per annum for life insurance and 6 percent per annum for non-life. In 2005, annual premiums per capita in emerging markets were approximately \$46 and \$30 USD per capita for life and non-life insurance, respectively (compared to \$1900 and \$1400 USD per capita in developed countries).

Figure 1

Property insurance premiums (non-life, non-health) per person and per year



Macro-level insurance programmes

In spite of currently low coverage rates in developing countries, several schemes have been implemented in recent years that show potential for further growth. The Caribbean Island States recently formed the world's first multi-country catastrophe insurance pool, reinsured in the capital markets, to provide governments with immediate liquidity in the aftermath of hurricanes or earthquakes.¹³ The World Bank and other institutions are exploring the possibility of extending the benefits of similar pooled risk transfer solutions to other regions, such as Asia and Southeastern Europe.¹⁴

Meso- and micro-level insurance programmes

Insurance tools can be used by governments to ensure the provision of critical services in the case of a shock. A well-known meso-level example is that of the World Food Programme (WFP) in Ethiopia. WFP issued a novel weather-index insurance scheme to assure sufficient funds

to the Ethiopian government to protect the livelihoods of Ethiopia's vulnerable drought-exposed populations. This insurance instrument holds promise for supporting institutions that have traditionally provided humanitarian assistance.¹⁵ Another example is found in Malawi where a combination of sufficient weather stations and start-up assistance from the World Bank and WFP helped start a pilot weather insurance project. The insurance pilot bundles loans and insurance for nearly 1000 smallholder farmers enabling them to buy affordable index-based drought insurance. The insurance is linked to loans and both improves the credit-worthiness of participating farmers and enables them to increase their farm productivity.¹⁶ A challenge with such initiatives tends to be scalability; current schemes tend to cover only a few hundred or thousand farmers. An initiative in India launched in 2007 offered insurance with crop loans and was taken up by 700,000 farmers¹⁷.

At the community and household level, micro-insurance aims to improve the affordability of insurance for lower-

income groups. Micro-insurance that covers life and health risks is becoming more widely established, and in this sense may support adaptation by helping the poor deal with the increase in other risks that climate change will bring (e.g., changes in disease and pest patterns).

The use of micro-insurance to cover losses caused by severe natural hazard events is only just emerging. Experts acknowledge that development of risk transfer schemes for the poor face a number of challenges including a lack of reliable information for pricing risk, affordability,

Box 2 Index-based insurance in Bolivia

The Fundación PROFIN has developed a scheme in four provinces in the north and central Altiplano regions of Bolivia that combines incentives for pro-active risk reduction and an insurance index mechanism. In this scheme the index is based on the production levels of reference plots of farmland in areas which are geographically similar in terms of temperature, precipitation, humidity, and type of soil. A group of farmers identify a peer who is considered to use the best available methods. That farmer serves as a technical assistance agent to help other farmers reduce their risks and improve their yields. The system encourages other farmers to match the reference farmers in implementing risk reduction efforts to reduce the effects of drought, excess rains, hailstorms and frost. The reference farmer's land becomes the reference plot, the yields from which serve as an indicator of whether production levels have been adversely affected by environmental factors (triggering an insurance payout) or by other factors within the farmer's control. The objective becomes to perform or out-perform the reference plot by improving agricultural practices and reducing risk of damage from weather hazards¹⁸.

Box 3 The Mongolian index-based livestock insurance programme

The World Bank and other organisations have been actively involved in Mongolia developing programmes for sustainable livelihoods that emphasise pastoral risk management including improved early warning systems and risk preparedness actions, access to supplementary feed and grazing reserves, coordination of pasture-land use, and conflict management. These measures were combined with efforts to extend the outreach of micro-finance services to herders, and community-prioritised investments in basic infrastructure. The index-based micro-insurance coverage helps to reduce the administrative costs of insurance, making it more affordable. Micro-insurance and complementary interventions in a wider risk management framework in Mongolia are helping to reduce herders' vulnerability to climate and non-climate hazards.

accessibility, low levels of awareness, and sustainability of the schemes themselves.¹⁹ These fundamental obstacles to expanding micro-insurance must be addressed if it is to become a useful disaster reduction tool in poor and vulnerable communities. This in turn means that disaster reduction needs to become a core aspect of development strategies. Yet if proven viable, and if micro-insurance schemes are able to be scaled up, these tools could become an important part of a comprehensive climate risk management strategy including risk reduction, disaster preparedness, and risk transfer.

In summary, this section has raised one of the central questions posed by climate negotiators about insurance: What are the benefits of insurance for developing countries in managing risks from (climate-related)

natural hazards? Does current experience in developing countries substantiate claims that insurance can promote risk reduction? The answer to both of these questions is that current experience in developing countries remains promising but limited. Insurance is growing rapidly there, but it is not clear whether all programmes spontaneously achieve the benefits of reaching the most vulnerable, building resilience and reducing indirect and longer-term losses. A handful of examples have been presented in this section which do indicate that it is possible to design programmes that contribute to risk reduction, and use insurance tools as one of a set of measures to work towards that aim. In light of the limited current experience in developing countries, our attention turns to what would need to be done to make disaster risk reduction and insurance work together, using examples from current experience mostly from industrialised countries.

3. Making disaster risk reduction and insurance work together: Examples from current experience

In this section, we explore how insurance can work alongside risk reduction measures and incentivise such measures in a developing world context.

In developed insurance markets, many examples can be found where insurance has helped to drive risk reduction through working with governments, providing pricing incentives and imposing terms and conditions requiring action. The approaches to link risk reduction and insurance, discussed in detail below, include:

- Risk awareness raising and provision of information (including information on the benefits of risk reducing measures)
- Risk pricing: premiums that reflect the level of risk (i.e. price differentiation)
- Establishing enabling conditions and appropriate regulations
- Direct financing of risk reduction measures, either through investments or loans
- Risk reduction as a pre-condition for insurance

The following subsections describe current experiences of linking disaster risk reduction and insurance, explore the barriers to such links, and then draw general principles that could be applied when designing a framework for insurance within a disaster risk reduction strategy.

3.1. Risk knowledge and awareness raising

Risk knowledge is the foundation of any risk management strategy. Public awareness of risk can have a major effect in reducing the impacts of extreme weather events: risk awareness encourages risk-reducing behaviour and increases the demand for insurance coverage. Insurers and public authorities can work together in increasing public awareness by collecting and providing high quality information about hazard risks and helping to translate this awareness into real action. The following examples illustrate collaboration between insurers and the public sector to enhance public risk awareness.

- Following massive damage after heavy rainfalls and flooding in summer 2002 in Austria, the insurance industry and public authorities in Austria developed a public risk zoning tool for floods and earthquakes, the HORA programme. The public authorities provided GIS basis data and the insurance and reinsurance industry contributed modelling and development. . The resulting exhibition has been open to the public since 2006.
- In 1976, United States insurers and reinsurers jointly established the Institute of Business and Home Safety (IBHS) as a non-profit initiative to promote risk reduction by homeowners, developers and regulators. IBHS conducts research and disseminates information on the costs and benefits of improved construction and home maintenance and preparation practices. Among other products, the IBHS published and disseminated a California-state version of its leaflet “Protect your home against wildfire damage”.

By sharing risk information with policymakers, the insurance industry can contribute to the establishment of appropriate regulatory frameworks for risk management, for example through lobbying for building codes and for planning that account for relevant risks including climate change impacts. Insurers can represent an additional voice in the argument for risk reduction expenditure. For example, insurers in the United Kingdom and elsewhere are also working to reduce losses due to extreme weather events to property through influencing government building design and choice of construction materials. The European insurance industry supports land use planning and risk awareness raising by developing improved risk mapping and zoning tools within European markets, as well a supporting improved construction standards.

Potential barriers: The challenges include the technical difficulties related to risk assessment (that is, risk data tends to be more limited in developing countries and institutional risk assessment capabilities may be lower), dissemination of appropriate information and overcoming education and language barriers in some areas. That said, people in developing countries have a good awareness of risks relevant to their livelihoods and daily lives even if there is limited data. For example, risk awareness is manifest when farmers invest in crop diversification to limit risks or avoid potentially higher-yielding but less resilient crops. Many organisations,

including micro-insurance brokers, are also successfully building risk reduction and insurance literacy in developing countries.²⁰ In short, raising risk awareness is constrained by lack of access to risk information but it can be overcome.

3.2. Risk pricing

The use of traditional insurance schemes to provide incentives for risk reduction investment will usually require differentiation in premium levels; that is, charging premiums that reflect the true level of risk (and therefore, offering appropriate discounts for risk reduction). Where premiums do not reflect the risk, this can provide a disincentive for risk reduction. An example of this comes from the National Flood Insurance Program (NFIP), a publicly-funded insurance programme in the United States that has replaced the private market (which withdrew during the 1920s following concerns about the risk of correlated losses along major rivers). Private insurers sell policies, the Federal Emergency Management Agency (FEMA) manages the premiums and claims paid by the NFIP. Although participation in NFIP is contingent on local communities' adopting construction standards to reduce flooding, the initiative has encouraged development in high-risk zones because premiums charged by the NFIP do not accurately reflect risks. Moreover, construction standards are designed only to withstand rare events (1-in-100 years). There is evidence that the Programme provides little incentive for homeowners to invest individually in measures to reduce their vulnerability to flooding, with a growing number of repeat claims from frequently flooded properties.

Potential barriers: There are a number of barriers to risk-based pricing, including: (1) its potential effects on the affordability of insurance in high-risk areas; (2) the need for accurate estimates of risk at an individual-level on which to base the pricing (challenging with current modelling, without detailed and potentially costly investigation); (3) the expense and time costs involved in verifying that any risk reducing measures are implemented and maintained; (4) market influences (e.g. the need to reduce/harmonise premiums to increase affordability and competitiveness and gain market share).

Some of these barriers are reduced where an insurer covers large or aggregated risks, for example, for a large corporation or sovereign state. In these cases, the expenses and time costs involved in verification and providing

detailed risk assessments is more economically viable. In some circumstances, insurers offer fixed premium discounts in exchange for implementation of certain risk reduction measures:

- In 1997, as part of the Caribbean Disaster Mitigation Project (CDMP), the United Insurance Company (UIC) began offering substantial premium discounts (25 – 40 percent) to homeowners and businesses in Barbados who took actions to retrofit their properties against hurricane-force winds. This initiative was accompanied by the dissemination of information of retrofitting methods. However, after one year, the take-up of this initiative had remained low. The reasons for this were assessed to be: (1) low risk perception of property owners; (2) competition within reinsurance market that offered discounts without requiring risk reduction actions; and (3) deficiencies in the promotion of the programme, such as lack of user friendly information.
- In July 1994, the United States state of Florida legislature introduced Statute 627.029 requiring insurance companies to file rates for residential property that included “appropriate discounts, credits, or other rate differentials, or appropriate reductions in deductibles, for properties on which fixtures actuarially demonstrated to reduce the amount of loss in a windstorm have been installed”. The Statute was updated in 2002 to ensure that homes constructed in compliance with the Florida Building Code (FBC) were automatically eligible for insurance discounts. As of 2005, insurers are required to notify those applying for insurance of the discounts available (Ward et al. 2008). No analysis of the success of this initiative is available.
- An extensive survey in The Netherlands found that many people (up to 68%) in low-lying polder areas at risk from flooding are willing to take risk-reduction actions in exchange for discounts on insurance premiums. These measures include investment in barriers that reduce inundation, the installation of water-resistant floor types, and the moving of central heating installations to higher floors. This could potentially reduce flood losses by billions of euros.²¹

The above cases highlight the potential role of regulation (either government or self-regulation) to overcome insurance market conditions, ‘levelling the playing field’ and enabling insurers to offer premium discounts for risk reduction.

3.3. Enabling conditions and regulation of insurance programmes

Insurance solutions and the involvement of the insurance industry can contribute to the establishment of appropriate regulatory frameworks, for example through building codes and planning practices that account for relevant risks and climate change impacts. The Florida state premium discount initiative described above demonstrates the potential role of the public sector in steering insurers towards incentivizing risk reduction. The Association of British Insurers case also demonstrates how insurers and governments can work in partnership towards a comprehensive risk management strategy. The Turkish Catastrophe Insurance Pool has tried to persuade participants to follow better building code standards and to comply with building codes in exchange for affordable coverage for earthquake risk. In this case, the link has not proved to be strong, possibly due to the structure of the local housing market (that is, most people rent rather than own) or other factors.

Another aspect that would enhance poverty reduction is the potential for insurance instruments to contribute to overall reduction of vulnerability. For example, micro-insurance in the health sector is often tied to related programmes such as immunisation programmes or training for medical staff. Some organisations like the All India Disaster Mitigation Institute have developed schemes that tie micro-insurance to disaster prevention and reduction measures.

Potential barriers: Barriers to effective regulation may be a lack of good governance, institutional capacity or adequate legal and enforcement structures. Public intervention in insurance markets must also be balanced to facilitate the development of competitive markets (e.g. to keep costs down) and to ensure that insurance is allowed to be actuarially sound. For example, in Florida State, the government has attempted to overcome affordability issues by implementing a system of regulated insurance rates, which in places do not reflect the real price of the risk. Actuarially unsound rates not only expose the insurer to potential insolvency (as premiums may not cover their

liabilities), they also mask the true level of risk and could contribute to poor risk management decisions.

3.4. Direct financing of risk reduction measures

In most industrialised countries, risk reduction is financed either by the government (e.g. investments in sea defenses) or households. There are a handful of examples where an insurer itself may pay directly for risk reduction, either through investment or lending. Such solutions have multiple benefits as the risk holder receives higher protection and the insurer may be able to avoid a large claim:

- Tokio Marine Nichido has invested in the protection of mangrove plantations in Indonesia, Myanmar, the Philippines, and Thailand, which reduce the risks posed by storm surges to areas further inland. Protecting mangroves reduces the risk of losses both to plantations as well as insured assets inland.
- Insurers like American International Group (AIG) offered its clients a premium wildfire protection service that deploys crews to covered property threatened by wildfire in parts of California and Colorado states in the United States thus reducing risk to those insured.

Potential barriers: The key barrier against households and governments investing in risk reduction is the upfront cost of risk reduction (in terms of both cash and time), relative to other investments (e.g. education, transport infrastructure) versus the perceived benefits of these actions. Particularly, in the case of infrequent disasters, people can often underestimate risk if an event has not happened for a long time, or reject multi-generational investments where they may not themselves enjoy any benefit. The perceived availability of post-disaster assistance may reduce the incentive for risk reduction, even if actual experience shows that such assistance does not cover all losses. Insurers may be unwilling to pay for measures from which they may not benefit. For example, an insurer could be reluctant to pay to retrofit a home for increased resilience fearing that the following year the risk holder may cancel the insurance policy. A competing insurer would then reap the benefits of another company’s investment in risk reduction. To overcome these barriers, the public sector plays a central role in setting the regulatory and incentive framework to encourage investment in risk reduction.

3.5. Risk reduction as a prerequisite for insurance

Commercial property policies often contain conditions that certain risk control measures should be in place for the policy to be operative, creating a risk management environment for industries and sectors. For example, many homeowners are required to install particular types of locks on their doors to qualify them for theft insurance. This can be an effective market mechanism for signalling risk and changes in risk or understanding of risk but has most impact when coupled with other signals, such as fiscal incentives like tax breaks. Such pre-conditions are applicable at the level of an individual insurance policy or may be applied at an aggregate level in partnership with government. Almost all commercial insurance products include a deductible where small losses are excluded from coverage as a means of motivating risk reduction behaviour. Insurance pays for losses beyond the deductible. The size of the deductible is often less than one percent of the value of coverage and reflects the relative importance of incentives to encourage risk reduction. Co-insurance is a further mechanism that occasionally is added to provide further motivation for

risk reduction. For losses beyond the deductible, the insurance mechanism may pay a portion or percentage of the loss.

Potential barriers: A key barrier on the side of an insurer to applying pre-conditions for insurance is that a competitive market may work against such incentives (in the same way as in the Barbados example above). Governments with short-term perspectives may argue against strong risk reduction conditions on insurance applied by the industry on affordability grounds. At the international level (that is as part of adaptation negotiations toward an international climate agreement), sovereign nations could resist making risk reduction commitments a prerequisite for participation in international insurance schemes. However, it is expected that in the context of the climate change negotiations, the international community may assist vulnerable countries to invest in risk reduction related to climate adaptation. Some proposals suggest that the international community should largely pay for the costs of an international insurance mechanism.²²

Box 4 Public-private partnership for risk reduction and insurance

The British insurance sector has developed a partnership with the United Kingdom Government to promote risk reduction. In 2002, the insurance industry agreed on a statement of principles for flood insurance coverage whereby the insurance industry agreed to continue to provide flood insurance as a standard feature of household and small business policies, and in return, the government agreed to take steps to manage the growing flood risk through a long-term strategy, taking into account climate change. This partnership approach helps the country to protect itself from flood both through risk reduction and insurance cover. It also allows the industry to take an active role in other policy areas such as promoting stricter planning rules and building regulations to reduce losses.

4. Climate change negotiations: Risk reduction and insurance in the adaptation package

It cannot be overemphasised that insurance must be viewed in the wider perspective of managing the spectrum of risks. This section discusses some of the limitations of insurance in a climate change context, again stressing that risk reduction must remain the focus to address these limits. This section then briefly examines two of the main proposals related to risk reduction and insurance, under consideration in the climate negotiations.

4.1. Limitations of insurance in a climate change context

Key limitations of insurance include (1) it does not prevent or reduce the likelihood of direct damage and fatalities from extreme weather events; and (2) it is not always the most appropriate option to manage risks (for example, in terms of cost-effectiveness or affordability). These same limitations are potentially aggravated in a climate change context (i.e. more frequent and intense extreme events). Climate change also poses additional challenges for insurance, a point that further underscores the vital importance of disaster risk reduction.

Two of these issues include:

- Potential un-insurability associated with increasing frequency and magnitude of extreme weather events. The United Nations Environment Programme's Finance Initiative (UNEPFI) reports that by 2025, insurers may withdraw from some markets as the risks become too high for the pool of premium available. This has happened periodically in the United States. CERES, a United States-based NGO, has identified a growing move by insurers to reduce coverage in coastal areas. In this context, it would be beneficial to further explore the use of alternative risk transfer products such as catastrophe bonds (cat bonds), which pass the risk on to investors in the capital markets rather than to reinsurers. At the very least, maintaining affordability will be challenging as climate risk impacts increase in frequency and magnitude, becoming less insurable. Given increased levels of uncertainty coming with climate change, higher risks to insurers ultimately mean higher premiums for clients unless significant risk reduction measures are in place.
- Unsuitability of traditional insurance for longer-term foreseeable hazards like sea-level rise and desertification. Two preconditions for insurability of disasters are the unpredictability of a specific event, which means that losses occur suddenly and cannot

Box 5 Creative insurance solutions for climate change adaptation

The Malawi micro-insurance pilot project described in Section 2.1 illustrates the benefits of an index-based insurance and seed distribution package for farmers. The effectiveness of this package could be made more powerful if premiums were tailored to reflect not the average historical risk but the risks anticipated for the next season. Seasonal forecasts differ from the historical average in Malawi mainly because of El Niño Southern Oscillation (ENSO) phenomenon, which is the major single source of climate variability on seasonal-to-inter-annual scales. Droughts are strongly related to ENSO in many areas within Southern Africa, including Malawi, and are expected to become more frequent and intense under a changing climate.²³

be foreseen; and the ability to spread the risk over time, regions and between individuals/entities. For two of the already ongoing changes caused by global warming, that is, sea-level rise and desertification, the insurability criteria cannot be fulfilled. Both processes are slow and continuous changes that potentially affect the population of one or more countries. They can lead to a deterioration of living conditions in developing or poor countries and, in the long term, could threaten the survival of human populations in affected regions. Further, only rapid and significant reduction of greenhouse gas emissions that lead to global warming could effectively prevent these risks in the long run. For this reason, insurance alone is hard-pressed to address some of the dire effects of climate change.

Some of the general limitations today explored in this paper may be partly addressed through well designed initiatives that maximise the incentives for disaster risk reduction. For the effective application of insurance programmes, it is critical that public interventions ensure long-term risk reduction for the entire spectrum of climate risks—not only those that can be addressed by insurance. The public sector must play an active role to integrate risk reduction into all development efforts (for example, by not allowing some activities that could lead to mal-adaptation in the future, such as building sea walls that will need to be replaced in the future due to sea level rise).

Seasonal precipitation forecast can help farmers choose a drought-resistant crop variety or engage in high-yield (and high-risk) farming practices, respectively. Attempts to communicate climate predictions to farmers through agricultural extension services often failed due to inadequate communication infrastructure in rural areas and because few farmers incorporated the forecasts into their decision making.²² Insurance pricing offers an alternative. Ideally, premiums are adjusted upwards in El Niño years when less rain is expected (reducing the incentive of farmers to purchase high-risk seeds) and adjusted downwards in La Niña years to reflect the reduced risk of drought. By carrying out simulations based on the rainfall record, historical yield data and ENSO forecasts, researchers examined the potential for taking seasonal forecasts into account in pricing Malawi's micro-insurance pilot program.²⁵ Results showed that cropping behaviour, which is incentivised by insurance pricing, can potentially increase gross revenues

for farmers during La Niña years (by a factor of up to seven) and substantially reduce losses during El Niño years. Creative design of an insurance programme, in this case integrating seasonal rainfall forecasts into the premium pricing, can greatly increase the coping capacity of farmers to increased climate-related drought risk – and thus further adaptation.

4.2 Proposals for risk reduction and insurance in the climate change adaptation package

In charting the course for a new negotiating process designed to tackle climate change, the 2007 Bali Action Plan calls for 'consideration of risk sharing and transfer mechanisms, such as insurance' as a means to address loss and damage in developing countries particularly vulnerable to climate change.²⁶ The Plan strengthens the mandate to consider insurance instruments, as set out by Article 4.8 of the 1993 UN Framework Convention on Climate Change (UNFCCC) and Article 3.14 of the 1997 Kyoto Protocol. Numerous proposals for insurance instruments have been put forward and even tabled in the climate negotiation process. Most recently, the Swiss Government reinforced earlier calls by proposing a multi-lateral adaptation fund, which would be spent on prevention and insurance.²⁷ Building on the Swiss proposal, the Alliance of Small Island States (AOSIS), the Munich Climate Insurance Initiative (MCII) have submitted two separate but similar proposals for prevention and insurance that will be considered at the climate negotiations in December 2009 in Copenhagen (COP 15). Each proposal suggests that international adaptation finance would support comprehensive risk reduction of climate impacts with a specific focus on the most vulnerable countries. As both AOSIS and MCII suggest, there are two promising ways to link international support for insurance with disaster risk reduction activities: First, support can depend on the "smart" design of insurance that builds in incentives for reducing disaster risks and minimises maladaptive behaviour or moral hazard. Second, risk reduction activities like land-use restrictions, early warning, building codes and other collective risk reduction measures could be prerequisites for participating in internationally-supported climate risk insurance programmes.

5. Policy considerations for climate change policy makers

It is expected that the climate talks will, by the end of 2009, create an international climate agreement with a disaster risk management element that includes insurance solutions especially targeted for developing countries. This process offers an unprecedented opportunity to design mechanisms including insurance that incentivise and promote disaster risk reduction. If successful, the combined positive impacts of disaster risk reduction and risk transfer could lower the longer-term costs of adaptation to climate change and tangibly improve the ability of many countries and vulnerable people within those countries to manage the risks of climate change.

What guidance could be offered to climate negotiators trying to achieve this ambitious aim? Several phased steps could prove useful in the planning and implementation of a strategic adaptation plan that reduces disaster risk and includes insurance. The following section presents some steps that are particularly important for action at the national and sub-national level and could guide national adaptation planning efforts. Other steps are needed at the international level to facilitate successful implementation of disaster risk reduction and insurance for particularly large weather-related risks.

5.1 National-level measures that facilitate disaster risk reducing insurance

The following steps could be undertaken at the national level in climate risk management planning, supported by national adaptation plans and as needed by the international community.

Comprehensive risk reduction as part of national adaptation plans

First, countries can develop comprehensive risk reduction plans as part of national adaptation plans, following principles set out in the Hyogo Framework for Action. It is crucial to analyze the relative roles of various disaster risk reduction measures and insurance at a government level and develop strategies to implement these in coordination.

The plans should take into account climate change impacts and be analyzed across multiple hazards (e.g. floods or storms) and classes of risk (e.g. public infrastructure, homes, agriculture or health). As relevant, this assessment should be integrated across a range of key risks (e.g. price fluctuations in agriculture), emphasizing the building of social and economic resilience. Comprehensive risk reduction plans are crucial to guide the development of insurance systems. With risk information, appropriate risk pricing, and a comprehensive risk reduction plan, governments will be able to design tailored approaches for insurance for their countries. The design of risk-reducing insurance will depend on local circumstances, including geography (exposure to hazards), economic conditions and sensitivities, local history, culture, risk perception and governance capacities.

Awareness and information base

Second, building awareness and an information base about weather-related risks at all levels of society can facilitate adaptation. Risk awareness fosters individual action and informs political will for comprehensive risk management. Risk information is the foundation of risk management and in many developing countries will require sustained investment to develop and maintain. One of the most powerful ways that insurance supports risk reduction is through its capacity to put a price on the risk that indicates a “true” sense of the likelihood of loss, so participants in the insurance programme (like public or private property owners) can quantify the risks they face and how this changes over time.

Quality data is a foundation for effective insurance programmes. A number of international agencies, insurance companies, modelling companies and academic researchers are working to enhance society’s capacity to accurately estimate severe weather risks and to gather necessary physical, biophysical, and socio-economic information. Premiums for every insurance programme should be “risk adequate”—meaning that the premiums are sufficient to cover expected losses. Risk-adequate pricing is a fundamental building block for sustainable insurance. In many of the target developing countries the database for pricing is currently insufficient. For countries without suitable meteorological as well as historical loss data, it is imperative to build up systems that could fill

data gaps in the medium term and also reliable and neutral monitoring systems to house data. During a transition phase before all necessary data is in place, modelling approaches and comparisons with other similar countries where data is available could help to make risks in such countries insurable. Further, while the appropriate data basis is being established, the potential for inaccurate loss estimates could be covered by an insurance pool solution. As currently the losses from climate-related disasters in developing countries are about seven percent of global losses, cover of this kind should not pose an insurmountable obstacle for the capital requirements of insurance. Support from the international community and the private sector could facilitate awareness and information building.

Developing countries without the infrastructure for insurance need not only data but also the means of communicating relevant information in a way that is useful to the end-users, who may be the public, decision makers designing disaster risk management systems including insurance, and other stakeholders. These groups in turn need to have access to data and other relevant risk information, as well as the capacity to interpret this information to make informed risk management decisions. This points again to the importance of embedding insurance into a comprehensive risk management strategy rather than as a stand-alone measure.

Appropriate pricing of weather-related risks

Third, the *appropriate pricing of weather-related risks* can help raise awareness about these risks and assist decision makers in establishing priorities. Even before the insurance industry engages in underwriting, its expertise in risk information can be of assistance. Insurance is often the messenger of change through adjusting pricing applied to policies. In the context of climate change, one design issue is the duration of insurance contracts: Insurance is typically written on a one-year basis and therefore, insurance providers are unlikely to focus on immediate risk reduction options, rather taking a longer term view of risk management. This highlights the role of the public sector (and the international community) *to ensure a longer-term focus on risk reduction*. For example, the United Kingdom insurance industry has been successful in calling for a clear adaptation policy to be embedded in the new Climate Change Act, which was enacted in 2008. This

new legislation requires the United Kingdom Government to publish a full climate risk assessment every five years and to outline the policy responses to manage these risks. The United States National Association of Insurance Commissioners adopted new mandatory rules early in 2009 requiring United States insurers to disclose to regulators the risks they face as a result of climate change.

Enabling conditions for risk reduction and insurance

Fourth, these plans can establish enabling conditions and appropriate regulatory frameworks for the proper functioning and coordination of various disaster risk reduction measures and insurance. The presence of an effective regulatory system is an essential element to ensure consumer confidence in insurance mechanisms. The importance of regulation is perhaps greatest in countries where insurance is not yet well established, and paradoxically, where government may lack the capacity to develop regulation frameworks. In consultation with other governments, international organisations and specialised bodies, governments need to address issues related to insurance provision like solvency regulation for insurance companies and, perhaps more importantly, licensing of those involved in the sale and distribution of insurance. There are a number of international mechanisms in place to support the transfer of international best regulatory practices. Additionally, countries should explore the potential to build on traditional forms of community risk sharing and risk transfer. Transparency and disclosure are essential elements to the successful design of an insurance mechanism. For national and sub-national insurance programmes this should include information measuring the overall risks assumed and earnings recorded by participating insurance and reinsurance companies. In addition, it is important to clearly identify any subsidies and support. For any international insurance mechanism, transparency and disclosure would be equally important to manage and maintain stable pooled insurance solutions over time.

5.2. International measures and strategies that link disaster risk reduction and insurance

In spite of best efforts at the national level to prevent and reduce risk, countries will face increasing risks associated with climate change. There is a role for the international community to facilitate adaptation through disaster risk

reduction and insurance, especially in vulnerable developing countries.

Financing risk reduction measures related to climate change adaptation

The international community can provide appropriate levels of (adaptation) financing for risk reduction measures in vulnerable countries that enable qualification for insurance coverage. In some countries and regions, international financing may be required to overcome the upfront costs of investing in disaster risk reduction.

Commitment to reduce risk: prerequisite for participation in international insurance programmes

For international insurance schemes to maintain long-term viability in the face of climate change, it is critical that participating countries commit to reducing their vulnerability and exposure to risks associated with weather and climate hazards. In exchange for international support and finance for risk reduction measures, those countries that choose to participate in insurance programmes established with national and international support, commit to reducing their weather-related disaster risks. The international community could be helpful in establishing standards for the measurement, reporting, and verification of risk reduction as a prerequisite for continuing insurance coverage in an international scheme.

6. Conclusions

As the frequency and intensity of extreme weather events mount, the urgency of building on successful risk reduction initiative is increasing as well. The previous sections indicate that insurance can be a useful component of a comprehensive risk reduction strategy. Insurance solutions can only support effective adaptation where they are implemented among measures to reduce disaster risk and increase societal resilience. If not embedded in a comprehensive risk reduction strategy, insurance may actually encourage risk taking behaviour, potentially leading to greater fatalities and damage.

Today the need is greater than ever to reduce and transfer risk in ways conducive to climate change adaptation and sustainable development. Insurance, if properly designed, can be a valuable risk management tool to support adaptation in developing countries. To harmonise climate risk insurance with adaptation, it is essential to align incentives with disaster risk reduction. The new climate change agreement in Copenhagen in December 2009 represents a historical chance to establish a comprehensive risk management framework that prioritises disaster risk reduction. Planning with the end in mind—to help developing countries adapt to and manage the climate risks they face—will help negotiators fit elements like insurance into a larger adaptation package. By placing disaster risk management and risk reduction first, insurance mechanisms in the emerging climate agreement could be designed in ways that help motivate and shape resilience and adaptation to climate change.

Annex: Making risk reduction and insurance work together: Issues for government, insurance sector, households

	Government	Insurance	Household
Generic (apply to all)	<ul style="list-style-type: none"> Commit to cover upfront programme development costs Manage perceptions of risk and benefits (long term) vs. costs Coordinate with post-disaster assistance to avoid disincentives Build institutional capacity 	<ul style="list-style-type: none"> Commit to engage in dialogue about risk reduction Design innovative longer-term insurance tools that are also applicable in developing country context Design tools to address moral hazard 	<ul style="list-style-type: none"> Upfront costs/affordability Perception of risk Perception of benefit (particularly given timescales of benefit) Availability of post-disaster assistance
1. Awareness raising and risk information	<ul style="list-style-type: none"> Develop appropriate dissemination channels for risk information 	<ul style="list-style-type: none"> Develop appropriate dissemination channels for risk information 	<ul style="list-style-type: none"> Engage in insurance literacy programmes Need tools to build ability to understand risk information
2. Risk pricing (i.e. a price signal to incentivise risk reduction)	<ul style="list-style-type: none"> Address equity issues to ensure affordability of and access to insurance for vulnerable and/or poorer communities who live in high risk areas 	<ul style="list-style-type: none"> Need for high-resolution risk analysis Lower transaction costs (Expense and time for verification of risk and loss in developing countries) 	<ul style="list-style-type: none"> Upfront costs of risk reduction vs. relatively small potential premium adjustment
3. Enabling conditions and regulation	<ul style="list-style-type: none"> Governance Legal frameworks Monitoring and Enforcement 	<ul style="list-style-type: none"> Potential limits to competitiveness and implications for actuarial soundness of insurance 	<ul style="list-style-type: none"> Understanding of disaster risk reduction and insurance Availability of technical assistance programmes (adaptation support)
4. Financing risk reduction	<ul style="list-style-type: none"> Establish funds to invest in ex ante risk reduction measures which are independent of election cycles or other political considerations (to overcome barriers, i.e. no reward for catastrophe avoided) 	<ul style="list-style-type: none"> Upfront costs Need to collaborate closely with public sector to coordinate risk reduction that is conducive with insurance programs, risk information "Who pays vs. benefits" Insurer may see little direct benefit from investment 	<ul style="list-style-type: none"> Potential of risk reduction-for-insurance-coverage (exchange of work time devoted to risk reduction measures for insurance coverage)
5. Risk reduction as a prerequisite for insurance	<ul style="list-style-type: none"> Voluntary participation in insurance programmes with the prerequisite of ongoing disaster risk reduction 	<ul style="list-style-type: none"> Competitive market conditions may work against incentives if not coordinated with public sector 	<ul style="list-style-type: none"> Need knowledge of appropriate risk reduction techniques and options

Endnotes

A complete list of the references and suggestions for additional reading can be found at: http://www.preventionweb.net/files/9654_bibliography.pdf

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