

# An Integrated Approach to Managing Extreme Events and Climate Risks

TOWARDS A CONCERTED PUBLIC-PRIVATE APPROACH



SEPTEMBER 2016



## **The Geneva Association**

The Geneva Association is the leading international insurance think tank for strategically important insurance and risk management issues. The Geneva Association identifies fundamental trends and strategic issues where insurance plays a substantial role or which influence the insurance sector. Through the development of research programmes, regular publications and the organisation of international meetings, The Geneva Association serves as a catalyst for progress in the understanding of risk and insurance matters and acts as an information creator and disseminator. It is the leading voice of the largest insurance groups worldwide in the dialogue with international institutions. In parallel, it advances—in economic and cultural terms—the development and application of risk management and the understanding of uncertainty in the modern economy.

The Geneva Association membership comprises a statutory maximum of 90 chief executive officers (CEOs) from the world's top insurance and reinsurance companies. It organises international expert networks and manages discussion platforms for senior insurance executives and specialists as well as policymakers, regulators and multilateral organisations.

Established in 1973, The Geneva Association, officially the 'International Association for the Study of Insurance Economics', is based in Zurich, Switzerland and is a non-profit organisation funded by its members.

# An Integrated Approach to Managing Extreme Events and Climate Risks

## Towards a Concerted Public-Private Approach

*With recommendations to harness potential contributions of the insurance industry*

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# Preface



**Anna Maria D'Hulster**

*Secretary General,  
The Geneva Association*

For a growing number of people climate change is the biggest threat humanity has ever faced. Its potentially devastating effects on the planet—from fuelling geopolitical conflicts, damaging human health, jeopardizing food security to impairing future economic growth—are increasingly well understood by public and private sector decision-makers as well as the public at large.

It is generally accepted that climate change is one of the reasons for the rising frequency and severity of natural catastrophes and extreme events, compounding the impact of unrelated developments such as urbanisation and an increasing global economic inter-connectivity. Therefore, 'Extreme Events and Climate Risk' (EE + CR) is one of The Geneva Association's top priorities for research and stakeholder dialogue. We believe that insurance and risk management has a vital role to play in strengthening societal resilience and ensuring appropriate loss mitigation. Insurers put an actuarially supported price tag on risks, thus raising awareness of risk levels and characteristics. They underwrite risks, efficiently spreading and diversifying them across the globe. In addition, insurers generate and share knowledge, expertise and experience in risk management and disaster risk reduction. The industry, as one of the world's largest institutional investors, also engages closely with policymakers, regulators and the wider investment community on the development of relevant and sound low-carbon investment practices.

Against this backdrop, The Geneva Association is pleased to present the following research report. It offers an authoritative and comprehensive discussion of the benefits from an integrated public private approach to managing extreme events and climate risk. The insights from this report have also underpinned the extensive consultations with The Geneva Association's members and partners to develop priority workstreams of the Association's Extreme Event and Climate Risk Programme. Specifically, the authors share insights about the causes and effects of mounting socio-economic risks, offer an account of international policymakers' increasing acceptance of the important role to be played by market-based insurance solutions, analyse the obstacles to fully capturing the industry's potential and, last but not least, make concrete recommendations on how to overcome some of these hurdles.

This publication has greatly benefited from substantial inputs from the Association's member companies and other public and private sector as well as international organizations. We are very grateful for their support and are convinced that this major collaborative effort will prove effective in further deepening and broadening the insurance industry's dialogue with all relevant stakeholders, raising awareness of the need for action.

# An Integrated Approach to Managing Extreme Events and Climate Risks

On 19 November 2015, just days before global leaders began gathering in Paris to forge a landmark global agreement on climate change, The Geneva Association issued its Climate Risk Statement, a commitment to progress on climate resilience and adaptation signed by 68 chief executive officers of the global insurance industry. The statement stresses the vital role of (re)insurers through (i) signalling the price of risks and thus raising awareness of risk levels and characteristics, (ii) underwriting risks and redistributing the cost both geographically and financially around the world and (iii) contributing knowledge and experience in risk management and disaster risk reduction. The statement also points to the contributions of the industry as major institutional investors, engaging more closely with policymakers, regulators and the wider investment community on the development of relevant and sound low-carbon investment practices.

During the COP21 meeting in Paris, the chairman of the Board of The Geneva Association, also representing the International Insurance Society (IIS) and the International Cooperative and Mutual Insurance Federation (ICMIF), pledged that the best minds of the insurance industry would engage in strengthening global resilience to climate change and in helping to enable a low-carbon transformation of the global economy.

Following the COP21 meeting, a Geneva Association report (Golnaraghi *et al.*, 2016) outlined the opportunities and challenges of the COP21 Paris Agreement for the insurance industry. The report highlights that the explicit inclusion of insurance in the COP21 Paris Agreement, is a reflection that all countries recognise the importance of insurance as an integral component of national climate risk management strategies for building socio-economic resilience.

On 13 April 2016, The Geneva Association, in collaboration with IIS and ICMIF, led a High-Level Meeting (HLM) hosted by the UN Secretary General, on resilience, engaging the CEOs of the insurance industry. This HLM identified a set of short- (2020) and long-term (2030) priorities that could be implemented through public-private partnerships, for the development of scalable and sustainable insurance solutions, particularly in the middle and low-income countries.

The HLM was followed by announcement of the Insurance Development Forum (IDF), on 14 April 2016. The IDF is an industry-led international platform which will also engage

international organizations to work in a more coordinated fashion on issues related to a “better understanding and utilisation of risk information that could help governments in better deployment of their resources to build resilience to protect people and their property” (IDF Press Release April 2016).

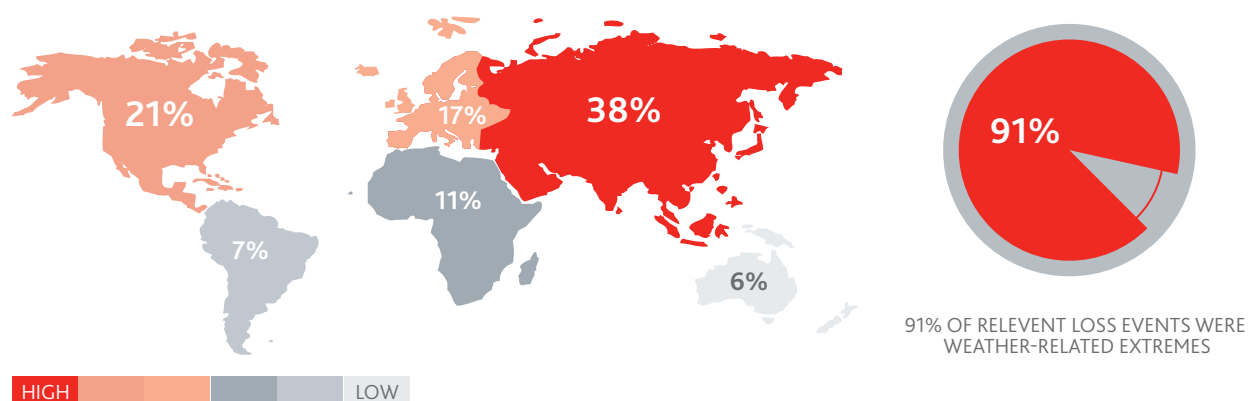
Against this backdrop, it is evident that the (re)insurance sector’s key role in addressing extreme event and climate risks is increasingly recognised by governments, international development organisations, the UN, and non-governmental organisations (NGOs). The (re)insurance industry is keen to support the strengthening of risk management capacities and the expansion of risk transfer solutions to increase society’s resilience to adverse impacts of extreme events and climate change. However, it is important to identify the most promising and suitable pathways to harness the industry’s potential as absorbers of risk, providers of risk expertise, data and advice as well as responsible investors and innovators.

## ***This report has been prepared in order to provide:***

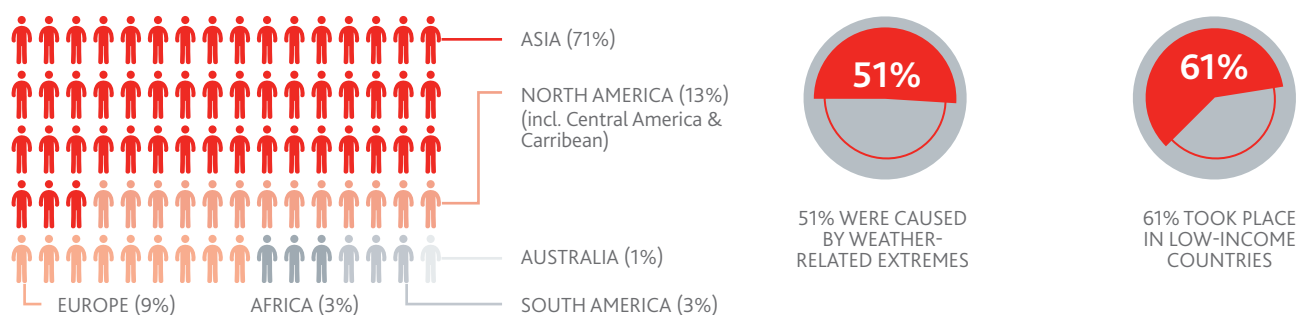
- (i) Insights about causes and effects of the rising economic risks resulting from extreme events and climate change and the growing protection gap
- (ii) Components of an integrated approach to disaster and climate risk management, synthesis of the international policy momentum for harnessing insurance, and the landscape of stakeholders and related initiatives
- (iii) An analysis of challenges and gaps with investing in preventive and risk transfer measures and the potential role of (re)insurance
- (iv) Four recommendations for expanding the footprint of insurance within the integrated disaster and climate risk management framework.

**Figure 1: Natural disaster losses worldwide (1980-2015)**

A) 15,700 RELEVANT GLOBAL LOSS EVENTS WERE RECORDED

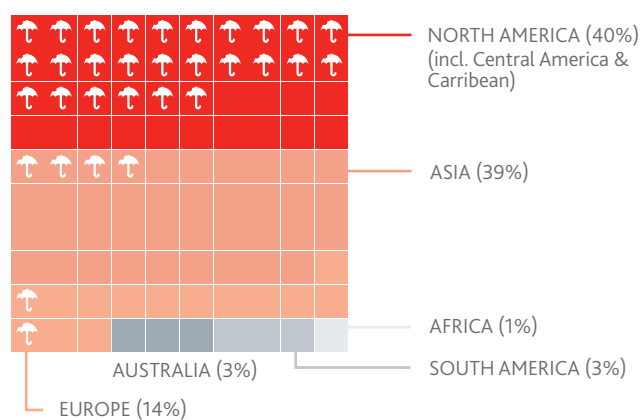


B) RELEVANT LOSS EVENTS CAUSED 1.7M DEATHS



C) RELEVANT LOSS EVENTS COST USD 4TN

Distribution of overall losses



Insured losses

Global proportion of insured losses



Source: Data from Munich Re NatCatSERVICE

## **International policy dialogue motivated by rising economic risks of extreme events and climate change**

***Economic losses associated with weather-related extremes are in general on the rise, posing significant challenges to socio-economic development***

Over the last three and a half decades, we have observed a trend of rising economic losses from weather-related disasters. During the period from 1980 to 2015, Munich Re's NatCatSERVICE identified 15,700 disaster loss events (Munich Re, 2016). Of those, 91 per cent were caused by weather-related extremes (meteorological, hydrological and climatological events), accounting for 51 per cent of the total of 1.7 million lives lost and 79 per cent of the USD 4 trillion in total economic losses and 90 per cent of insured losses, both inflation adjusted.

Asia accounts for most events (38%), fatalities (71%) and overall economic losses (39%). However, insured losses are mostly attributed to North America and Europe (44%). The overall economic losses in Asia and North America, and the insured losses in North America and Europe are primarily caused by weather-related extremes. During this period, 61 per cent of weather-related fatalities occurred in low-income countries, whereas over 62 per cent of total economic losses and 94 per cent of insured losses occurred in high-income countries. Whilst, in absolute numbers, economic losses are highest in high-income countries, relative to average GDP, such losses are more dramatic for low- and middle-income countries.

The growing impacts from such calamities pose threats to human lives, livelihoods and health. They can also severely impair socio-economic growth and development. Losses are experienced through direct damage to assets such as infrastructure and buildings, as well as indirect costs due to business interruption, loss of jobs and reduction in tax revenues.

This loss trend can be attributed primarily to changes in exposure, and to a smaller share, to changes in vulnerability and hazards: In general, the lack of preventive strategies (e.g. land zoning, building codes, etc.) within the development planning of many countries results in increasing vulnerabilities and risks due to disasters and climate change<sup>1</sup>. Furthermore, ever more people and assets are concentrated in exposed (urban) areas such as coastal regions in low- and middle-income countries. At the same time, interconnected global supply and manufacturing chains are highly vulnerable to disaster-induced disruption. And, last but not least, climate change is believed to add to the increasing severity

and frequency of extreme events (World Bank, 2013a; World Bank, 2014a; World Bank, 2014b; IPCC, 2014; IPCC, 2012). The complex dynamics of these factors suggest that rising loss trends will continue. Some of the world's fastest growing metropolitan areas display a significant exposure to the main natural perils of earthquakes, wind storms, river floods, storm surges and tsunamis.

## **Multi-sectoral cooperation in disaster and climate risk management is gathering momentum**

***The international community is waking up to the challenge***

Over the last three decades, international policy dialogue on disaster risk reduction, climate change, sustainable development and poverty alleviation has advanced. This has led to a more coordinated approach to negotiations of the three UN-facilitated international framework agreements in 2015, whereby over 190 Member States adopted: (i) the Sendai Framework for Disaster Risk Reduction (2015–2030) (United Nations General Assembly, 2015a), (ii) the 2030 Agenda for Sustainable Development (United Nations General Assembly, 2015b) and (iii) the Paris Agreement on Climate Change (UNFCCC, 2015a).

While each of the three agreements has its respective priorities for action, a common thread is the recognition of the need for an integrated approach to managing the risks of extreme events and climate across different economic sectors, levels of government and society. Such an approach would include *ex-ante* pre-disaster investments in (i) risk analysis to understand the risks, (ii) early warning, preparedness, and preventive measures to reduce the risks; and, (iii) innovative risk financing and risk transfer measures to distribute the residual risks. This should be combined with realising opportunities after any major event through effective reconstruction plans to reduce further the disaster risks and build resilience to future major events.

Thus, we consider "resilience" within a holistic context; including all measures, *ex-ante* and *ex-post*, to reduce socio-economic impacts of extreme events and climate change.

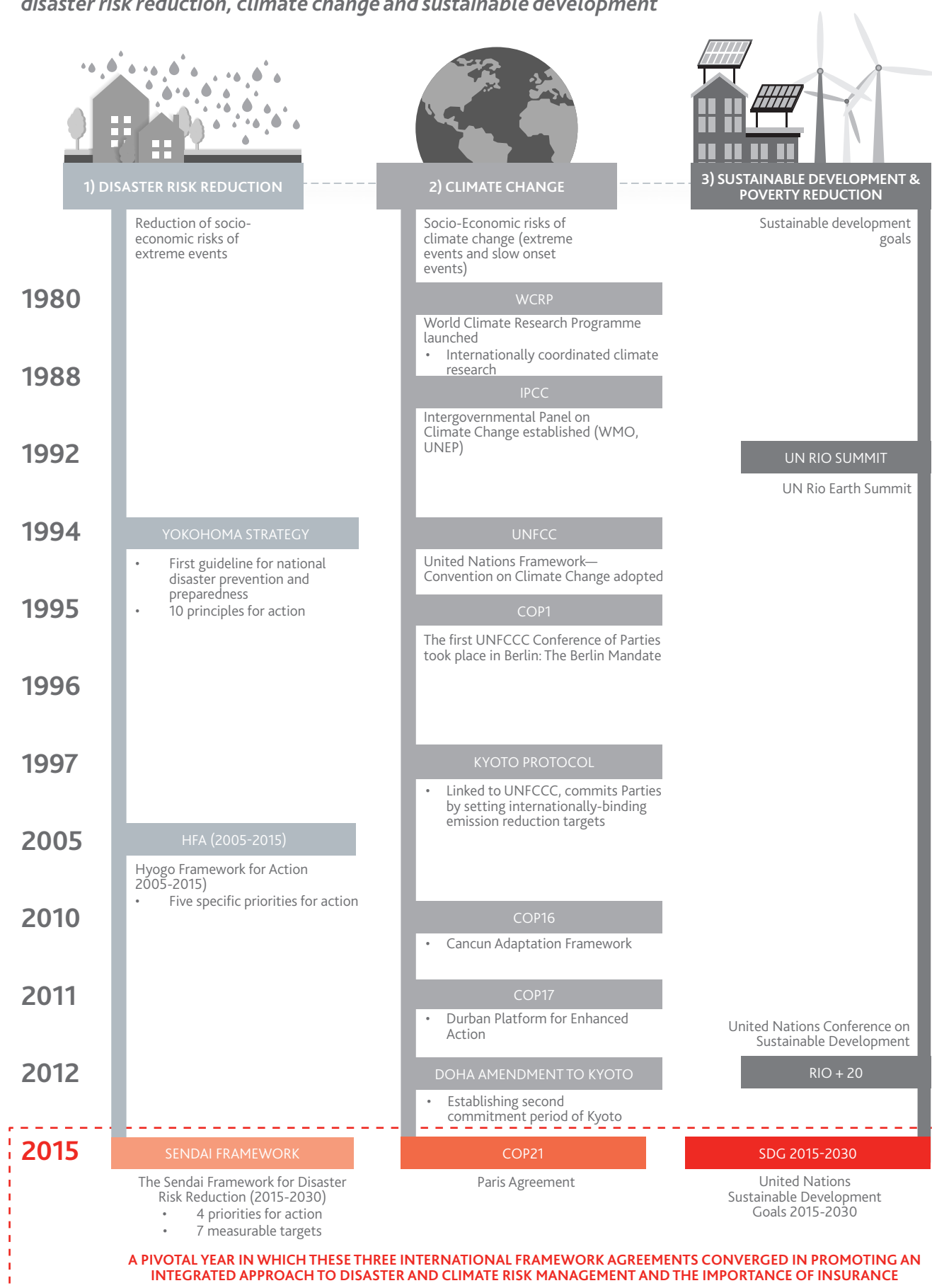
***The potential role of insurance within an integrated approach is recognized by a growing number of stakeholders***

The insurance industry has a critical role in that regard, as mentioned explicitly in the Sendai Framework and COP21 Paris Agreement. We are witnessing (i) increasing national policy actions on resilience and risk reduction, (ii) national

<sup>1</sup> While change in exposure is proportional to growth in wealth, changes in vulnerability is linked to development patterns.



**Figure 2: Key milestones of three United Nations facilitated framework agreements in disaster risk reduction, climate change and sustainable development**



and local government budgeting and risk financing strategies and (iii) specific regional risk-pooling schemes at the sovereign level, backed by commercial reinsurance, all reflective of a more proactive approach by governments to reduce their budgetary and other related economic risks.

The international policy dialogue as well as intensifying global discourse on disaster and climate risk (e.g. UNISDR, 2015a; UNISDR, 2013; UNISDR, 2011a; Munich Re Nat-CatSERVICE reports; Swiss Re sigma reports) have led to a growing awareness of risks and understanding of the role of market-based (re)insurance solutions in addressing the economic challenges associated with extreme events and climate risks. The international development community, the United Nations and non-governmental organisations (NGOs) are increasingly promoting insurance as a key element of an integrated disaster and climate risk management strategy for governments, businesses, communities and households. In principle, well-designed market-based risk transfer tools could make an important contribution to more reliable and timely post-disaster relief and response, early recovery and ultimately the reconstruction phase.

***There is still a large and, in some places, growing insurance protection gap, indicating that the potential of insurance is not fully used***

On average, the overall insurance protection gap in high-, middle- and low-income nations, has been estimated to be around 70 per cent for weather related and 75 per cent for all natural hazards (Munich Re). Put differently, 75 per cent of total economic disaster losses remain uninsured and need to be absorbed by taxpayers in particular. Globally, over the past three decades, the share of uninsured losses as a percentage of world GDP has increased from 0.02 per cent to 0.12 per cent, according to Swiss Re. The gap is particularly pronounced in low-income countries where typically more than 95 per cent of all losses remain uninsured. This gap is around 97 per cent if we consider data since 1980.

***Measures to reduce and transfer risks need to be brought to life in a scalable and sustainable manner***

A number of factors augur well for meeting this challenge. Examples include:

- (i) renewed international commitment to a risk-informed and cohesive approach to disaster and climate risk management,
- (ii) adoption of insurers' catastrophe risk modelling by other sectors,

- (iii) increasing government investments in early warnings, flood and storm mitigation programmes, and,

- (iv) insurance market trends, e.g. alternative capital and the development of new innovative insurance solutions.

***Governments, the insurance industry and other stakeholders need to leverage their strengths and initiatives to address the resilience challenge***

The design of effective disaster risk management strategies requires an in-depth understanding of the risks along with an appropriate consideration of the specific governance, institutional, financial, societal and cultural characteristics.

Kunreuther (2015) and KPMG (2015) stress the importance of public-private partnerships, particularly noting the win-win situations that could arise through cooperation of governments and the insurance sector. They emphasise the importance of enabling environments (e.g. policies, legislation, regulatory framework, investments and innovation) that facilitate design and implementation of scalable and sustainable protection programmes to reduce the economic impacts of disasters and build resilience to the threats of climate change.

***The public sector is required to lay the institutional foundations...***

An assessment of the last 10 years of implementing the Hyogo Framework for Action (2005–2015), the predecessor to the Sendai Framework for Disaster Risk Reduction (DRR) (United Nations General Assembly 2005), reveals that, whilst progress has been made, several gaps and challenges remain. Despite many countries' efforts to develop national policies and disaster risk reduction plans, they are frequently not operationalised or properly funded (UNISDR, 2011b).

A major impediment to the implementation of DRR programmes are gaps in the systematic collection and maintenance of reliable, high-quality socio-economic and disaster loss and damage (and 'even' hazard) data. The public sector's capacity for identifying and analysing risks remains limited or not available, at all levels of government, even in many high-income nations. In many countries, government planning and budgeting occur in silos at all levels of government, despite cross-cutting impacts of extreme events and climate risks on many socio-economic sectors. Continuing lack of coordination and effective engagement amongst the different levels of government leads, at best, to

a fragmented approach to risk reduction and risk management approaches.

For an effective application of risk transfer, the public sector needs to provide enabling legal and regulatory environments, ranging from clearly defined property rights, land zoning, freedom from corruption and regulatory certainty concerning innovative products such as parametric insurance products, to free, cross-border trade in reinsurance and risk-based pricing.

This fundamental role should be complemented with specific government-sponsored initiatives in close partnership with the private sector. Examples include the establishment of multi-country and regional risk-pooling platforms, the expansion of innovative risk transfer schemes based on parametric insurance and the utilisation of technology for more accessible distribution channels and contract settlement in areas such as microinsurance. Whilst there are some encouraging success stories, the jury is still out as to the scalability of these efforts towards meaningfully strengthening resilience, for example, in rapidly growing Asian mega-cities. Furthermore, experiences from different countries show that scalable and sustainable insurance programmes work best through compulsory models such as New Zealand's Earthquake Commission, implemented through effective public-private partnerships. Finally, if properly designed and implemented, market-based insurance mechanisms not only help with risk sharing and risk transfer, but also encourage more risk-conscious behaviour.

***... Whilst the insurance industry is challenged to think and act more creatively about development of new markets, strategies and products***

For (re)insurers, disaster and climate risks are associated with concerns about insurability: with respect to the high risk levels, risk pools often lack the required size; insured losses are not independent but correlated, affecting a number of policyholders and insurance lines of business and even different regions at the same time; risk assessment is impaired by deficits in data quality and availability; asymmetric information can lead to adverse selection, and moral hazard is a challenge unless insurance is incentivising risk-reducing behaviour. In addition, there is often a lack of demand for insurance protection, partially owing to financial, insurance and risk illiteracy, but also a lack of willingness and/or ability to pay for insurance coverage.

These obstacles to insurability could be further aggravated by climate change, and one could argue that effective adaptation to climate risk may actually become a precondition for granting insurance cover in the future.

The insurance sector can help design and launch relevant and innovative risk transfer solutions in response to known risks, particularly in regions where insurance is still in its infancy. Examples include reinsurers' support of innovative regional sovereign risk-pooling schemes such as the Caribbean Catastrophe Risk Insurance Facility (CCRIF), African Risk Capacity (ARC), and Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI) or the structuring of catastrophe bonds on behalf of sovereign issuers, as in the case following Superstorm Sandy in New York City.

In many established insurance markets, the trade-off between affordability and risk-based pricing continues to pose a particular challenge, as recently seen with flood insurance in the U.S. and the U.K. Yet, it also needs to be understood that a high level of insurance premiums is a direct signal of a high level of risks. Actions to reduce risk levels (such as flood resilience programmes) could subsequently result in less risk and more affordable insurance. In addition, (re)insurers can harness advanced analytical tools to refine pricing techniques and project future trends and, as such, promote the availability and affordability of insurance.

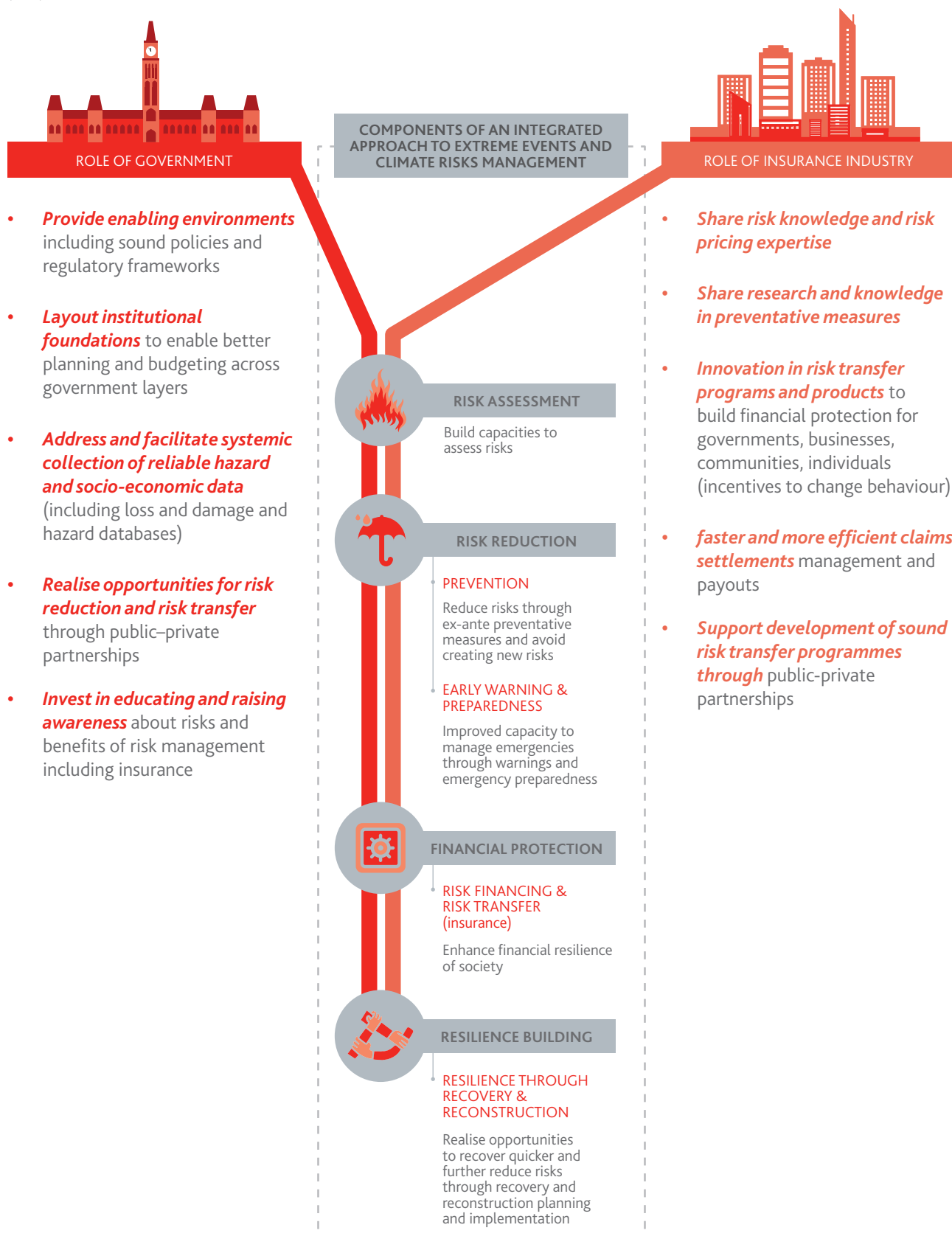
Over the last years, international and regional development banks have stepped up their efforts to assist governments with the development of disaster risk financing strategies and post-disaster contingency measures. They have also catalysed engagement of the (re)insurance industry to provide innovative risk transfer solutions for middle- and low-income countries. On the other hand, international donors have realised the benefits of insurance and are investing in activities that help expand insurance to the most vulnerable communities. In these cases, consultation and systematic cooperation with the insurance industry could lead to development of effective and more sustainable programmes.

***There is emerging evidence of the economic benefits of effective disaster risk financing and insurance***

A sound disaster risk financing and insurance strategy helps to increase the financial resilience of governments, businesses, communities, households and individuals. Research has revealed that countries with a robust penetration of market-based disaster insurance coverage recover faster from the financial impacts of extreme events. Von Peter *et al.* (2012) show that it is the uninsured part of catastrophe-related losses that drives macroeconomic costs, whereas well-insured catastrophes can be inconsequential or even positive for economic activity.

In a similar context, Lloyd's (Cebr, 2012) analyses five recent major catastrophes to identify the impact of low insurance prevention levels on the taxpayer. The research finds that a one percentage point rise in insurance

**Figure 3: Managing Risks of Extreme Events and Climate: Role of Governments and (Re)insurance Sector**





penetration can reduce the burden on the taxpayer by 22 per cent.

Finally, according to Standard & Poor's (2015a, b), large natural catastrophes (250-year events) can weaken sovereign and company ratings, more so if there is no risk management and particularly no insurance in place.

However, insurance is not a silver bullet for all disaster and climate risks. This is particularly relevant in the context of insurance for the poorest and most vulnerable population, and for the longer-term loss and damage expected from slow-onset events linked to climate change. To make best use of risk sharing and risk transfer now and in the longer term, insurance needs to be embedded in an integrated risk management and adaptation approach that addresses the underlying sources of risks (Surminski and Oramas-Dorta, 2013).

## ***Harnessing (re)insurance and investing in prevention—current challenges and gaps***

### ***Moving from plan to action***

*There is need for a stronger economic case in favour of ex-ante investing in prevention and resilience building*

Over the last 10 years, the United Nations and the international development community (e.g., OECD and the World Bank Group) have promoted the need for *ex-ante* public investment in preparedness and preventive measures such as early warning systems, resilient critical infrastructure and housing, and the building of natural and hard defence mechanisms. Yet, despite the overall growing political recognition, this has not led to the required increase in resilience investment. "Although some countries, cities and communities have made progress, funding is still heavily biased towards ex post measures" (Tanner *et al.*, 2015).

The insurance industry, building on its extensive research and expertise, can provide more evidence and suggestions for how best to utilise risk transfer to influence risk reduction behaviour, either through solidarity-based or more individualistic risk-based pricing regimes. This is in the broad interest of society, but it is also advantageous for the industry, as it will help to preserve and potentially enhance the role that insurance can play in the face of growing disaster and climate risks.

Another important benefit arises from risk-based pricing, which has enabled insurers to generate risk signals, which can influence human behaviour towards risk reduction in a way that could benefit society at large. For insurers, this

area is of such fundamental importance that it would be worthwhile to support independent academic or collaborative, industry-sponsored research activities aimed at substantiating this claim, both theoretically and empirically. An important aspect is also the quest to overcome apparent trade-offs between risk-based pricing, affordability and political support for risk transfer and insurance schemes.

### ***Ensuring resilience of critical infrastructure is still a major challenge for governments***

The vulnerability of critical infrastructure (e.g. energy, food and agriculture, water, transportation, health, etc.) to shock events such as natural catastrophes has become a critical concern of many governments. Destruction, disruptions or interruptions in critical infrastructure could lead to cascading effects across sectors and sometimes across borders, causing significant harm to the population's well-being as well as significant direct and indirect economic impacts. Whilst protection of critical infrastructure is climbing to the top of governments' national security agenda, from the resilience and risk management perspectives, it is a very complex management issue as it can span many sectors, stakeholders and activities. When the delivery of critical infrastructure is privately operated, the government has to set clear public policies, legislation and regulatory framework on the requirements for resilience, including measures for system robustness, back-up capacity, rapid recovery and adaptability to new risks that will apply to different phases of the infrastructures life cycle. Further complexities also arise when national and local governments share the policy-setting, monitoring and enforcement responsibilities.

Increasingly the potential benefits of the insurance sector, not only because of its investment and risk transfer functions, but also its expertise in risk modelling and resilience research are being recognised to be indispensable to the public and private sectors. Initiatives by the OECD and the Global Infrastructure Facility (GIF) of the World Bank Group, amongst other issues, aim to further explore and facilitate the benefits of insurance.

### ***Managing risks of extreme events and climate in the fast growing urban areas and mega-cities also remain a global concern***

Some of the world's fastest growing metropolitan areas display an enormous exposure to the main natural perils of earthquakes, wind storms, river floods, storm surges and tsunamis. According to Swiss Re (2014) more than 130 million people are directly exposed to these perils in Asia's top

five urban regions alone (Manila, Pearl-River Delta, Jakarta, Kolkata and Shanghai).

Extreme events do not only affect people but can also severely disrupt entire economies, as many metropolitan areas are key national economic hubs.

Consequently, the strengthening of urban resilience through investments in critical infrastructure is emerging as a key concern for local governments and insurers alike. Such investments are vital for helping urban areas adapt to rising levels of exposure, vulnerability and hazard. Where new infrastructure is being developed there is a clear opportunity to do so with disaster and climate resilience in mind. Achieving this would need assessment and understanding of risks, as well as well-thought out public-private collaboration. It is important to highlight that private-sector decisions, including those by insurance companies, also matter greatly and drive more than 70 per cent of worldwide investment in new buildings, industry and critical infrastructure (UNISDR, 2013). Enforcement of stricter planning rules and building regulations are also of crucial importance.

Multilateral efforts such as The Rockefeller Foundation's 100 Resilient Cities, the UN's Making Cities Resilient campaign, and advocacy and fund-raising initiatives by Compact of Mayors, are also leading to growing recognition of the importance of risk management practices around urban systems. Increasingly, local governments are establishing chief risk officer position, tasked to facilitate and oversee more coordinated planning and risk management practices across government departments.

### ***Harnessing (re)insurance for increasing resilience***

*The rapid increase in global economic losses from disasters has put the spotlight on insurability.*

Generally speaking, for risks to be considered insurable by private insurance companies, several conditions need to be met: a sufficiently large pool of risks with preferably independent and diversifiable risks, availability of risk information, and randomness of the insured event. Beyond these, there obviously needs to be demand for insurance protection, often determined by financial literacy, risk awareness and perceptions, as well as willingness and ability to pay.

Similarly, public policy and regulation can create the necessary preconditions for insurance and shape the operating environment of the industry (Ranger and Surminski, 2013a; Masci *et al.*, 2007). Evidence from established and newly emerging markets suggests that there are a wide range of

factors that determine if and how private insurance can succeed in the provision of disaster risk transfer. Among macro scale issues are institutional stability and quality, effective law enforcement, protection of property rights, judicial efficiency and transparency. In addition, the specific characteristics of a market, such as distribution channels and appetite for innovation in terms of products and services, can drive or hold back the development of insurance. For the engagement of the private sector the regulatory approach is also of crucial importance.

Disasters caused by weather extremes present several challenges for these insurability principles:

- (i) difficulties in risk assessment and pricing, particularly where there is lack of underlying data;
- (ii) insured losses that are not independent but are correlated and affect a number of policyholders and insurance lines of business at the same time;
- (iii) asymmetrical information leading to adverse selection, with those at high-risk being more likely to buy insurance, which can threaten the economic viability of the programme, due to gaps between premiums received and claims paid;
- (iv) limited take-up of disaster insurance, meaning that there is often a relatively small pool of policyholders;
- (v) moral hazard unless insurance is incentivising risk-reducing behaviour, for example, risk sharing via deductibles or co-insurance, or by being embedded in an overall disaster risk management framework or providing pricing signals. Although, in case of parametric triggered solutions this may not be an issue.

As mentioned before, innovative sovereign risk pooling schemes and parametric forms of cover can go a long way in mitigating these challenges to insurability.

*In high-income markets, four factors present further challenges for expanding the use of risk transfer tools.*

Reflecting on recent experiences with disaster insurance, four specific key challenges are evident in high-income markets including:

- (i) **Limited take-up:** Many individuals, businesses and governments do not take up insurance against disasters caused by natural hazards, even where it is available at an affordable price. The main reasons for this are lack of risk awareness, limited understanding of insurance mechanisms, underestimation of the potential impacts, and reliance on other support mechanism such as post-disaster government hand-outs. In some countries this has led to the introduction of compulsory insurance schemes.

**Figure 4: Challenges and hurdles with expansion of insurance around the world**



**(ii) Fluctuating capacity and appetite in the market:**

The key consideration for private companies providing disaster cover is to match premium levels with the underlying risk—unless their engagement is seen as a strategic investment to open up new markets or a corporate social responsibility (CSR) activity (Charpentier, 2008; Kunreuther *et al.*, 2009). The decision to offer coverage can be influenced by the loss experience, regulatory requirements and the overall market conditions. At the same time the capacity of the insurance industry to provide coverage is driven by a wide range of other factors, including interest rates, regulatory requirements, overall market conditions and investment flows into the insurance sector, which can lead to fluctuations in capacity and risk appetite. However, the emergence of alternative sources of capital is widely believed to smooth traditional underwriting cycles and reduce capacity fluctuations.

**(iii) Pricing difficulties:** The pricing of disaster risks faces several challenges. Charging technically accurate prices is very difficult due to the complexity of disaster risks, lack of data and the volatility of losses. However, even if and when companies apply risk-based premiums, this often stands in direct conflict with affordability of cover. This can lead to cross-subsidisation, formal subsidy schemes or under-pricing of insurance, which might impact the solvency of a scheme.

**(iv) Role of public policy and political motivations:**

Disaster insurance is dependent on political support and often subject to public intervention—either at inception and approval stage, or during operations, when loss events may lead to premium rises. The relationship between public and private sector is of particular importance in the context of rising losses, where effective public-private collaboration is seen as the only viable option for maintaining insurability.

*A range of other challenges further hamper the scaling of private disaster risk transfer in low- and middle-income countries.*

The prevailing low level of insurance penetration in low- and middle income countries is mainly attributable to the relationship between per capita income and aggregate insurance penetration. However, income alone cannot explain the variability in disaster insurance penetration from one country to another. Beyond the factors outlined above, there are a range of other issues that create particular challenges, such as:

- (i) **Limited or lack of:**
  - availability of data, and risk modelling tools, technical expertise to run the models and understand their uncertainties;
  - know-how and experience with the interpretation and use of risk information;
  - financial infrastructure and a strong and reliable domestic finance sector;
  - awareness of risk management culture with multi-hazard, multi-sectoral approach;
  - access to insurance and limited distribution channels, particularly in remote rural areas;
  - scale, given the low number of insured parties.
- (ii) **Regulatory constraints** such as inadequate minimum capital requirements or a lack of enforcement.
- (iii) **Need for global (re)insurance capacity** and expertise.
- (iv) **High distribution and claims settlement costs**, particularly in remote rural areas. Although attempts have been made to utilise technologies such as cell phones to increase accessibility to, and take up of, insurance to these levels.

### ***Engaging across sectors and stakeholders***

With governments at the centre of this issue, over the last decade, increasingly more coordinated multi-lateral initiatives have been forged to raise awareness and facilitate the implementation of disaster and climate risk management capacities at the international, regional, national and local levels. These efforts have engaged various international intergovernmental organizations (IGOs), international donors, non-governmental organisations (NGOs), insurance industry, scientific and engineering community, academia, and media agencies. An analysis of the complex landscape of stakeholders and initiatives indicates progress along four main areas, including: (i) promoting investments in risk assessment capacities and expansion to the public sector, (ii) promoting the integrated

approach to disaster and climate risk management, (iii) developing solutions in disaster risk financing and risk transfer and (iv) expanding innovative insurance products in the agriculture sector.

We conclude that despite the evident progress and achievements, development of sustainable and scalable risk management practices could benefit from stronger, more coordinated and strategic public-private partnerships, that leverage the strengths of the engaged stakeholders, avoid redundancies and align priorities.

### ***Addressing the changing climate***

*Climate change offers both challenges and opportunities to insurance-based adaptation and mitigation strategies*

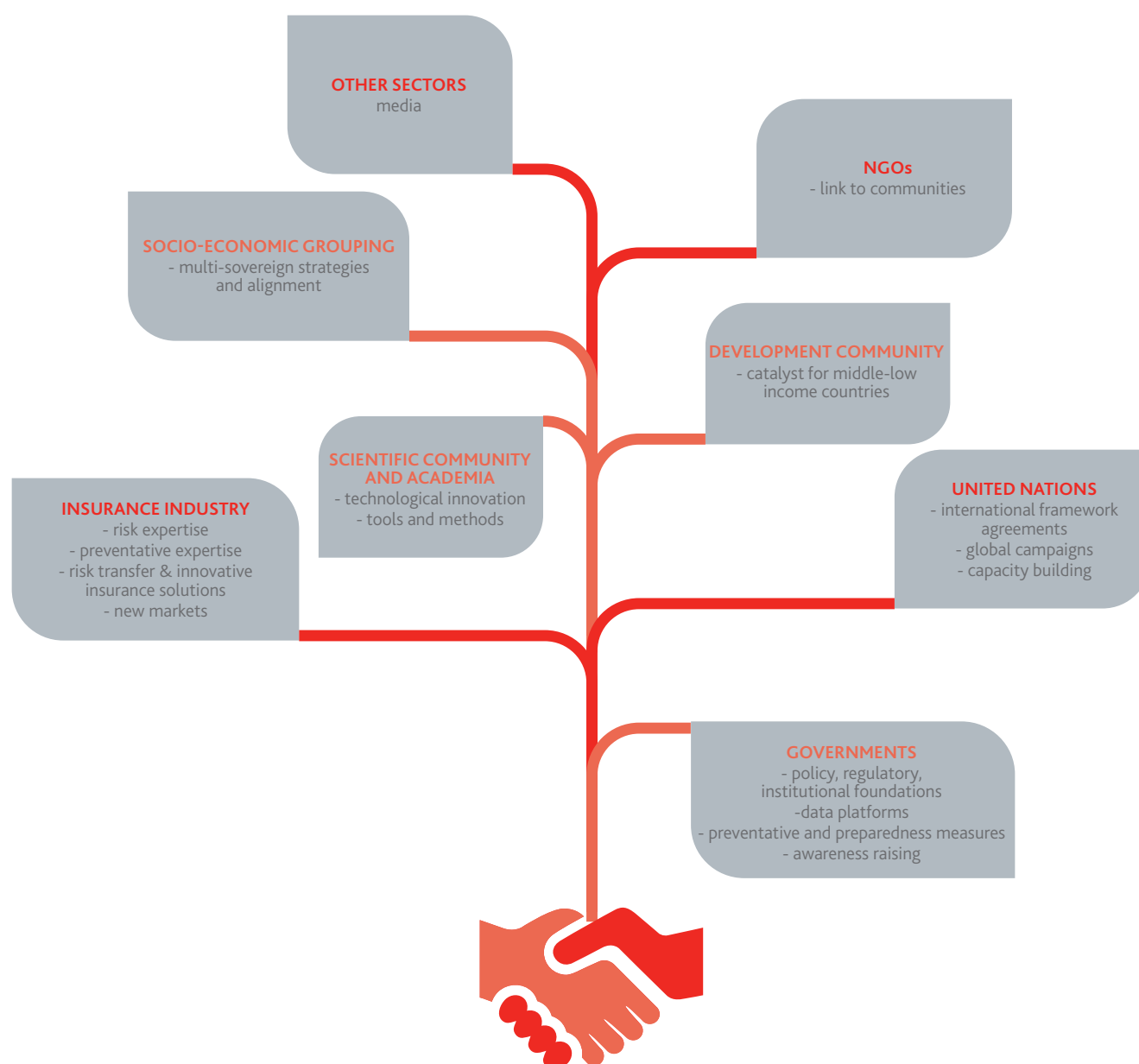
The 2016 Global Risks Report of the World Economic Forum (WEF) has identified 'failure of climate change mitigation and adaptation' as the highest risk facing our society. Our understanding of how climate change impacts the nature of extreme events is increasing, but is subject to uncertainty due to the complexity of the global climate system. Whilst, traditionally, historical records of hazards have been used as a proxy for quantifying probability of future events, science is revealing that the past may not be a good reflection of the future. IPCC (2012, 2014) particularly illustrates that climate change impact and associated scientific uncertainty vary for different hazards (perils) and geographic locations. A wide range of studies are investigating the impact of climate change on risk patterns and implications for assessing and forecasting risks. On the hazard side, scientific advancements in observing and predicting climatic regimes and related weather patterns may provide essential input for forward-looking risk models.

The private insurability of disaster risk could be negatively impacted by a changing climate. Theory and evidence from existing insurance markets suggests that a 'riskier and more uncertain world would be associated with an increase in insurance demand, at least until some local threshold were reached where the affordability of insurance or the insurability of risk were threatened' (Ranger and Surminski, 2013b).

The influence of climate change on insurance provision is expected to be multifaceted, complex and regionally variable (Standard & Poor's, 2014). This was recently underlined by the U.K.'s Prudential Regulatory Authority (PRA), noting that the changing risk landscape has already led to some governments deciding that insurance provision 'has more of the nature of a public good' and requires intervention, suggesting climate change is likely to have implications for the balance of private and public insurance cover—as in 'extreme cases, insurers might even have to withdraw from certain regions or types of risk' (Prudential Regulation Authority, 2015).



*Figure 5: Leveraging partnerships is crucial to successful implementation of the integrated approach to extreme events and climate risk management*



**EFFECTIVE PUBLIC-PRIVATE PARTNERSHIPS ARE AT THE CENTRE OF DEVELOPING EFFECTIVE AND SUSTAINABLE RISK TRANSFER AND INSURANCE PROGRAMMES**

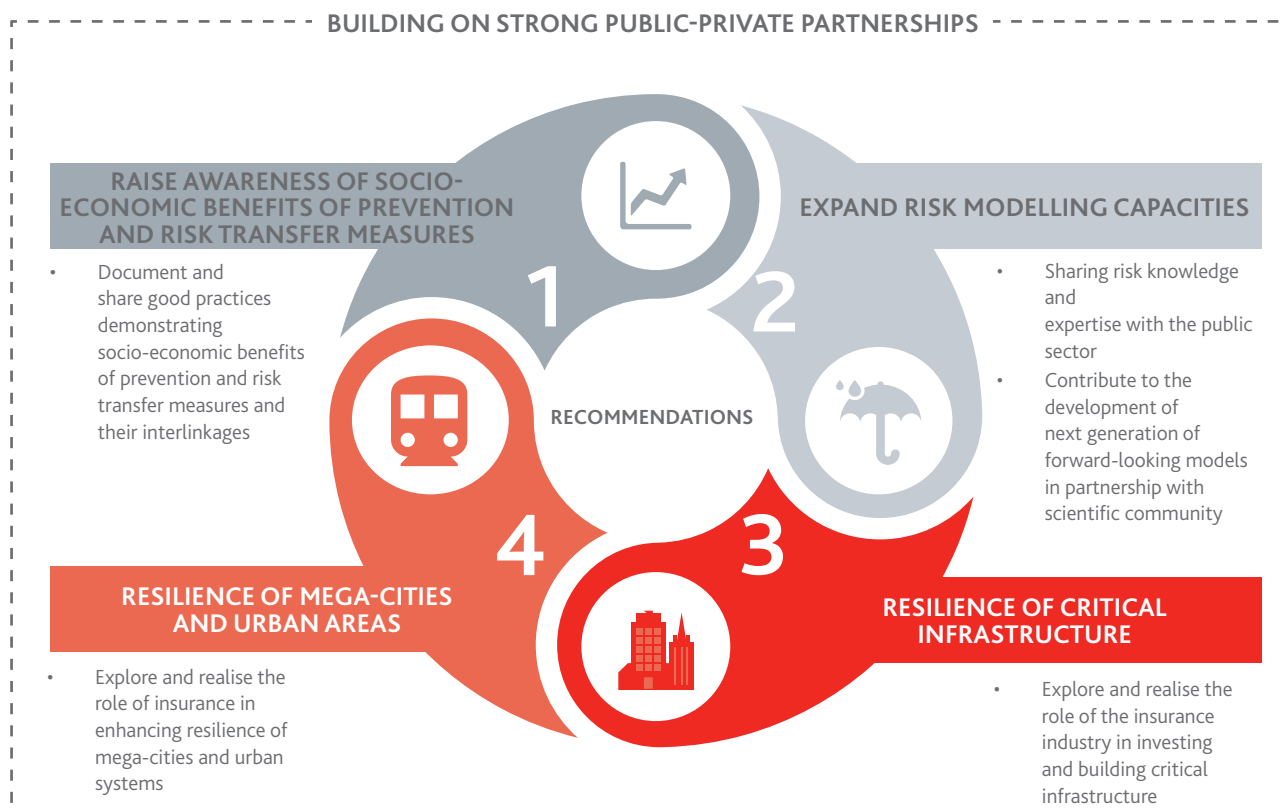
For those who provide risk transfer solutions, this creates new risks, but also opportunities. Several of the new pilots and risk transfer schemes in low-income countries have been motivated by the concern about climate change. Insurance is increasingly seen as an instrument for climate adaptation, justifying public investment into insurance. However, if and how future climate change risks are being factored in existing and new insurance schemes remains unclear. A handful of new schemes are aimed at changes in weather patterns (e.g. forecast insurance and El Niño cover in seasonal timescales), but the vast majority is providing cover for current risks on a year-by-year basis. It is also unclear how future risk trends are being considered when assessing the viability of new schemes, as currently seen in the U.K. with the Flood Re proposal, which was designed without reflecting on future risk projections (Surminski and Eldridge, 2015).

One important aspect in the quest to maintain insurability of disaster risks is the role that insurance can play in driving broader climate adaptation and disaster risk reduction practices. There is increasing evidence that insurance is not exhausting its prevention role for disaster risks. The absence of risk-based pricing is a key aspect, as this dents the signalling function of insurance and its role in influencing human behaviour.

But even if risk-based pricing would be applied, Bräuninger *et al.* (2011) note several issues that would need to be addressed in order for insurance to make a meaningful contribution to climate risk reduction including: the mismatch between required prevention investment by policyholders and the premium savings; the short-term nature of insurance contracts; simplified rating structures used by insurers; a prevailing uncertainty about the benefits of risk reduction measures—due to lack of standardised assessment methods; and the need for active involvement of policyholders to put in place, operate, and monitor those mitigation measures.

Therefore, one could argue that risk reduction efforts are critical for maintaining the insurability of these risks, especially in the context of flooding and other extreme weather events, and that effective adaptation may actually become a precondition for granting insurance cover in the future.

**Figure 6: Recommendations for expanding the contributions of the insurance industry to managing risks of extreme events and climate**



## CONCLUSION

### **Four recommendations for expanding the engagement of insurance industry within the integrated disaster and climate risk management framework**

The following four recommendations could help expand the contributions of the (re)insurance industry in building resilience to extreme event and climate risks in a scalable and sustainable manner. Strategic alignment of priorities and cooperation at the industry level along with effective partnerships with the public sector, the scientific community, IGOs and NGOs would be fundamental to successful implementation.

#### **Recommendation 1:**

*Raise awareness of the socio-economic benefits of an integrated approach to managing disaster and climate risks through documentation and sharing of good practices*

More efforts need to be deployed to develop compelling evidence of the socio-economic benefits of preparedness, prevention and risk transfer (including insurance) and how an integrated approach to risk management can help societies cope with extreme events and climate risks. There is also a wealth of practical knowledge and experience which could be documented and shared. Examples include:

- (i) The creation of enabling environments for the development and implementation of risk management strategies, particularly, focusing on the interplay of prevention and risk transfer
- (ii) The development of risk information to understand the key drivers of economic risk and the role of risk-based pricing as a signal of the right balance of preventive and risk transfer measures
- (iii) Innovation in risk transfer product development, expansion to new markets, distribution and settlement channels, including the role of technology

Additionally, global disaster loss and insurance penetration data could also be analysed to establish the link between insurance penetration (premiums as a share of GDP) and the insurance protection gap (uninsured losses as a share of total losses) on the one hand, and the post-disaster resilience of economies (e.g. the speed at which they recover to pre-disaster growth rates), on the other.

#### **Recommendation 2:**

*Harness the (re)insurance industry's risk knowledge and risk modelling expertise and develop of next generation of predictive catastrophe risk models*

Over the last 20 years, catastrophe risk models (also known as CAT risk models) have revolutionized the (re)insurance industry's capacities to manage risks. Built on three core elements for characterising risks - hazard, exposure and vulnerability - these numerical models have been used to calculate the potential range of events and their financial impacts, taking into consideration the insurance and reinsurance conditions for protection of those assets. While not perfect, the utilization of such models has proven to be highly beneficial on many fronts such as risk pricing, underwriting, portfolio management, and claims settlement.

Against this backdrop, a number of organisations such as the World Bank Group, regional development banks and international donors are collaborating with risk modelling firms to help governments in accessing and understanding their risks in mid and low-income countries. However, experiences with building and scaling up of the governments' capacities in producing, interpreting and utilising risk information have revealed a number of technical and institutional challenges, from which lessons could be learned in tackling this issue more practically in the future.

The expansion of risk modelling capacities and stronger public-private partnerships could also promote the availability, accessibility, and quality of publicly-funded hazard and loss and damage data, which pose challenges in many regions around the world.

Finally, extensive progress in scientific research and forecasting of weather and climate extremes (i.e. seamless forecasting from next minute to decades) combined with innovation in observing systems, big data, digital mapping, and advanced computing may offer unprecedented opportunities for the development of the next generation of predictive hazard modules to enhance risk modelling. The insurance industry, through bi- and multi-lateral initiatives has been working closely with the academic and research community. However, opportunities for stronger, more coordinated industry-wide engagement with the scientific community, through internationally coordinated scientific research and operational programmes should be further explored.

**Recommendation 3:**

*Engage the insurance industry in enhancing resilience of critical infrastructure*

The protection and building the resilience of critical infrastructure is rising to the top of governments' priorities. In this context, the role of the insurance sector in building and enhancing resilience of critical infrastructure to extreme events and climate risks should be further explored. For example, building on the initiatives of organisations such as the World Bank Group (e.g. Global Infrastructure Facility, Disaster Risk Financing and Insurance Program) and the OECD, the insurance industry can play an essential role in working with governments and private operators. Insurers can make a dual contribution based on absorbing and transferring risks on the one hand, and acting as an investor in sectors such as energy, transportation, food security and health care, on the other.

The underwriting part should consider the entire life cycle of the investment, i.e. the design, construction, operation and decommissioning phases. By pooling risk and providing financial compensation (re)insurance can contribute in a meaningful way to improving the resilience of critical infrastructure to extreme events and climate risks. Insurers could step up efforts to develop solutions tailored to the needs of exposed critical infrastructures, in high-growth markets in particular. At the same time, the public sector is called upon to strengthen resilience regulations and their enforcement as well as to offer an environment which facilitates the involvement of domestic and foreign private-sector (re) insurers.

The funding gap is huge: Annual infrastructure spending requirements are estimated to increase from today's USD 2.6 trillion to around USD 4.3 trillion by 2030 (Swiss Re, 2014).

The investment role of the insurance industry is as important as the underwriting function. An essential requirement of risk management in insurance is to match long-term liabilities with long-term assets. In this respect, infrastructure investments—either through project investments or indirectly through equity or debt investment into developers, operators, indices or funds—could and should gain in importance.

**Recommendation 4:**

*Employ insurance solutions to enhance the resilience of mega-cities and urban systems.*

The increasing concentration of people, wealth and assets through urbanisation in high risk regions (e.g. coastal areas, flood plains) is leading to significant socio-economic vulnerabilities and heightened economic risks, particularly in the middle-income countries. The changing climate is further exacerbating this situation through changes in the patterns of extreme events, environmental changes and sea level rise, with potential impacts on global trade and economic development. A number of initiatives such as the 100 Resilient Cities Initiative led by the Rockefeller Foundation, the UN-supported global campaign Making Cities Resilient, actions by the international association of mayors ICLEI—Local Governments for Sustainability, the establishment of the Compact of Mayors, combined with major events such as Super Storm Sandy and Hurricane Katrina have generated unprecedented political awareness of the importance of building resilience to extreme events and climate change in urban areas and mega-cities. Nearly 68 of the world's largest cities have established a chief resilience officer. New initiatives are demonstrating significant benefits of rebuilding and restoring the natural infrastructure for reduction of risks and building resilience in high-risk zones (e.g. coral reefs and coastal communities). The international development community is also organising itself to provide more systematic and coordinated support to the local governments.

Building on this momentum, the insurance industry can work with local governments and other critical stakeholders by contributing (i) its expertise in risk modelling and risk pricing to help identify the risk levels and inter-linkages, (ii) its expertise and knowledge from research on resilience and prevention and (iii) innovative insurance solutions that address the needs (direct and indirect).



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2015 was a pivotal year with three international framework agreements on disaster risk reduction, climate change, and sustainable development, recognizing the importance of an integrated approach to managing disaster and climate risks and the critical role of insurance in building economic resilience. Drawing from our in-depth analysis of the rising economic risks of disasters and climate, the complex landscape of the stakeholders and their initiatives, this report highlights the importance of public-private partnerships and offers four recommendations for harnessing the contributions of the insurance industry within an integrated approach to managing these risks, to build societal resilience.

