

## PRIVATE RISK TRANSFER MARKETS AS CATASTROPHE RISK STAKEHOLDERS

Andrew Coburn

*Vice President of Catastrophe Research, Risk Management Solutions, London*  
*Email: andrew.coburn@rms.com*

### ABSTRACT :

Insurance companies have a direct interest in mitigating earthquake losses, but the economics of insurance cannot provide sufficient financial incentives for building owners to make significant changes in their property. The greatest need for mitigation is in the emerging markets. Insurers see growth opportunities in these markets so are interested in increasing their presence. The use of private insurance capital by emerging market countries itself provides disaster mitigation by securing the economic growth that makes countries more resilient. Mitigation activities by insurers as they increase their penetration into emerging markets could also extend to involvement in partnership with government to improve building stock quality, particularly in the new vernacular of RC MRF multi-storey construction. Insurance companies can partner with governments, particularly for information provision and education that improves risk perception and decisions. Ultimately risk management metrics of the type used by insurance companies, such as 'PML's could provide guidance to authorities in prioritizing and managing the earthquake mitigation process.

**KEYWORDS:** Insurance, mitigation, emerging economies,

### 1. INSURANCE AND MITIGATION

Insurers clearly have a direct interest in earthquake risk mitigation: if their policy-holders' losses are reduced, they benefit from lower claims costs. However, insurance companies are often criticized for failing to be more engaged in promoting and encouraging risk mitigation activities.

#### *1.1 Financial incentives for building owners to reduce their vulnerability?*

The argument is sometimes posed that insurers could provide financial incentives to policyholders to mitigate their risk, through, for example, reduced premiums for more robust structures.

In some ways there are financial incentives built into the underwriting process: the more sophisticated insurance companies in well-developed insurance markets charge a tariff rate for their insurance premiums that differentiates the vulnerability of the structure to earthquake forces (structural system, construction materials, number of storeys, etc.). In a medium to high seismicity zone, the difference in technical rate (the annualized estimated cost) resulting from earthquake can vary substantially. The difference between an unreinforced masonry building and a steel frame engineered structure can be several orders of magnitude. The premium charged also includes administrative and risk-loading factors, but some of the difference in the quantifiable risk is reflected in a difference in the premium charged. So there is some economic incentive for a property investor to choose a less vulnerable building (e.g. steel frame) over a more vulnerable one (e.g. unreinforced masonry).

However the scale of the incentive is very small in comparison with the economics of property capital costs and structural interventions. A property worth \$1,000,000 located in a moderate to high seismic zone would pay earthquake insurance premiums of several thousands of dollars a year. Choices that the property owner would have to mitigate their earthquake risk, such as structural retrofits, improved safety equipment, or even relocating to a stronger building, would incur costs far in excess of any saved insurance premium. The cost of the intervention relative to the saving (the investment payback period) can be many hundreds of years – beyond the expected lifespan of the property. It is not an economic proposition to use insurance premium discounts as a financial incentive for mitigation.

### ***1.2 Financial incentives in deductibles and limits***

In practice insurance companies are reluctant to discount premium – this is their top-line revenue source and it dictates their business management metrics. Insurance works by diversification of risk, and individual risk pricing for structures is less critical than volume of premium and diversity of exposure. Insurers tend to favor other ways of incentivizing good risk management on the part of their policy-holders. For high end insurance purchasers they tend to offer lower deductibles (the initial part of the loss paid by the policy-holder when a claim occurs) or higher limits (the maximum payment an insurer will make in the event of a claim) to policy-holders who represent better risks. This means that the policy-holder is better compensated when damage occurs, which is a considerable benefit, but the policy-holder has to be relatively sophisticated to appreciate the value of these deferred incentives. These terms tend to be offered to professional and corporate buyers of insurance rather than mass markets or medium size businesses where mitigation incentives would be valuable.

## **2. EMERGING INSURANCE MARKETS**

Mitigation activities are most needed in those countries where earthquake losses are major but seen as preventable – countries where economic growth is occurring but disasters are still severe. High casualty events in poor quality modern building stock are examples of areas where disaster mitigation would be most valuable.

The opportunities for successful intervention to promote meaningful mitigation activity tend to be in countries in the second tier of economic development: countries with rapid developing economic growth, changing building stock, and new investment in physical infrastructure. These are also countries where insurance markets penetration is currently low but increasing.

Insurance industry analysts (e.g. Swiss Re 2006), see the world as three blocs:

- Industrialized countries (North America, Western Europe, Japan and Australia)
- Emerging insurance markets (about 60 countries with small scale but growing insurance activity)
- Non-insurance countries (some of the poorest nations where insurance is non-existent)

The industrialized countries dominate the insurance market, with nearly 90% of global premium income (Swiss Re 2006). International insurance companies naturally concentrate on these primary markets, engaging their efforts, product creativity and management attention there. The emerging markets however are growing rapidly and insurance companies are investing time and effort to benefit from the future growth opportunities in these countries. Emerging markets, particularly those in South and East Asia and Latin America, have maintained premium growth rates at over 10% a year for the past decade, contrasting with average growth rates of around 2% in the industrialized countries. Life insurance is the strongest area of emerging market uptake, but non-life insurance, and particularly property insurance (i.e. covering fire and catastrophe) has growing uptake in the small and medium size commercial companies that are driving the economic growth in these countries.

The rapid globalization of economic activity is fuelling the growth of commercial activity in emerging markets, as Western companies partner with local businesses to provide manufacturing, processing and other inputs. Western companies insure their own assets in the emerging countries and also encourage their local partner companies to insure themselves, improving the awareness of local businesses of insurance as a risk management tool, and promoting insurance penetration in these emerging insurance markets.

### ***2.1 Economic vulnerability of emerging countries to disasters***

There is significant opportunity for insurance to contribute to the risk management of these emerging economies. Many of these emerging economies are in hazard-prone regions of the world, and their economic development trajectory is itself vulnerable to the potential impact of a natural catastrophe in ways that industrial countries, with their strong economies, are not.

Economic losses from earthquakes in the past several decades shows that a major catastrophe can destabilize entire economies, and in the past several decades there have been at least seven earthquakes whose physical loss

represented at least 6% of the Gross National Product of the country it hit (Coburn & Spence 2002, Chapter 2 The Costs of Earthquakes). The loss caused in the Managua earthquake of 1972 represented 40% of the GNP of Nicaragua, and the burden of the national debt created by the reconstruction costs was a significant factor in the decline of its economy throughout the 1970s and 80s. The 1986 El Salvador earthquake represented 31% of its entire GNP. The economies of industrialized countries are sufficiently robust to withstand the economic losses caused by major catastrophes, even though they are more expensive and damage higher value assets: The 1989 Loma Prieta earthquake in United States cost over \$8 billion in physical loss – five times that of the 1986 El Salvador event – but by contrast this represented less than 0.2% of the US GNP.

As a country emerges as an economy, it invests in physical infrastructure – roads and utilities – and physical assets – factories and cities – which are then at risk of destruction from a natural disaster. Emerging economies generally invest in lower cost assets (buildings and equipment) than those in industrialized countries, which as a result tend to be less robust and more vulnerable to damage. Investing in robustness for disaster resilience is a cost-benefit calculation that is more difficult to justify when bootstrapping economic growth with capital at a premium. This is both the constraints and the opportunity for private market stakeholders in catastrophe risk. Insurance can contribute to economic resilience and provide or encourage additional capital – and possibly know-how – to improve the resilience of the property assets that need protecting.

### **3. INSURANCE MECHANISMS IN CATASTROPHE RISK MITIGATION**

Insurance works by economies of large scale and diversification of the risk across large numbers of policyholders. The rapid globalization of the insurance industry shows that the most efficient scale of operation is one where the cost of a catastrophe in Peru is offset by the premium income from the unaffected policyholders in Japan. Insurance has been credited with accelerating economic growth (insurance has been referred to as ‘the handmaiden of industry’) in those societies where it has operated, by mitigating the economic impact of disasters by providing rapid replacement of capital when a large loss occurs.

Over time, insurance helps ‘lock-in’ economic achievement. Improving the effectiveness of insurance in providing economic protection is an important element of catastrophe protection. Economic growth is the most important factor in disaster mitigation, providing society with the resources to protect itself and build a stronger and more resilient environment. Improving the reach and scale of this contribution to societal wealth creation is an important objective for those of us who want to increase the effectiveness of the private market in mitigation.

#### ***3.1 Government access to private market capital***

Governments in many countries play a vital role in disaster recovery. They assume the role of provider of last-resort to their citizens and set up and administer disaster recovery operations. In many countries, primary utilities are state-owned, and in most countries transportation infrastructure is built and maintained by the government. Public buildings, such as administration, schools and hospitals, are usually state-owned. The costs of replacing all of these public-owned infrastructure and assets can themselves be a massive and potentially ruinous economic drain, as in the Nicaraguan example above. Governments tend to fund these disaster reconstruction costs through increased borrowing on their national debt, but emergency borrowing is an expensive method of accessing capital: interest rates are higher than they might otherwise be if they were part of a longer-term budgeted financial proposition. Increasingly governments are examining the possibility of ‘budgeting for disaster’ – analyzing the likely costs of future catastrophe and building these into long term financial planning. This approach is similar to corporate financial planning, where prudent corporations expect and plan for rare surprises, and find that buying insurance against some extreme levels of loss and budgeting premium expenditure every year is an efficient method of financing these rare but potential catastrophic losses.

The size of the financial protection being sought by governments is beyond the level that can be provided by the traditional insurance market – even the largest reinsurers are unable to provide capacity for the billions of dollars needed for regional infrastructure rebuilding by a national government. Governments commonly access the international capital markets, which have much more capacity than the insurance industry, for finance in the form of treasury bonds and other instruments, and could potentially transfer their risk of financing disaster costs

to the private international capital markets in the form of catastrophe bonds. Catastrophe bonds have been increasingly used by insurance companies looking for reinsurance in areas where capacity is limited or difficult to obtain and have grown in acceptance by capital market investors looking for investments that diversify their investment portfolios. Several financial institutions are reported to be exploring the potential for the governments of developing countries to access disaster capital more efficiently through using catastrophe bonds, potentially via the World Bank or other development banking mechanisms. High quality analysis of catastrophe potential and loss return periods is essential for transparent pricing, spread negotiation, and investor confidence.

### ***3.2 Encouraging self-protection by using insurance***

In addition to the governments themselves transferring their risk of replacing infrastructure and utility provision, governments of many developing countries, and their citizens would benefit from increased uptake of insurance by private companies and individuals.

Most governments try to alleviate the financial loss of their citizens, particularly the poorest and most in need, after a disaster occurs. The range of solutions is wide, ranging from victim compensation funds, disaster recovery grants and subsidized loans, through to housing aid, and in some cases full reconstruction programmes of housing and small industry provision. The costs of assisting citizens recover from their losses is often more than the costs of replacing public sector infrastructure. In some socialized countries, housing is normally provided by the state, and so replacing damaged housing is a continuation of that obligation by the state. However, in most capitalist countries, private property ownership is the norm and it is exceptional for the state to provide compensation for the loss of a house or a property. Most citizens would not expect government compensation for their house or factory if it were lost in a fire, but when a catastrophe strikes an entire region, governments often try to alleviate the hardship of the community by providing compensation or rebuilding lost private property. In some countries this has been legally encoded in disaster response policy, in others it is a common political response to a destructive event. Many studies have shown that government intervention in replacing private property after a disaster are misplaced and tends to be an unsuccessful solution to long-term reconstruction (Davis 1978). Empowering citizens to control their own reconstruction and prioritize their own needs is generally a better solution, providing better economic regeneration and more powerful recovery growth.

Maximizing the ability of citizens to protect themselves, and having insurers paying out individual compensation to their policyholders is not only desirable to reduce the costs to the state, it also empowers the affected people to control their reconstruction and provides a better mechanism to fuel recovery. The private insurance industry is generally extremely effective in paying out claims after an event. Even catastrophes where large numbers of claimants have to be processed, validated and loss-adjusted, insurance companies have proven to be better, faster and have lower administrative costs than public sector solutions, such as a government compensation scheme. The more people can protect themselves, the lower the cost to the government, who can then concentrate on ensuring that the poorest and most needy are cared for.

For all these reasons, maximizing the penetration of private insurance is highly desirable as a method of ensuring rapid and effective recovery, mitigating future disasters, and minimizing government cost.

### ***3.3 Promoting insurance take-up***

Insurers have aligned interests with governments in ensuring the broadest possible penetration and coverage. A major part of marketing insurance – enabling individuals to decide to buy coverage – is education about the risk.

Where individuals properly perceive a risk to themselves, they can be relied upon to take whatever measures they can to minimize that risk. Perception of risk is complex, but information about hazards and educating the general public about the scale, frequency and geography of the perils they face is an important part of empowering them to protect themselves. All members of society benefit from information of this type, and can contribute to mitigation decisions, from company executives deciding about where to site new factories, to municipal officers deciding priorities for urban infrastructure, to individuals making decisions about their family's safety. Insurance companies and governments have aligned interests in making information available about the nature of the hazards that the community faces, and ensuring that people make the best decisions they can to protect themselves.

Insurance is a sophisticated financial concept and requires a level of education to grasp the abstract contractual obligations and benefits being purchased. In many societies, insurance companies are viewed suspiciously, even antagonistically, because benefits appear intangible while money is seen to flow from individuals to a capital-rich corporation. Perception of the advantages of insurance coverage can be improved by positive endorsement and attitudes by government and officials. Trust is an essential part of insurance operation – the policy-holder has to trust that the insurer will still be solvent when the event occurs, and will honour their obligation when called upon. Governments can boost trust by strong regulation and, in some cases providing government security back-stops or by providing government-linked insurance distribution channels.

A major barrier to uptake of insurance is the cost of insurance premiums. Take-up is subject to the fundamental economics of price and demand. In some countries, the pricing of insurance is so politically sensitive that it is government regulated. This sometimes happens even in the freest of markets, such as United States. However, economists generally prefer freely priced commodities, where insurance companies are free to set the prices that maximize their return. Low-cost insurance can be made available where administrative overheads are reduced (such as by partnering with other administrative organizations) or where profit requirement is minimized (such as in mutual insurance operations) or where risk capital costs and reinsurance can be kept low (such as through widely diversified and pooled risk, government capital subsidy or backstop). Barriers of cost, distribution, and education are slowly being overcome to provide increasing access to private insurance for the more vulnerable sectors of society, such as micro-insurance for the lowest income groups. (Coburn & Winchester 2008).

### ***3.4 Insurers as information providers***

Insurers invest – directly and indirectly – in research to understand the risk, and have played an important role in dissemination of that knowledge, for example published risk maps, zonings, technical guidance. More could be done and insurers and their agents and brokers could play a greater role in engaging with the companies, individuals and government agencies that need risk information. Government and the private insurance sector could work closely to develop information products, publicly accessible educational materials, and promotion campaigns to improve the knowledge and perception of risk by all sectors affected.

Insurers also contribute to the funding of the underlying science required for their risk assessment tools. Recent initiatives such as the Global Earthquake Model project, designed to make seismic risk and particularly hazard assessment information available for use in mitigation projects in the developing world, have received substantial contributions from the insurance industry. The underlying information and scientific data required for risk assessment is of critical use in mitigation. Modeling companies such as my own, Risk Management Solutions, is committed to a social responsibility agenda of providing risk information for disaster mitigation.

## **4. REDUCTION OF DISASTER LOSSES IN EMERGING INSURANCE MARKETS**

Public and private sectors also have aligned interests in reducing the costs of a major disaster. As risk stakeholders, insurers have interests in, and can contribute to, a number of public sector decision areas, such as government policies on disaster mitigation and compensation, public investment in emergency response capability, and the setting and enforcing of building code standards. Insurers are rarely represented or consulted in these processes, and yet could contribute substantially.

In section 1, above, the point was made that insurance premiums in well-developed insurance markets do reflect differences in construction vulnerability (but that these are too small to provide economic incentives for property upgrading). In emerging insurance markets, the insurance products are simpler and do not have the same pricing complexities, so do not tend to reflect very much difference in construction type. Insurance mechanisms in general are not well-gearred to providing economic incentives to property owners for them to strengthen buildings or build stronger. However there are ways that insurers can become involved in the process of improving the resilience of the building stock. Where change is occurring in the building stock in the emerging market countries, there is opportunity to influence choices and practices, and insurers are able to – and will benefit from – participating in mitigation actions. These should be targeted on where change can be achieved and the maximum amount of mitigation gains can be made. This may be in the RC MRFs.

#### ***4.1 The deadly new vernacular: RC MRFs***

Historically, most deaths in earthquakes around the world have been in the collapse of traditional, weak masonry buildings common in rural and low-income economies. However, increasingly with earthquakes that impact urban areas in emerging economies, death tolls have included significant contributions from the collapse of the deadly new urban vernacular: multi-storey reinforced concrete moment-resistant frames built within the past 20 years (i.e. new vernacular RC MRFs). In some recent earthquakes – for example in the Kocaeli, Turkey, earthquake 1999 and Wenchuan, China, earthquake 2008 the collapse of these high-occupancy, poor quality modern structures contributed very significantly to the total death toll.

These buildings are typically 4 to 8 storeys high – standard walk-ups without elevators – and are built by local building contractors to standard templates with very little professional engineering design or supervision. They are seen in towns throughout the developing world, and are used for multi-dwelling residential buildings as well as commercial office and service businesses. They have become ubiquitous in communities that are waged and becoming economically developed. The costs of building in this style are several orders of magnitude greater than the traditional older buildings, but their efficiency, modernity and utility make them the construction style of choice for townspeople across the developing world, from Kashmir to the Andes. Their high-occupancies, multiples of single dwellings and sometimes hundreds of occupants, make them lethal when they collapse.

The new vernacular RC MRFs are less vulnerable than the traditional old vernacular of masonry single-dwellings. Unreinforced masonry and earthen structures would typically have collapse rates (D5 Destruction as commonly defined by macro-intensity scales) of 10-60% at intensity IX MMI or MSK, (i.e. 10-13 PSI in Coburn & Spence 2002). The new vernacular RC MRF has collapse rates of 2-25% at this intensity (Damage surveys in Kocaeli, Turkey, Johnson et al. (1999), and in Wenchuan, China, EEFIT (2008)). However, this is a long way short of the performance of properly engineered reinforced concrete frame structures – those designed and built to the international Uniform Building Code standards of 2 and above would be expected to have collapse rates of less than 2% (and at higher standards closer to 0%) at this intensity of ground motion severity (Coburn & Spence 2002, table 9.6). Clearly the issue of mitigation for emerging economies is how to get the quality of the new vernacular RC MRF structures up to international standards of earthquake resilience.

#### ***4.2 Improving building quality of new vernacular RC MRFs***

The vulnerability of the new vernacular RC MRFs arises from poor construction standards and unskilled failure of appreciation of the engineering detailing required for structural resilience. Building contractors undersize structural members, choose inappropriate structural forms, poorly fix the reinforcement, under-mix the concrete, and a wide range of other faults that are regularly identified in post-earthquake damage surveys. Skills are the key missing ingredient. To build a structure of much better resilience may not require much more in terms of the costs of materials, but it would involve a significantly higher cost in terms of engaging a qualified engineer and in the time and effort required for careful construction.

In many countries, qualified engineers, clerks of work, and skilled construction foremen, are in short supply, and the value of the costs they add are not appreciated by the building owners. Changing these conditions, and the mind-set of the property owners, is needed to improve the building quality. Some of this can be achieved by regulatory frameworks, some can be achieved by financial processes and insurer involvement. The cooperation of government and insurers in tackling this issue could provide substantial long-term gains in reducing vulnerability as the building stock changes over time. Putting processes into place to improve the quality of the next generation of buildings is the main opportunity to achieve mitigation. Rapid economic and urban development means that old and vulnerable buildings will swiftly be replaced and over time, particularly within the time frame of earthquake occurrence, seismic risk can be reduced.

Building inspection and municipal approval processes in most emerging market cities are fairly rudimentary. Some cities require some documentary proof of code compliance (such as a signed engineering design) or a site inspection to check for any major construction errors, before allowing connection to utilities for example. These approval processes are minimal, easy to circumvent, and are not well-respected. Few people either implementing the checks or applying for the processes appreciate their value in achieving disaster safety.

Municipal engineers, who check and authorize buildings, are the front-line troops of disaster mitigation, yet they are poorly resourced and under-rewarded. They themselves may not fully appreciate the importance of engineering detailing and construction quality, and levels of ignorance, poor education and corruption are rife.

Insurance companies cannot themselves be policemen on the properties they insure – the costs of a site inspection relative to the value of the insurance premium make it uneconomic on all but the highest value facilities. However their interests, and those of the authorities, are aligned in wanting to ensure that buildings are of good quality, and structurally resilient. Insurance certification could become aligned with municipal quality control processes, and a virtuous cycle of mutual reinforcement established: mortgage lending, insurance and municipal control could all require increasing levels of professional input, quality control and inspection to enable a property owner to put up a new building. Colleges for the training of municipal engineers and education of building owners, officials and the general public might be co-financed by insurers and government.

## 5. METRICS OF MITIGATION

Techniques used by insurance companies to quantify their risk could be usefully adopted by public sector agencies involved in mitigation. The scientific community is constantly challenged about its ability to make a contribution to the struggle for reduced catastrophe losses, particularly in developing countries. Debate rages about whether the world is becoming safer or not. Evidence seems to suggest that worldwide, disaster-related losses are increasing, but there are few reliable benchmarks to be certain. People don't really know whether their efforts are making their community safer, or if so how much safer, and whether their efforts are worthwhile or a waste of resources better prioritized elsewhere. In short – how do we know if we are winning the war against catastrophe loss?

Most analysts and engineers believe that more efforts should be prioritized to pre-disaster mitigation, and are frustrated that this is difficult to do – funding is difficult to obtain, projects are difficult to justify and there is plenty of talk but no action until after a disaster occurs. Human nature being what it is, the aid and development community finds it easier to find resources after a major disaster for a wide range of dubiously-effective measures, than to address the real issues of pre-disaster mitigation measures.

### 5.1 *Disasters that did not happen*

Part of the problem is that mitigation is less visible, and extremely difficult to quantify. In the words of Kofi Annan, Secretary General of the United Nations, in 1999:

“Building a culture of prevention is not easy. While the costs of prevention have to be paid in the present, its benefits lie in a distant future. Moreover, the benefits are not tangible; they are the disasters that did not happen...”

However mitigation benefits could become more visible through scientific concepts of risk. Risk is a complex and largely invisible concept but risk metrics have become common tools for supporting decisions in the financial services industry that trades risk. Key risk metrics could be used to justify and prioritize catastrophe mitigation actions.

### 5.2 *PML metrics for Cities?*

In the world of insurance a key risk metric is the Probable Maximum Loss – the ‘PML’ – from a severe scenario for a facility, a portfolio or a group of assets. For example the insurer may monitor their ‘hundred year return period loss’ – shorthand for saying the worst loss that would occur with a 1% probability of exceedance in the next year – and ensure that the financial reserves of the insurance company are always there to meet this loss. Insurers pick the probability level that is of interest to them, and have sophisticated probabilistic models to assess their PMLs. This catastrophe modeling technology could also be used to assist mitigation activities.

The PML concept could be applied to a city. The city authorities could analyze their ‘hundred year return period loss’ PML – i.e. the number of casualties, economic loss and repair costs that would occur with a 1% probability

of exceedance in the next year. Mitigation actions would be recognized by their effect in reducing the city's PML. An action such as improving the quality and implementation of the building codes for all new buildings would result in a reduction over time of the city's PML. (Other factors, such as population growth and expanding onto hazardous geotechnical areas would increase the PML). The PML for a city, its main components and drivers, could be quantified and modeled within reasonable bounds of uncertainty, and could be openly published and perhaps independently verified. The effectiveness of mitigation measures in reducing a city's PML could be used for prioritization and cost effectiveness justification. The PML reduction metric would be 'the disaster that did not happen' – the benefit would be visible and would be comprehensible to the political decision makers, perhaps even to the general public, enabling them to determine what level of risk they are comfortable with, and having metrics to hold those authorities accountable by.

If a country were to analyze, publish and regularly update the PML metrics for each of its key cities, the highest risk cities would be identified, progress towards safety reduction would be made clearer, and catastrophe risk placed within the context of all the other calls on resources. In many democratic affluent countries, published metrics of civic services, ranging from healthcare to schooling to crime prevention, are used to maintain standards, provide comparabilities, and hold officials accountable to their citizens. Published PMLs could provide a similar role for the duty of civic officials to manage the societal catastrophe risk of their citizens.

### **5.3 Role of Insurers**

The analysis of societal PMLs for cities would have to be carried out using objective methodologies, and as far as possible, independent evaluators. It is unlikely that insurers would be motivated to provide these services, but their experience and expertise would be valuable in defining an open, transparent, and objective methodology. The PML methodology must be simple, credible, and accessible. It will have to be subjected to peer review and accepted by a consensus of scientists to have credibility. Above all it should be independent. It needs to be independent of the funding agencies, administrators and individual practitioners.

There would be distinct advantages and efficiencies in both insurer and civil authority using similar science and modeling techniques in their risk assessments. To this extent, there are commonalities, and as shared risk stakeholders, they could jointly agree methodological standards.

## **CONCLUSION**

Where individuals have a choice, and are well-informed, they can be relied upon to choose the safest option and to protect themselves. Insurance plays a vital role in providing an option for people to protect themselves, and offers a better solution in many situations than reliance on government compensation. The greatest opportunity for insurers to contribute to the mitigation of risk is in the emerging insurance markets, where economic protection is a vital tool for mitigation, and building quality improvement needs the stimulus of private focus.

The private risk transfer markets are important stakeholders that can contribute to the long-term mitigation of catastrophe risk, by aligning their interests with effective roles they can play.

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