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PROMOTING RISK INSURANCE IN THE ASIA-PACIFIC REGION: LESSONS FROM THE GROUND FOR THE FUTURE CLIMATE REGIME UNDER UNFCCC

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Abstract

Globally as well as in the Asia-Pacific region, disasters and related insured and uninsured losses are on the rise. Risk insurance has been argued to provide effective means of catastrophic risk reduction and climate change adaptation in the developing countries. Both life and other types of insurances play an important role in disaster risk reduction. However, in terms of the volume of insurance premiums life insurances are more prevailing than the non-life insurances and hence, there is a need to bridge the gap between both to achieve the maximum possible coverage. Though there are several policy and institutional initiatives to promote risk insurance in the Asia-Pacific region, the region has not been able to utilize the full potential of risk insurance. In order to promote risk insurance, this chapter encourages that the proposals by the Conference of Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) need to address some obvious but most relevant

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issues such as high basis risks, lack of historical data for designing risk insurance products, limited awareness in the utility of insurance instruments among vulnerable population, high premium prices, poor public-private partnerships, limited access to reinsurance, limited use of financial markets in sending right price signals, and lack of enabling policies to create a proactive risk mitigation environment with awareness of sustainability. These issues can only be addressed if the proposals incorporate lessons from on-the-ground experiences at local, regional, and national level.

Key Words: risk insurance, UNFCCC, bottom-up, scaling-up, climate change, disaster risk reduction

1. Introduction

An increase in the number of catastrophic disasters and related insured and uninsured losses has been reported (Munich Re, 2010) undermining the developmental gains across the world. The Asia-Pacific region is one of the most vulnerable regions to a range of primary hydro-meteorological and geological natural hazards such as earthquakes, storms, floods, tsunamis, landslides, and droughts. The Emergency Events Database (EM-DAT) of Center for Research on the Epidemiology of Disasters (CRED) suggests that specifically the number of hydro-meteorological disasters over the 2000-09 period was 10 times more than the number of disasters reported during 1947-56 (CRED, 2010). In the Asia-Pacific region, the hydro-meteorological disasters have claimed the lives of 0.22 million people with estimated total economic damage costs of 285 million US\$ during 2001 - 2012 (CRED, 2012).

The region's high vulnerability to natural hazards, compared to other regions in the world, is primarily caused by a range of geophysical, socioeconomic and developmental conditions. These include a long coastline of 187193 km, a highly variable monsoon system, high volcanic and tectonic activity, high poverty both within and outside of urban areas, high population densities associated with massive immigration to cities, partly poorly planned urban development, partly absence of proper disaster risk mitigation mechanisms and institutional/regulatory frameworks including prevalence and enforcement of structural standards such as building- and land-use planning regulations, as well as the poor development of risk spreading instruments such as risk insurance systems. The data available since 1900 show a steady increase in economic losses and a plateauing trend in loss of lives from disasters caused by natural hazards in the Asia-Pacific region (CRED, 2012). During

1960 and 2010, the average per capita deaths and average per capita economic losses were significantly higher in developing countries than in developed countries in the Asia-Pacific region (CRED, 2012). A disaster of the same intensity can lead to a greater number of death and economic damage in developing countries (e.g. Bangladesh and Philippines) than in developed countries (e.g. Japan) (Mechler, 2004). This clearly indicates differences in exposure and vulnerability between developed and developing countries of the Asia-Pacific region. What is noteworthy as well is that the loss of assets and related livelihoods significantly limit bringing the affected population to their normal life irrespective of the developmental state of a country and hence, the protection of assets deserves greater attention (Vatsa, 2004).

Climate change has brought an additional dimension to disaster risks in the Asia-Pacific region as it is projected to exacerbate the intensity and magnitude of various natural hazards such as storms, high-intensity rainfall events, heat waves, floods and droughts (IPCC, 2007; Kunreuther and Michel-Kerjan, 2007). Especially, the projections suggest high probability for an increasing trend in the high-intensity and low probability events. These increased catastrophic risks will further undermine the developmental gains already made in the Asia-Pacific region.

Take, for example, the case of the agricultural sector which is one of the sectors in the region that is highly vulnerable to climate change. Farming communities in particular are at greater risk to weather-related crop failures. Often, farmers borrow loans from local banks prior to the cropping season. However, farmers, banks, and governments are exposed to higher financial risks due to an increasing frequency of crop failures, and in many cases the governments are forced to waive the loans. In case of India, estimates suggest that the government waived crop loans totaling 14.4 billion US\$ in 2008 (Kanz and Robert, 2011). Similar incidences are observed across other countries in the Asia-Pacific region (e.g. bailout of Thai farmers in 2010) (Sompo Japan Insurance Inc., 2010; Kanz and Robert, 2011).

Hence, in order to address additional risks brought by the impact of climate change, there is a need to reassess and reframe the current risk reduction strategies especially in terms of development and utilization of risk spreading instruments within the Asia-Pacific region. Keeping this in mind, this chapter reviews the current status of risk insurance and identifies emerging issues and experiences. Those are compared with various risk insurance proposals

made by the COP to the UNFCCC for assessing the extent to which they can promote the risk insurance.

2. Risk Insurance and Climate Change Adaptation

The concept of risk transfer or risk spreading entails that the individual (the insured) risks are reduced by spreading or transferring the risks from the insured to the insurance provider (the insurer) since the insurer is in a stronger financial position than the insured (Njegomir and Maksimovic, 2009). The insurance provider is able to insure the risks of the insured to a great extent due to the fact that the insurer obtains premiums from a large number of insured who are at different levels of risks and by making sure that the total amount of premiums collected exceeds the underwriting of risks (termed as law of large numbers). Insurance agencies in turn underwrite some of these risks with reinsurance firms that provide the needed buffer against losses related to catastrophic events. In sum, the risk insurance scheme functions as part of the social safety net through risk transfer mechanisms and thereby contribute to an enhancement of the resilience of societies.

Risk transfer has been widely advocated as one of the best means of risk mitigation across the world (Siamwalla and Valdes, 1986; Arnold, 2008; Swiss Re, 2010a) due to several advantages it provides:

- Promotes emphasis on risk mitigation compared to the current response-driven mechanisms.
- Provides a cost-effective way of coping financial impacts of climate- and weather-induced hazards.
- Supports the climate change adaptation by covering the residual risks uncovered by other risk reduction mechanisms such as building regulations, land-use planning and disaster risk management plans.
- Stabilizes rural incomes and hence reduces the adverse effects on income fluctuation and socio-economic development.
- Provides opportunities for public-private partnerships.
- Reduces burden on government resources for post-disaster relief and reconstruction.
- Helps communities and individuals to quickly renew and restore the livelihood activity.
- Addresses a wide variety of risks emanating from climatic and non-climatic origin, depending on the way the insurance products are designed.

3. Current State of Risk Insurance in the Asia-Pacific Region

The prevailing insurance widely observed in the Asia-Pacific region could be broadly classified into health- and non-health-based insurances which are offered both by the governmental insurance programmes and by the private insurers. The most popular form of insurance is the life insurance where the insurance companies pay for the insured party's death or other risks such as critical terminal illness. Other forms of insurances cover for health, vehicles, properties, liability, credit, housing, and crop among others. Though both life and non-life insurances have a stake in disaster risk reduction, promoting the non-life insurances is of paramount importance in the region due to its poor spread compared to the life insurance.

Among the world regions compiled by Swiss Re, the non-life insurance penetration indicated by premium volumes is highest in North America followed by Western Europe and South and East Asia (Figure 1; Swiss Re, 2010b). Within Asia, the non-life insurance penetration is highest in Japan followed by China, South Korea, Taiwan, and India. In general, the spread of health insurances in the region is much higher than that of the non-health insurances overlooking the premiums, though the magnitude varies between developed and emerging economies. Car insurances and insurances for industrial and commercial establishments are among the dominant forms of non-life insurances in the region.

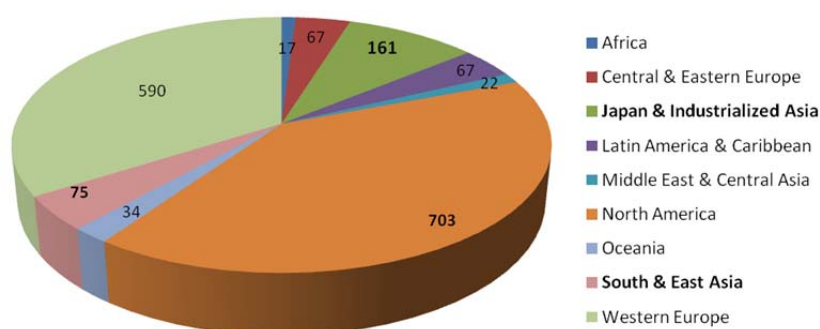


Figure 1 Penetration of non-life insurances indicated by premium volumes in different world regions (in billion US\$). *Source:* Swiss Re, 2010b.

It should be noted that most insurance mechanisms have been conceptualized and developed largely in the developed country markets and are being adapted in the developing countries. While most high-income households in the developing countries pay their own insurance

premiums, most of the premiums of the low- and middle-income families are often enrolled by their employers (O'Donnell et al., 2008).

The poor spread of the insurances remains a concern for the Asia-Pacific region, especially in the non-health disaster risk insurance sector, which is attributed to the following factors:

1) Affordability: The issue of affordability could be put at the top of all the bottlenecks limiting the spread of risk insurance in the developing Asia-Pacific. Though insurance premiums in the majority of those countries are lower than in the developed countries, the annual insurance premium costs are still not affordable for most of the income groups in the developing countries. Parts of the high insurance premium costs emerge from the high residual risks and the little number of insured persons (i.e. poor development of the insurance portfolio).

2) Residual risks: High residual risks are one of the major causes for the poor risk insurance coverage in the region. The high residual risks exist due to poor disaster risk mitigation mechanisms as well as the lack, poor enforcement and inadequacies of laws, respectively, such as building regulations, structural codes, and laws pertaining to land-use planning.

3) Presence of insurers and reinsurers: One of the reasons for the poor penetration of insurances as well as insurance prices above affordability is the limited presence of private insurers and reinsurers. Reinsurers play an important role in providing shock-absorbing capacity to the insurers. To date, very few national (e.g. General Insurance Corporation in India, China Reinsurance Company in China, Zenkyoren or *Zenkoku Kyousai Seikatsukyoudoukumiai Rengou Kai* in Japan) and international reinsurers (e.g. Munich Re, Swiss Re, Toa Re, Axis Re) operate in the region. Hence, there is a high potential for the expansion of the reinsurance sector. Insurers and reinsurers cannot afford to operate in the region unless there is sufficient enabling environment including efforts to reduce the residual risks.

4) High premium costs: The high residual risks, lack of optimum number of insurers, low competition, and low number of insured parties lead all to the higher premium costs than what they could be in the Asia-Pacific region.

5) Policy environment: Though risk insurance is a “market instrument”, its

dynamics are determined or governed by the principles of an open market, government policies and regulatory guidelines which act as precursors for a flourishing of the sector and ensure the effectiveness of the instrument. Hence, the role of the government in promoting the culture of risk mitigation through awareness-raising activities, as well as designing and implementing structural respectively non-structural disaster risk mitigation codes/laws, which include institutional mechanisms and conducive regulations, is paramount.

Though there has already been a significant improvement of policy support for the insurance sector, as apparent from the high growth rates of the insurance sector in the region, the support is still not comprehensive enough. For example, currently, most developing countries in the Asia-Pacific region are at the nascent stages of formulating national disaster risk mitigation plans and policies (GFDRR, 2009) and they have not fully utilized the potential of risk insurance in promoting risk reduction. Traditionally, most governments propagate disaster response rather than mitigation to hinder the public participation in risk insurance schemes (Yucemen, 2008). Limited financing is the major reason behind the poor emphasis of disaster risk mitigation in the region.

6) Cultural and perceptual issues: A general lack of awareness and misplaced perceptions about dealing with risk in general and risk insurance in particular among the common people and the business sector is also an obstacle (Yazici, 2007; Yucemen, 2008). Sociological research has indicated the existence of behavioural patterns that can be characterised as “lethal attitude”, i.e. things will happen whatever is done and that things are beyond ones’ control. As a consequence, the individual willingness to mitigate risks is limited.

7) Lack of data: Infrastructure for collecting and managing systematic and comparable data on past risks, vulnerabilities, disasters, and the nature of disaster losses provides important information on designing risk insurance schemes. In fact, this infrastructure is neither fully developed nor readily available and accessible to the risk insurance industry as well as to the general public in most of the developing countries in the Asia-Pacific region.

Another important challenge, which did not gain much attention in the region yet and which could undermine the implementation of an effective insurance facility, is that of liability.

Insurers will have to deal with it when not reporting their climate-related risks to their shareholders (O'Connor, 2005; Kunreuther and Michel-Kerjan, 2007). Besides, the probability of high insurance payouts increases due to the greater uncertainty and higher frequency of occurrence of extreme weather events in a changing climate that could lead, for example, to crop failures/harvest losses at increasing intervals (Iizumi, Yokozawa, Hayashi and Kimura, 2008). As a result of these limitations, most of the initiatives could not be effectuated and there are still large, sometimes even important regions as well as socio-economic groups that could not benefit from insurance-related instruments.

Thus it appears that most of the above factors are interlinked and that the situation is akin to the “chicken and egg” dilemma. In order to promote the risk insurance in the Asia-Pacific region, there is a need to overcome these limitations. In this regard, drawing lessons from some of the existing examples of implementing risk insurance in the Asia-Pacific region and elsewhere can provide insights in how to overcome these limitations.

4. Case Study of Current Experiences

At present, several pilot projects exist within and outside the Asia-Pacific region that provide practical knowledge of promoting risk insurance (Table 1). One of the features of existing examples is that most of these experiences emanate from efforts to promote disaster risk reduction funded by the multi- and bilateral assistance organizations implemented at the local, regional, and national level.

The Caribbean Catastrophic Risk Insurance Facility (CCRIF) is probably the epitome. It is the only insurance facility implemented and with premiums pooled on the regional level in which national governments pay the premiums for the insurable risks assessed at the national level. There are a number of examples for national level insurance facilities (e.g. Mexico cat bonds, Turkish catastrophic insurance pool, and Indian national agricultural insurance scheme, Japanese rice insurance) and numerous examples for the local level mostly implemented by non-governmental organisations (e.g. BASIX-ICICI Lambard microinsurance in India). Among the local level experiences, India and Mexico are reported to have well developed weather-based insurance programmes (Barnett and Mahul, 2007).

Table 1: Selected cases of risk insurance mechanisms from the Asia-Pacific region and elsewhere.

S No	Case	Geographical coverage	Hazards covered	Direct benefactor	Payment trigger
1	Caribbean Catastrophe Risk Insurance Facility	Caribbean (Regional)	Hurricane and earthquakes	National governments	Parametric
2	Mexico cat bonds	Mexico	Earthquakes and hurricanes	Government	Parametric
3	Turkish catastrophic insurance pool	Turkey	Multi-peril (Currently earthquake only)	Building owners	Indemnity
4	BASIX-ICICI Lambard microinsurance	Andhra Pradesh, India	Monsoon failures	Farmers	Index
5	Indian National Agricultural Insurance Scheme	All over India	Crop failure due to a range of conditions	Farmers	Indemnity
6	Agricultural weather index insurance	Thailand	Crop failure (Maize and rice)	Farmers	Index
7	Crop insurance in Japan	Japan	Crop failure (Rice)	Farmers	Indemnity
8	Microinsurance for cooperatives	Philippines	Protect loan portfolio from typhoons	Cooperatives and farmers	Parametric

Sources: Abousleiman, Zelenko and Mahul, 2011; Ghesquiere, Mahul, Forni and Gartley, 2006; Manuamorn, 2007; Munich Re, 2011; Sompo Japan Insurance Inc., 2010; Yazici, 2007

4.1 Weather Index Insurance is the Way: Experiences from India

National policy environment

Around 70 % of Indian agriculture is susceptible to the vagaries of the monsoon and other factors beyond the control of farmers. As a result, Indian agriculture has throughout been affected by Nature's caprices. Each agro-climatic region requires different cropping plans as well as a distinct policy regime. With this in view, the Government of India has initiated several policy initiatives to address various risks faced by farmers in the country:

(i) Programme based on “individual” approach (1972-1978): The first-ever crop insurance programme was introduced in 1972 to cover H-4 cotton in Gujarat and was later extended to a few other crops and states.

(ii) Pilot Crop Insurance Scheme – PCIS (1979-1984): PCIS was introduced on the basis of a report by Prof. V. M. Dandekar (Dandekar, 1976) presenting the “Homogeneous Area” approach. The scheme covered food crops (cereals, millets and pulses), oilseeds, cotton, and potato and was confined to borrowing farmers on a voluntary basis.

(iii) Comprehensive Crop Insurance Scheme – CCIS (1985-1999): The scheme was an expansion of PCIS and has made insurance compulsory for borrowing farmers.

(iv) National Agriculture Insurance Scheme – NAIS (1999): NAIS (i.e. area yield index based crop insurance programme) replaced CCIS in the year 2000. Despite it is ideally suited for Indian conditions, the scheme has some shortcomings. The most important one is “basis risk” as the area (insurance unit) is rarely homogenous. As the index is based on yield, the insurance covers primarily the processes between sowing and harvesting, but pre-sowing and post-harvest losses are not reflected in the yield index. Another challenge is the infrastructure and manpower required to conduct millions of crop cutting experiments (CCEs) across the country to estimate the yields of crops. The process also contributes to a delay in the settlement of indemnities as the CCEs can take several months. Moreover, yield index based insurances can be designed only for those crops for which historical yield data for at least 10 years (at insurance unit level) exist. Despite these shortcomings, the area yield index crop insurance operational in India is still regarded as one of the most illustrious crop insurance programmes in the world.

(v) Modified National Agricultural Insurance Scheme (MNAIS): The government announced a pilot project on experimental basis in selected states and districts which is an improved version of NAIS titled “Modified NAIS” (MNAIS). The new version bridges to a large extent the gaps of the existing NAIS.

The following are a few salient features of MNAIS:

- a) Insurance unit for major crops is the village Panchayat or other equivalent units;
- b) In case of prevented / failed sowing, claims up to 25 % of the sum insured are payable, while insurance cover for subsequent periods gets terminated;

- c) Post-harvest losses caused by cyclonic rains are assessed at farm level for the crop harvested and left in “cut and spread” condition up to a period of two weeks;
- d) Individual farm level assessment of losses in case of localized calamities like hailstorm and landslide;
- e) payment on account of up to 25 % of likely claim in advance, for providing immediate relief to farmers in case of severe calamities; and
- f) Threshold yield based on average yield of past seven years excluding up to two years of declared natural calamities.

One of the major issues in implementing MNAIS is that the insurance unit for major crops has been lowered to village Panchayat which is good for the farmers but increases exponentially the work load of CCEs. Many states are moving away from the pilot because of the enormity of the work load. Some states are requesting the federal government to share parts of the costs of CCEs. From the insurer’s point of view, accurate and timely data are needed to price the product accurately and to make timely payouts.

Risk insurance experiences in India

Significant experimentation and pilot projects has been taken up since 2003 in various states by all the major insurance service providers (Table 2). To provide risk cover to farmers, weather index insurances are better placed. Advocates of index-based insurances argue that it is transparent, inexpensive to administer, enables quick payouts and it minimizes moral hazard and adverse selection problems associated with other risk-coping mechanisms and insurance programmes (Giné, Townsend and Vickery, 2007; Hellmuth et al., 2009, p.13). Most importantly there are many low-income countries for which no historical data are available, except for weather data, affording an opportunity to try out index insurances of some kind. As a result, weather index-based insurances caught the imagination of policy makers at the beginning of the 21st century. Development institutions like the World Bank initiated pilot projects of this form of crop insurance in low-income countries where traditional crop insurances could not take off for various reasons that include unavailability of historical yield and/or loss data. The underlying principle for weather index insurances is the quantitative relationship between weather parameters and crop yields. There are various crop modeling and statistical techniques to estimate the impact of deviations in weather parameters on the crop yields (Rao, 2011).

Table 2: Comparison of various local initiatives of risk insurance in India

S No	Case	Geographical coverage	Hazards covered	Direct benefactor	Payment trigger	Benefits accrued
1	Weather Insurance by ICICI Lombard General Insurance Company (BASIX as local partner)	Mahabubnagar District, Andhra Pradesh during kharif 2003	Rainfall	Farmers	Excess and deficit rainfall	Claim amount to be adjusted against the crop loan
2	Mausam Bima Yogana by IFFCO Tokio General Insurance Company	Coimbatore District, Tamil Nadu during rabi 2008	Rainfall	Farmers and State Cooperatives	Excess Rainfall	
3	Varsha Bima by Agriculture Insurance Company of India Limited (AIC)	Selected districts in 15 states in the Country	Rainfall	Farmers	Sowing failure and deficit rainfall during various phenophases	Partial payments as per the case during the crop cycle
4	Weather Based Crop Insurance Scheme (WBCIS) by AIC	Whole Rajasthan along with various other states	Rainfall, temperature, frost, heat wave and relative humidity	Farmers	Excess and deficit rainfall, deviation from the normal temperature and relative humidity	i. Trigger events can be verified independently; ii. Quick settlements of indemnities; iii. Covered all ranges of farmers
5	Weather Insurance by ICICI Lombard General Insurance Company	Nagapattinam, Tamil Nadu	Rainfall	Gujarat Heavy Water Chemicals Limited for Salt Industry	Rainfall disruption for salt preparation	Hedging against rainfall

S No	Case	Geographical coverage	Hazards covered	Direct benefactor	Payment trigger	Benefits accrued
6	Weather Based Crop Insurance Scheme (WBCIS) by AIC	Nashik, Maharashtra	Rainfall, temperature and Relative Humidity	Vine Making Industry	Disease and pest incidences considering weather as proxy	Hedging against weather for selected period of risk
7	Bajaj Allianz microinsurance	All over India	Life, asset damage, accidents etc	Rural communities	On maturity or damage	Accidental death benefit & accidental permanent total / partial disability benefit

The first pilot project of weather index insurance in India was carried out in 2003 by ICICI Lombard General Insurance Company Limited which was followed by projects of Agriculture Insurance Company of India Limited and IFFCO-Tokio General Insurance Company Limited, both during 2004. An impressive repository of historical weather data, high dependence on rain fed agriculture and a huge pool of scientific resources place India at the forefront in piloting different models of weather index insurance. The government's realizing of the need for encouraging pilot projects of this risk management tool has supported weather index insurance programmes from 2007 onwards by providing financial support in the form of premium subsidy paid up-front. The weather parameters that have been incorporated so far in weather index insurance include rainfall (deficit, excess, number of rainy days, consecutive dry days, and wet days), temperature (minimum for frost, hourly chilling units, maximum for heat wave, mean etc.), humidity and wind speed.

Rao (2011) reported that, from 2007 onwards, both borrowed and non-borrowed farmers are covered under this scheme. Between 2010 and 2011 as many as 15 states have implemented the project Weather Based Crop Insurance Scheme (WBCIS) in over 100 districts covering more than 800 blocks/tehsils. As per estimates, it insured nearly eight million farmers constituting acreage of more than 12 million hectares for a sum insured of approximately Rs. 96 350 million at a premium of Rs. 8830 million. The cumulative number of Indian farmers covered under WBCIS during 2010 and 2011 is estimated to have crossed 9.27 million, in 13.23 million hectares and risk exposure of Rs. 143 000 million at a premium of Rs. 12 900

million.

Lessons from the ground

Despite several risk insurance experiences in India, the farmers' loyalty has not been won completely (Singh and Jogi, 2011). There are various reasons for it and the most important are basis risk, either no or delay in payment of claims, lack of knowledge and awareness of various contracts, lack of historical weather data and hence high premiums.

The two major challenges of the present weather risk index-based insurance product are (i) designing a proxy weather risk index with predictive capability to measure crop losses realistically and (ii) basis risk. Basis risk results if the actual experience of weather risk (rainfall) in the neighborhood significantly differs from the data recorded at the weather station. The two aspects lead to compounding of the problem for all parametric triggered insurance products: both may not trigger a payout despite the occurrence of damages at an individual farm, or these may trigger a payout when loss did not occur.

The State of Knowledge Report by the Global AgRisk (2010) has brought out few important observations on using weather index for small, moderate and large losses. When rainfall is around the optimal level for a crop, many other important factors affect crop yields (e.g., soil quality, fertilizer use, pesticide use, crop husbandry practices, etc.). Around this level, the correlation between rainfall and crop yields is likely to be not very strong. When rainfall is extremely low, however, the relationship between rainfall and yields is expressed more strongly. Other variables such as use of fertilizers and pesticides have very little effect on yields at low levels of rainfall.

Due to high transaction costs, insurance is perceived to be rather an expensive financial instrument and is mostly designed to protect against low probability and extreme loss events. However with increasing awareness, penetration and efficiency, the unit cost is going down rapidly. The schemes like WBCIS are in fact more desirable as they have the ability to mitigate even small to moderate losses and also provide extended coverage like for pre-sowing periods and quality of output which are difficult to cover under other schemes.

On the other hand, catastrophic events affect just not yields but assets and long-term income. A 'generic' insurance product (in place of a sophisticated product), therefore, can do well for

mitigating such losses (Rao, 2011). Compared with a weather index insurance a catastrophic coverage could be an alternative as it is designed to cover the insured party in case of a fire, flood, earthquake, tornado, or other major accidents. The data requirements for designing catastrophic coverage insurance products are relatively low and hence the basis risk is lower. The cost of administration is also lower for catastrophic coverage. Premiums for covering catastrophic risks through catastrophic coverage are generally affordable which leads to availing insurance for almost all important assets, which in-turn can lead to increased demand for insurance and ultimately high level of insurance penetration.

Insurers have to find a way to offer a technically sound product that is simple and easily accessible to farmers. Farmers must be able to understand the products sufficiently in order to calculate claims and expect realistic payouts. The lack of benchmarking for weather index insurance products erodes the value of financial support provided by the state under WBCIS.

By their very nature, weather index insurance products are difficult to comprehend, especially by a typical Indian farmer who has limited capacities and experience. The multitude of weather index insurance products offered by various insurance providers necessitates the need for benchmarking the various products to enable the farmer to make an informed choice. Through benchmarking it may be ascertained whether the products offered by the different insurance companies carry at least comparable benefits (Protection vis-a-vis Premium). The complex weather index insurance products may be disintegrated into the constituent covers for different perils.

The opinion of WBCIS beneficiaries on 16 different aspects of weather index insurance was assessed by the Government of India (2010). 80 % of the respondents highlighted high basis risk (location of weather station), 57 % were not satisfied with grievance redress mechanism, equal number have reported inconvenience in enrollment, 17 % were not satisfied with the transparency, 19 % were not satisfied with the reliability of weather data and 25 % were not satisfied with weather index as a substitute for yield index insurance. From this exercise, it is clear that weather risk index-based insurance is rated well on data accuracy, transparency and quick claims settlement, which are very attractive to both farmers and the reinsurance market.

Though the WBCIS programme is perceived by states as a good alternative to NAIS, there are some key challenges to be overcome for scaling up of the scheme (Rao, 2011).

1. Scope of WBCIS is limited to parametric weather exigencies like rainfall, temperature, humidity etc. In addition to weather-related impacts, often crops suffer due to hailstorm, floods, pests and diseases, which to a large extent are difficult to cover under the scheme. However, over the years with increasing understanding between weather parameters and effects on crops, indices have been designed which provide cover against pests and diseases by considering weather as a proxy.
2. Product design under WBCIS is challenging as crop yield and weather relationship is not only complex but also influenced by various factors such as cultural practices, date of sowing, soil type and crop variety. It requires focused research by agricultural scientists to fine-tune the weather-yield relationship.
3. The growth of WBCIS demands that every village has a weather station so that basis risk in weather index insurance is minimized. Nevertheless, with consistent increase in coverage under WBCIS the penetration of weather stations is also increasing. The weather stations are now available at about a radius of 15 km for locations where they were available at more than 30 km earlier. The acceptable radius for insuring rainfall is about 5 km and for other parameters is 10 km. For achieving these levels, nearly 50 000 weather stations are required as against about 5000 stations which are presently available including both public and private stations in the country (Milesi et al., 2011).
4. Calibration of sensors and data at weather station is another challenge as presently weather data providers are using stations of different make and quality. This would require third party accreditation and calibration services to vouch for reliability and accuracy of the data.
5. There is a need to develop location specific and crop specific insurance contracts by making use of local historical weather data.

Recognizing the problems being faced in creating and delivering weather index based insurance products around the world, systems such as Terrestrial Observation and Prediction System (TOPS) have been developed to organize disparate streams of information into a cohesive framework to serve a variety of societal needs (Nemani et al., 2009). The need for data synthesis for producing actionable information is greatest in rural India where nearly 70 % of the population lives and works.

TOPS is a modeling software system designed to produce ecological forecasts. TOPS brings together advances in information technology, weather/climate forecasting, ecosystem

modeling, and satellite remote sensing to enhance management decisions related to floods, droughts, crop condition, human health, forest fires, forest production etc. TOPS provides a suite of ecosystem “nowcasts” (measures of current conditions) and forecasts. These data products include measures of vegetation condition and productivity, snow dynamics, soil moisture, and meteorological conditions and forecasts (Milesi et al., 2011). Another key feature of TOPS is an automated system for ingesting climate observations from local, regional, and global networks of meteorological stations in real-time to produce spatially continuous gridded meteorological fields. This capability allows TOPS to provide continuous estimates of ecosystem conditions for any location in the country, including remote and sparsely instrumented regions.

Information from TOPS can benefit the risk insurance society in a number of ways. By blending data from few weather stations with satellite data available for over 30 years, TOPS creates high-quality information at village level. Similarly the integrated information from TOPS allows one to verify fraudulent claims, in a way acting as third party verification. Using TOPS capabilities for long-term simulations of vulnerabilities, key insights about the potential consequences of climate change in a variety of sectors can be generated and disseminated. The weather stations are not total tamper-proof and their maintenance costs are high. The concept of a “virtual weather station network” based on TOPS platform can produce the daily weather data at a scale of one kilometer grid for the past 10 years which is valuable for agriculture meteorological risk reduction.

4.2 Financial markets play a vital role: Experiences from Japan

Although Japan has made large investments in infrastructure, agriculture, fisheries, and allied sectors, the great Tohoku earthquake in 2011 has revealed that these sectors are still vulnerable to natural hazards. The damage caused by the Tohoku earthquake reaffirms that Japan is potentially one of the countries in the world that holds the highest liability to natural hazards. According to UNU-EHS’s and Munich Re’s (2007) Natural Hazard Risk Index (Table 3) potential disaster losses in Japan’s megacities are significant.

Table 3: Natural Hazard Risk Index for Megacities.

City	Natural Hazard Risk Index	City	Natural Hazard Risk Index
Tokyo/Yokohama	710.0	Hong Kong	41.0
San Francisco	167.0	London	30.0
Los Angeles	100.0	Beijing	15.0
Osaka/Kobe/Kyoto	92.0	Dhaka	7.3
New York	42.0	Mumbai	5.1

Source: UNU-EHS and Munich Re, 2007

Based on statistics issued by the Government of Japan, both direct and indirect social and economic damages caused by Hanshin-Awaji earthquake (also known as the Great Hanshin or the Kobe Earthquake) was approximately 2.6 % of national GDP in 1995 (Kato, 2009). This quake also had surprisingly low insured losses compared to the very high economic losses (see also Fig. 1). The recent Tohoku earthquake has affected wider areas leading to significant economic and financial damage to Japanese economy. It was estimated that the damage could be to the tune of 16.9 trillion Japanese Yen, 1.7 times of Hanshin-Awaji earthquake in 1995 (Cabinet Bureau of Japan, 2011). The earthquake has worsened the nation's fiscal balance.

Having passed depression era in 1990's, the so-called "lost decade", Japan issued deficit-covering government bonds in large proportions (OECD, 2011). Due to Japan's economic situation, which includes fiscal imbalance, it is not easy for the national and prefectural governments to issue bonds for disaster reconstruction, since this could affect fiscal consolidation and fiscal deficit. Hence, the Tohoku disaster damage cannot be covered by the reconstruction bonds issued by the national and prefectural governments and it is essential to consider other financial instruments (OECD, 2011).

Though Japan's individual financial asset is the biggest in the world (1 450 trillion Yen) (Bank of Japan, 2012) consisting of bonds and bank deposits (nearly 80 %), only little contribution comes from risk assets such as equities and mutual funds. This shows a huge potential for the growth of market oriented risk management schemes such as equities and mutual funds, replacing public financing assumes importance in Japan.

National policy environment

In Japan, the risk insurance is mainly represented in the form of earthquake insurance.

Earthquake insurance issued by private insurance companies is designated to financially support lives of earthquake victims and hence is limited to cover residential houses and personal properties. Until Niigata Earthquake in 1964, damages on assets caused by earthquakes in Japan were not covered by fire insurance since the fire insurance schemes in place have regarded the earthquake damages as legally immune to compensate even though fire could have led to secondary disaster in the wake of an earthquake. The Government of Japan has decided to support the earthquake insurance as an exclusive reinsurer since private insurance companies could not fully afford to compensate without government support. As a result, the Government of Japan has established Japan Earthquake Reinsurance Co. Ltd. as a Special Purpose Vehicle through 'The Law Related to Earthquake Insurance, 1966' to give impetus to the earthquake insurance in Japan (Ministry of Internal Affairs and Communications of Japan, 1966). Despite this, the earthquake insurance could not become popular and the major spread of insurance has limited to fire insurance with coverage of 30-50 % in the present value of the asset (with an upper limit of 50 million Yen). Due to the high premium costs and low compensation levels, the earthquake insurance has not been popular until Japan experienced Hanshin Earthquake in 1995. After 1995, the number of earthquake insured has steadily increased up to 23.7 % of entire households in 2010. Such an inadequate spread of earthquake insurance could be a financial burden in the wake of a major earthquake (General Insurance Association of Japan, 2011).

Due to limited demand for risk insurance products and limited volume of Japan's reinsurance market, only very few other forms of risk insurance, other than the government supported earthquake insurance, could be observed in Japan (Financial Centre Futures, 2011). During recent years, big corporations have started using alternative risk transfer products such as captive, finite risk insurance and cat bonds. For these firms, risk hedging using the financial schemes helps getting higher evaluation by credit rating agencies. However, these practices are hardly contributing to risk insurance for the vulnerable citizens.

In early 2008, the Government of Japan has introduced Japanese Sarbanes-Oxley Act (J-SOX) to strengthen corporate internal control (Kato, 2009). The act stresses firms' risk management and ensures risk mitigation against physical and financial damages. Since then, Japanese businesses, from small to large scale, have found encouragement to minimize the disaster risks and realized that the government reinsured earthquake insurance is inadequate

to address range of risks these firms face.

The Government of Japan has begun amending Private Finance Initiative Act (PFI Act) to diverge risks on public infrastructure between public and private sectors (Kato, 2011). J-SOX require companies to disclose various risks that companies face in their financial reporting. With this amendment, private corporations can also involve in large scale public infrastructure projects such as agricultural community sewerage projects with government subsidies. This requires corporations to invest in weather derivatives to deal with unexpected hydro-meteorological extreme events.

Although the Government of Japan has recognized the importance of aggressively promoting the risk financing, the related processes are still in infancy. The current rigid financial law does not allow establishing captive insurance firms in Japan and this need to be addressed at the policy level. The direction of Government of Japan's policy is to emphasize various risk mitigation provisions for both public and private sectors. With this, the application of risk insurance and alternative risk transfer is being increasingly recognized in Japan.

Risk insurance experiences in Japan

Currently, major part of alternative risk transfers in Japanese market is through cat bonds², captive³, finite risk insurance⁴, and weather derivatives⁵ (METI, 2006). These form the greater part of risk transfer strategy for big companies and large associations such as Zenkyoren, the National Mutual Insurance Federation of Agricultural Cooperatives. Zenkyoren in turn will compensate the financial losses faced by its members. After Hanshin-Awaji earthquake in 1995, Oriental Land, which runs Tokyo Disney Land, issued two different cat bonds to cover reconstruction costs.

Big corporate bodies can create Special Purpose Vehicle (SPV) for captive insurance and they can afford to accumulate sufficient funds for finite risk insurance. Small businesses and

² A debt instrument that is usually insurance linked and planned to raise money in case of a catastrophe such as a typhoon or earthquake.

³ A subsidiary that is designed to provide financing to customers by purchasing the parent company's product.

⁴ An insurance contract that shifts the risk of loss from an insured to an insurer during a given years.

⁵ A financial commodity used by companies is designed to hedge against the risk of weather-related losses.

households can purchase risk insurance issued by associations like Zenkyoren. However, these forms of insurance are inadequately covered by reinsurance and hence pose financial threat to the insurer in the wake of a large disaster (Froot, 1999). In addition, it is extremely unlikely for small business to utilize these financial risk transfer mechanisms due to the need for large portfolio volume for these instruments to work effectively.

Munich Re issued cat bond called ‘Muteki’, which covers Zenkyoren’s earthquake risk and transfer to the capital market (Munich Re Group Risk Trading Unit, 2011) (Table 4). The bond is well recognized in the market since it is independent of stock market and practical to put in portfolio. According to Steve Evans (2011a), Muteki was triggered during the Tohoku earthquake and made a loss to the tune of 300 million US\$. However, despite these losses, the investors may not have lost their confidence in Japanese cat bonds (Evans, 2011b). The earthquake also took a toll on the Zenkyoren which faced a reported loss of US\$ 11.2 billion (Evans, 2012a). If the insurer (Zenkyoren) cannot bear the financial damage, small businesses and households insured cannot expect receiving full compensation.

The Midori bonds are designated for the JR East, the largest railway company in Japan since 2007. This five-year bond is expected to cover loss of public transportation services and the infrastructure when a significant earthquake hits within a 70 km radius of Tokyo.

Table 4: Comparison of various local initiatives in risk insurance in Japan

No	Case	Geographical coverage	Hazards covered	Direct benefactor	Payment trigger	Benefits accrued
1	Muteki Ltd (cat bond)	Japan	Earthquake	Zenkyoren	Richter scale	Investors
2	Midori Ltd (cat bond)	Japan	Earthquake	JR East	Richter scale	Investors
3	Typhoon Derivative (Tokio Marine Co.)	Japan	Typhoon	Farmers Union, Hotels, Leisure industry,	Number of typhoon passed	None
4	Warm Winter Derivative (Sompo Japan)	Japan	Climate Change	Farmers Union, Energy retailers, Fashion Industry	Temperature	None
5	Winter	Japan	Climate	Farmers Union,	Temperature,	None

No	Case	Geographical coverage	Hazards covered	Direct benefactor	Payment trigger	Benefits accrued
	Preparation aka Fuyu no Sonae (Aioi Insurance)		Change	Energy retailers, Fashion Industry, Hotels	Rainfall, Snowfall	

Sources: Aioi Nissey Dowa Insurance Co. Ltd., 2011; Sompo Japan Insurance Inc., 2010b; Munich Re Group - Risk Trading Unit, 2011; Tokio Marine and Nichido Fire Insurance Co. Ltd., 2011.

Despite rising reinsurance costs, Kibou, another cat bond, has been issued on behalf of Zenkyoren (Evans, 2012b). According to Swiss Re Global Cat Bond Performance Index, Index Exposure by Peril (shown in Evans, 2011b), the global cat bond market is still dominated by the U.S. hurricane risk bonds and the share of typhoon/earthquake risk related bonds in Japan are on the decline. Since capital markets welcome diversification of investable, there is enough room for cat bonds in Japan.

Initiatives 3 to 5 in Table 4 are examples of weather derivatives in Japan which are emerging as significant financial tool for farmers and small businesses (Yokouchi, 2007). The weather derivative sales are significantly increasing recently (Yamada, 2010; Figure 2) as local small banks and credit unions played intermediate role to sell weather derivative for agriculture and allied sectors (Figure 3). Weather derivatives in Japan are designated for the specific clients since the derivatives are not publicly offered. Therefore, the premium is usually over one million Yen (approximately US\$ 1250 at an exchange rate of 80 JPY per US\$) and this is too expensive for individual and small businesses. However, the local financial institutions (FIs) such as local banks and credit unions with strong local network played a significant role to sell weather derivatives benefiting commission from insurance companies. FIs know the need for weather derivatives and how to access the potential market. These FIs can even accommodate farmers and business owners with a loan for the derivative since FIs have strong local network to sell financial commodities unlike insurance companies.

The strong ties of farmers and business owners with FIs have helped them in getting familiar with the sophisticated financial products such as weather derivatives. As a result, this has emerged as a key model in disseminating alternative risk transfer. The mediation by the local FIs' has stimulated their sales and has drastically reduced the cost of designing the financial instrument. The growing number of weather derivative sales helped to reduce the premium costs (0.3 million Yen, approximately US\$ 3750) and helped in their spread. No significant

impact of financial crisis could be seen on the derivatives market in Japan since people are sensitive enough and aware of weather risks.

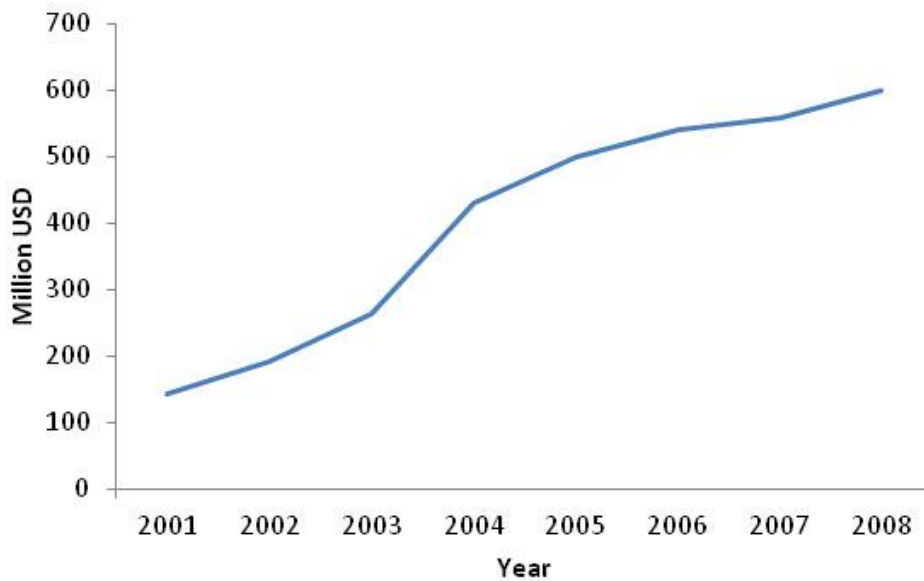


Figure 2 Growing market volume of weather derivatives (million USD) in Japan. *Source:* Compiled by the author, based on Yamada, 2010.

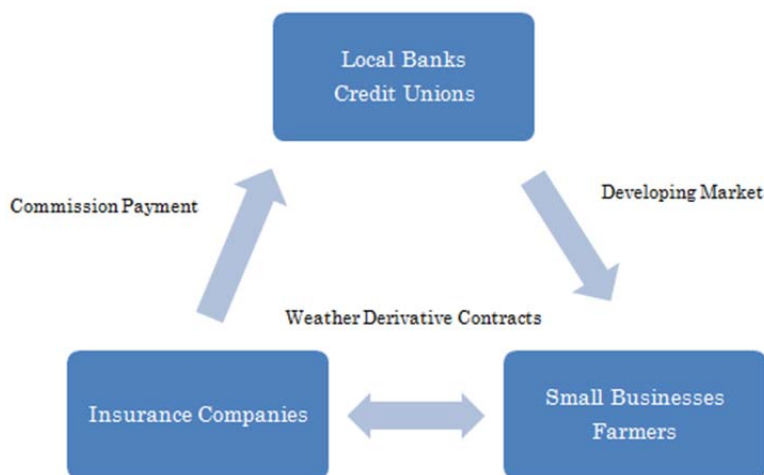


Figure 3 Weather derivative sales scheme using local financial institutions. *Source:* Ono, 2004.

Although the weather derivatives market is growing, their volume in Japan is much smaller than in the U.S. (Bank for International Settlements, 2010). To avoid holding domestic risk insurance within the country, it is necessary to transfer the risk abroad by increasing trade

volume and risk transfer will be accelerated if foreign investors hold more Japan issued derivatives. Weather derivatives in Japan are only negotiated over-the-counter and are not traded on exchanges. This is due to the Commodity Exchange Act (METI, 1950) that allows only trading of 'tangible objects'. Without a provision in the law, the weather derivatives in Japan cannot be traded in domestic and international markets. However, exchanges such as Chicago Mercantile Exchange, London International Financial Futures and Options Exchange (LIFFE), Intercontinental Exchange (ICE) and the Catastrophe Risk Exchange Inc. (CATEX) are listing standardized weather derivatives (Amazaki et al., 2003). Such trading of weather derivatives will have positive impact on price discovery, volume, and market liquidity.

The weather derivatives sold by Japanese insurance companies are only intended for corporate bodies and unions, since selling the financial products to individual can be a violation of Consumer Contract Act in Japan (Itabashi, Iwazawa and Watanabe, 2007). Individuals, mostly farmers, purchase the derivatives through local agricultural associations. Each derivative has different trigger for the payment and hence it is not rare to purchase multiple financial products. The strong demand from businesses and industries affected by weather change has stimulated the insurance companies to develop numbers of weather derivatives, and expansion of the market has reduced the premium prices. With this trend, the insurance companies are now able to provide various weather derivatives from small to big scale.

Lessons for scaling up

It is clear that Japan needs multiple sources to finance disaster risk reduction in the future. As described in the previous section, financial risk transfer in Japan is mostly used by small businesses and big corporations leaving individuals out of the risk insurance market. From the analysis, it can be said that the risk finance market is segmented and the market should be consolidated to adjust needs from various sectors such as households, public, and industry, if risk transfer to be strengthened. The government supported reinsurance is a strong backbone for the earthquake insurance system but alternative risk transfers also need to be encouraged.

One of the reasons why the market cannot respond to the growing need for risk financing is the immaturity of Japan's capital market infrastructure in terms of capability of domestic FIs. It is indicated by the existence of few Japanese reinsurance companies with small gross billings compared to top reinsurers elsewhere. Consequently, most of the funds flow to

Europe, the United States, and other regions such as Bermuda as Japanese market cannot provide needed financial services meeting domestic investors' demand. If Japan and countries in Asia need to utilize abundant funds in Asia for the region's risk reduction, it is necessary to establish sound capital market and reinsurance market supported by domestic agents. By doing so, disaster risk will be shared not only in Japan and the region, but also in the world through flow of funds.

The following points emerge clearly, considering the current fiscal condition and discussion above: a) existing risk mitigation mechanisms such as investments in infrastructure are not sufficient to mitigate disaster risks; b) there is a huge potential for increasing the risk insurance in Japan in terms of insurance from the individual subscribers as against institutional and corporate insurance and in terms of insurance for specific natural hazards such as earthquakes, tsunami and floods; c) the role of financial markets can further be strengthened by linking domestic risk insurance market with that of the regional and international financial markets; d) there is diminishing role of the governments (national or prefectural) in promoting risk insurance in the country, but it is expected to support establishing generic risk finance market in the future; e) consolidating risk insurance and alternative financial risk transfer markets is not only complementary of Japan's current risk mitigation but also provides opportunity to disperse various risks to natural hazards in the region; and f) it is highly desired to establish transparent and openly accessible risk finance market in Japan for farmers, small business owners and investors.

5. Proposals to the UNFCCC for the Future Climate Regime

The future climate regime can facilitate promoting the climate risk insurance in the Asia-Pacific region through providing the additional finances required which is one of the major limitations in promoting disaster risk mitigation (GFDRR, 2009). The mentions to the risk insurance can be found in the negotiated text of the UNFCCC and the Conference of Parties. The Article 4, paragraph 8 of the UNFCCC text refers to the risk insurance as a funding mechanism to meet the needs of the developing countries arising from the adverse effects of climate change (UNFCCC, 1992) 'including actions related to funding, insurance and the transfer of technology, to meet the specific needs and concerns of developing country Parties arising from the adverse effects of climate change and/or the impact' (p.8). The

UNFCCC text also characterizes countries eligible for financing and insurance mechanisms. The Bali Action Plan goes further and explicitly states that the risk insurance mechanisms should be used in promoting adaptation (UNFCCC, 2007).

Various proposals have been submitted by the Parties to the Convention as well as by those outside the Convention for promoting the risk insurance under the Convention (Table 5). The Alliance of Small Island States (AOSIS), the most rigorous promoter of such risk insurance scheme, has proposed for an International Insurance mechanism and Solidarity Funds to address catastrophic risk and collective loss sharing. Cook Islands proposed the International Insurance Scheme where it emphasized the collective burden sharing, subsidy elements to maintain fund as a compensation for unavoidable impacts, and funding risk reduction initiatives (Harmeling, 2008). A Swiss proposal to the UNFCCC on promoting risk insurance includes prevention and insurance pillars with funds coming from global CO₂ levy with greater benefit to low income countries (Government of Switzerland, 2008).

Munich Climate Change Initiative (MCII) made a proposal consisting of two tracks or pillars, one for supporting risk reduction through mitigation activities and the other supporting the insurance (Bals, Burton and Butzengeiger, 2008). The insurance component was divided into two tiers with tier I consisting of climate insurance pool to cover the high level risks in non-Annex I countries and the tier II consisting of public safety nets and insurance systems through public-private partnerships covering medium level risks.

Table 5: Summary of Selected Country/Consortium Proposals on Disaster Risk Insurance Mechanisms at UNFCCC Negotiations

Characteristics	Proposals			
	AOSIS	MCII	Cook Islands	Switzerland
Target group (governments/individuals)	National Governments of SIDS, LDCs and other developing countries	Governments and individuals	National governments of SIDS	Regional authorities, governments, and individuals
Geographical coverage (national/local/regional)	Regional/National	National and regional	National	<ul style="list-style-type: none"> • Regional and sub-regional (insurance pillar); • National (prevention pillar)

Characteristics	Proposals			
	AOSIS	MCII	Cook Islands	Switzerland
Source of funding	<ul style="list-style-type: none"> Convention Adaptation Fund Kyoto Protocol Adaptation Fund (existing) Other bilateral and multilateral sources 	Financial mechanism of the Convention channeled through CIP, CIAF, and CRMF	Internationally-sourced pool of funds (subsidy in establishing establishing/maintaining fund)	<ul style="list-style-type: none"> Global Carbon Tax Insurance pillar funded through MAF
Promotion of re-insurance	Yes, through conventional risk sharing and transfer instruments	Yes, through CIP	No reference to re-insurance	Yes, through public-private partnership
Targets premium prices	No indication for premium prices	No indication for premium prices	No indication for premium prices	Provides funding for premiums
Inclusion of risk mitigation component	Yes, through technical and financial support for risk reduction efforts	Yes, through the prevention pillar	Yes, mechanism funds risk reduction initiatives	Yes, through the prevention pillar
Reference to guidelines for implementation	No reference to guideline	Yes, under the authority and guidance of COP	No reference to guideline	Yes, defines eligible extreme events and insured damage
Reference to awareness	No reference to awareness	No reference to awareness	No reference to awareness	Yes, awareness generation is financed by NCCF
Addressing the risk data gaps	Yes, though improved risk management tools, collection and analysis of data	No reference to addressing data gaps	No reference to addressing data gaps	Yes, through small budget under the insurance pillar
Sustainability issues if any	No reference to sustainability	No reference to sustainability	No reference to sustainability	No reference to sustainability

Notes: **AOSIS**: Alliance of Small Island States; **MCII**: Munich Climate Insurance Initiative; **SIDS**: Small island developing states; **LDC**: Least developed countries; **CIP**: Climate Insurance Pool; **CIAF**: Climate Insurance Assistance Facility; **CRMF**: Chronic Risk Management Facility; **MAF**: Multilateral Adaptation Fund; **NCCF**: National Climate Change Fund.

Sources: AOSIS, 2008; Cook Islands on behalf of AOSIS, 2008; The Munich Climate Insurance Initiative, 2009; Government of Switzerland, 2008.

Recent negotiations have anchored the risk insurance subject in the Paragraph 14 of Decision

1/CP.16 of the Cancun Adaptation Framework (CAF) in Cancun Agreements. Under the Cancun Agreements, a work programme to consider approaches to address the loss and damage associated with climate change impacts in vulnerable developing countries was established by the COP. These discussions have stressed the need for a climate risk insurance facility. The related submissions by Parties display the general convergence among Parties and relevant organizations for risk insurance mechanisms to be included under the work programme (UNFCCC, 2011). However, divergence of views can also be observed in terms of its form: for instance, AOSIS envisages establishment of international risk insurance mechanism under the UNFCCC framework whereas countries such as the United States and EU prefer climate risk insurance facility at national and regional level, taking into account of country differences and respecting country-driven approach. The related discussions in March 2012 in Tokyo have emphasized the need for improved knowledge sharing among various UNFCCC processes; need to standardize damage assessment and reporting, and identifying entry points and facilitating the engagement of the finance sector in disaster risk reduction (UNFCCC, 2012).

6. Messages for the future climate regime

Several lessons and best practices emerge in terms of what should be the essential design elements for promoting risk insurance under the future climate regime.

1) Keep the price of the insurance premium affordable: The price of the insurance premiums is one of the major determinants for enrolling maximum number of insured and hence keeping its price affordable is an important aspect of the overall design of the insurance system. In the case of Japan, the premiums were heavily subsidized (over 50 %) to make the premiums affordable (Tsuji, 1986). Since the amount of residual risks and premium prices are directly correlated, other insurance programmes such as Turkey catastrophe insurance pool have combined promoting the risk mitigation measures such as enforcing seismic resistance codes along with the insurance program. In Philippines, the prices of premiums were able to be kept at affordable level by linking microinsurance with the cooperatives (Munich Re, 2011). However, there is a limit to which the insurance agencies can reduce the insurance premium prices since the premium prices would have to cover capital costs, reinsurance costs and admin costs and profit margins. Any substantial reduction in insurance costs can only be possible by a combination of approaches such as efficient management at the end of the

insurance firms, reducing basis risks through risk mitigation measure such as enforcing structural standards and land use planning regulations, and subsidies by the national governments.

2) Generate public awareness: Apart from the issue of the price of the premium, the lack of awareness among various stakeholders is a major hurdle in spreading the risk insurance. This hurdle was mostly overcome by incorporating the grassroots level awareness generation activities. For instance, such an effort could be seen in agricultural weather index insurance, Thailand; and in various locally implemented insurance programs (e.g. BASIX-ICICI Lambard microinsurance; Turkey catastrophe risk insurance pool). Through insurance agencies closely working with farmer associations, the Japan example provides a good case for increasing public awareness and overcoming other attitudinal barriers.

3) Avoid the moral hazard: One of the major problems with the traditional insurance programs including the crop insurance programs has been the moral hazard i.e. unfair insurance claims leading to higher risk for the insuring agencies (Giné, 2009). This limitation has largely been overcome by the advent of index based insurance systems where payment is triggered by factors that are extraneous to the human control, i.e. the actual incidence of the particular intensity level of the hazard (e.g. 60 % reduction in rainfall). One factor that needs to be taken into consideration, however, is the weather data required for developing such indexes. The India case provides a good example of overcoming this barrier.

4) Link with reinsurers and investment in financial markets: Support by reinsurers is one of the important considerations for putting in place robust risk insurance systems as reinsurers provide needed financial backup to the insurers. In addition, insurance facilities created may also consider investing, in part or total, in international financial markets by the support of the international reinsurance facilities. Such example is epitomized by current agricultural weather index program in Thailand (Sompo Japan Insurance Inc., 2010a) and the Caribbean catastrophe risk insurance facility (Ghesquiere, Mahul, Marc and Ross, 2007). The structure of current financial markets is only favorable for large corporations and businesses and does not seem to benefit direct risk reduction for the individuals. Efforts should be made so as to ensure that the financial markets provide greater risk reduction benefits to individuals by giving right price signals encouraging greater participation in risk insurance.

5) Enhance availability of risk information: Availability of reliable rainfall data and associated crop losses is a prerequisite for designing a robust index based insurance facility. Similarly, comprehensive information on physical characteristics of the infrastructure such as buildings, warehouses etc., to be insured is needed for estimating the risk from hazards such as floods, droughts, and earthquakes. Such robust information infrastructure is still not readily available in the large-scale in most of the countries, including the Asia-Pacific region, hindering expansion of the risk insurance facilities.

For example, the lack of widespread historical data to assess relationship between weather parameters and crop losses has limited the implementation of risk insurance facility to the area where historical weather information is available in Thailand (Sompo Japan Insurance Inc., 2010a). Risk insurance facilities have overcome this limitation by investing the resources to collect and analyse the available information, employing simulation modelling, interpolation and extrapolation techniques as well as by increasing the risk margin while calculating the price of the premium (United Nations, 2007; O'Connor, 2005). Nevertheless, in all the cases, the availability of risk information determined the feasibility and success of an insurance facility.

Comparing these experiences with the issues identified in the beginning of this section, the insurance initiatives did not translate in terms of scaling up and sustainability of these initiatives which are areas where the future climate regime could play an important role.

7. Conclusions and Way Forward

This chapter has identified existing limitations in promoting risk insurance by drawing lessons from within and outside of the Asia-Pacific region and looking into how the future climate regime could help overcome these limitations.

Numerous risk insurance experiences show that risk spreading is a way forward for dealing with a variety of climate and non-climate related risks. However, feasibility and sustainability of implementing an insurance facility at global, regional, national, and local level could face several barriers, as identified in this chapter, which include limited knowledge among stakeholders about the benefits of risk insurance systems, limited expertise to design and implement insurance products, challenges in keeping the premium prices sustainable, lack of good quality data on risks and historical losses and limited presence of reinsurers. Addressing

these limitations is essential in enhancing readiness to accept insurance as a risk reduction tool.

While divergent positions are observed between Annex I and non-Annex I parties on the fundamental need to support insurance mechanism, it is crucial for parties to consider and assess the opportunities that insurance mechanisms provide in reducing risks at different levels in line with the role of the UNFCCC as a catalyst to promote collective actions. It is important for the Annex I parties to recognize the fact that any risk reduction promoted in Non-Annex I countries would benefit the Annex I countries as well due to the role these countries are playing in terms of production of goods and services.

To adapt to the future climate, it should be considered to adopt a convergence approach consisting of the lessons drawn from regional models such as CCRIF as well as from local models, e.g. numerous microinsurance schemes which have proven to be suitable especially for developing countries. In this regard, further assessment is needed to identify the best mix or combination of such tools for each region concerned, including Asia-Pacific. The proposals to the Convention should aim at promoting public awareness on risk insurance, putting in place robust and transparent systems to collect, analyze and disclose risk information, providing for continuous evaluation of the performance of the risk insurance systems, encouraging greater private sector participation, and most importantly, helping to keep the premium prices at affordable levels. The latter objective could be achieved by a combination of approaches, such as targeted subsidies or enforcing structural and land-use planning regulations. In addition, the proposals should make clear how the regional and local insurance mechanisms are to be governed and sustained while improving the existing risk governance systems at the national level. The ultimate metric for the real impact of these proposals should be in terms scaling up of insurance leading to substantial risk reduction on the ground.

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References

- ABOUSLEIMAN, I., ZELENKO, I. AND MAHUL. O., 2011. *Mexico MultiCat Bond - Transferring Catastrophe Risk to the Capital Markets*. Washington D.C.: Global Facility for Disaster Reduction and Recovery, The World Bank.
- AIOI NISSEY DOWA INSURANCE CO. LTD., 2011. *Aioi Nissey Dowa Insurance Co. Ltd.*. [online] Available at: <<http://www.aioinissaydowa.co.jp/>> [Accessed 21 November 2011].
- AMAZAKI, Y., OKAMOTO, H., SHIIHARA, K., NIIMURA, N. AND HIROSE, N., 2003. *Weather Derivatives*. Tokyo, Japan: Tokyo Denki University Press.
- AOSIS, 2008. *Multi-Window Mechanism to Address Loss and Damage from Climate Change Impacts: Submission to the AWG-LCA*. [pdf] Alliance of Small Island States, UN. Available at: <<http://unfccc.int/resource/docs/2008/awglca4/eng/misc05a02p01.pdf>> [Accessed 12 November 2010].
- ARNOLD, M., 2008. *The role of risk transfer and insurance in disaster risk reduction and climate change adaptation*. Stockholm: Commission on Climate Change and Development.
- BALS, C., BURTON, I., BUTZENGEIGER, S. ET AL., 2008. *Insurance-related options for adaptation to climate change*. [pdf] Bonn: The Munich Climate Insurance Initiative. Available at: <<http://germanwatch.org/rio/c11insur.pdf>> [Accessed 12 November 2010].
- BANK FOR INTERNATIONAL SETTLEMENTS, 2010. *Triennial Central Bank Survey - Report on global foreign exchange market activity in 2010*. [pdf] Available at: <<http://www.bis.org/publ/rpfx10t.htm>> [Accessed 12 December 2011].
- BANK OF JAPAN, 2012. *Flow of Funds - Overview of Japan, US, and the Euro area*. [pdf] Available at: <<http://www.boj.or.jp/en/statistics/sj/sjhiq.pdf>> [Accessed 15 April 2012].

BARNETT, B.J. AND MAHUL, O., 2007. Weather Index Insurance for Agriculture and Rural Areas in Lower Income Countries. *American Journal of Agricultural Economics*, 89 (5), pp.1241-1247.

CABINET BUREAU OF JAPAN, 2011. *Estimate of damage by Northeast Japan Earthquake*. [pdf] Available at: <<http://www.bousai.go.jp/oshirase/h23/110624-1kisyu.pdf>> [Accessed 28 November 2011].

Commodity Exchange Act 1950. (Act No. 239 of August 5, 1950), Tokyo: METI. Available at: <<http://www.meti.go.jp/policy/commerce/b00/pdf/b0000008.pdf>> [Accessed 22 May 2012].

COOK ISLANDS ON BEHALF OF AOSIS, 2008. *Advancing adaptation through finance and technology, including National Adaptation Programmes of Action - Views of AOSIS*. Presentation material at the Workshop on advancing adaptation through finance and technology, including National Adaptation Programmes of Action. [pdf] Available at: <http://unfccc.int/files/adaptation/application/pdf/cookislands_awgcla2_adaptation_workshop.pdf> [Accessed 12 November 2010].

CRED (Centre for Research on the Epidemiology of Disasters), 2010. *Emergency Disasters Data Base, 2010*. [online] OFDA/CRED International Disaster Database, Data Version 06.06. Brussels: Université Catholique de Louvain. Available at: <www.em-dat.net> [Accessed 15 December 2010].

CRED, 2012. *EM-DAT Database, 2012*. [online] OFDA/CRED International Disaster Database, Data Version 12.07. Brussels: Université Catholique de Louvain. Available at: <www.emdat.be> [Accessed 14 December 2011].

DANDEKAR, V.M., 1976. Crop Insurance in India. *Economic and Political Weekly*, 11 (26), pp.A61–A80.

EVANS, STEVE, 2011a. Muteki Ltd. catastrophe bond triggered by Japan earthquake confirmed as total loss. *Artemis.bm – The Alternative Risk Transfer Portal*, [blog] 7 May. Available at: <<http://www.artemis.bm/blog/2011/05/07/muteki-ltd-catastrophe-bond-triggered-by-japan-earthquake-confirmed-as-total-loss/>> [Accessed 22 May 2012].

EVANS, STEVE, 2011b. Catastrophe bond market still largely dominated by U.S. hurricane risk. *Artemis.bm – The Alternative Risk Transfer Portal*, [blog] 29 December. Available at: <<http://www.artemis.bm/blog/2011/12/29/catastrophe-bond-market-still-largely-domi>

nated-by-u-s-hurricane-risk/> [Accessed 18 May 2012].

EVANS, STEVE, 2012a. Zenkyoren loss creep makes Muteki loss seem small by comparison. *Artemis.bm – The Alternative Risk Transfer Portal*, [blog] 6 January. Available at: <<http://www.artemis.bm/blog/2012/01/06/zenkyoren-loss-creep-makes-muteki-loss-seem-small-by-comparison/>> [Accessed 18 May 2012].

EVANS, STEVE, 2012b. Kibou Ltd. catastrophe bond from Zenkyoren doubles in size. *Artemis.bm – The Alternative Risk Transfer Portal*, [blog] 7 February. Available at: <<http://www.artemis.bm/blog/2012/02/07/kibou-ltd-catastrophe-bond-from-zenkyoren-doubles-in-size/>> [Accessed 22 May 2012].

FROOT, K.A., 2001. The Market for Catastrophe Risk: A Clinical Examination. *Journal of Financial Economics*, 60, pp.529-571.

GENERAL INSURANCE ASSOCIATION OF JAPAN, 2011. *Numbers of earthquake insurance consumers*. [pdf] Available at: <http://www.sonpo.or.jp/useful/insurance/jishin/pdf/reference/jishin_suii.pdf> [Accessed 12 December 2011].

GFDRR, 2009. *Disaster risk management programs for priority countries*. Geneva, Washington D.C.: United Nations International Strategy for Disaster Reduction (ISDR), The World Bank.

GHEQUIERE, F., MAHUL, O., FORNI, M. AND GARTLEY, R., 2006. *Caribbean Catastrophe Risk Insurance Facility: A solution to the short-term liquidity needs of small island states in the aftermath of natural disasters*. IAT03-13/3, Washington, D.C.: The World Bank.

GINÉ, X., TOWNSEND, R. AND VICKERY, J., 2007. Statistical Analysis of Rainfall Insurance Payouts in Southern India. *American Journal of Agricultural Economics*, 89 (5), pp.1248-1254.

GINÉ, X., 2009. Innovations in insuring the poor: Experience with weather index-based insurance in India and Malawi. In: R. Vargas Hill and M. Torero, 2009. *Innovations in Insuring the Poor*. Washington D.C.: International Food Policy Research Institute, pp.17-18.

GLOBAL AGRISK, 2010. *State of Knowledge Report – Data Requirements for the Design of Weather Index Insurance*. [pdf] Lexington, US: Global AgRisk, Inc.. Available at: <http://www.globalagrisk.com/Pubs/2010_GlobalAgRisk_State_of_Knowledge_Data_sept.pdf> [Accessed 15 November 2011].

- GOVERNMENT OF INDIA, 2010. *Report on Impact Evaluation of Pilot Weather Based Crop Insurance Scheme (WBCIS)*. New Delhi, India: Ministry of Agriculture, Government of India.
- GOVERNMENT OF SWITZERLAND, 2008. *Funding Scheme for Bali Action Plan: A Swiss Proposal for global solidarity in financing adaptation*. [pdf] Available at: <http://unfccc.int/files/kyoto_protocol/application/pdf/switzerlandfinancebap091008.pdf> [Accessed 12 November 2010].
- HARMEILING, S., 2008. *Adaptation under the UNFCCC – the road from Bonn to Poznan 2008*. [pdf] Briefing paper, Bonn: Germanwatch. Available at: <<http://www.germanwatch.org/klima/bonnadapt08e.pdf>> [Accessed 12 November 2010].
- HELLMUTH, M.E., OSGOOD, D.E., HESS, U., MOORHEAD, A. AND BHOJWANI, H. eds., 2009. *Index insurance and climate risk: Prospects for development and disaster management*. Climate and Society No. 2. Columbia University, New York, USA: International Research Institute for Climate and Society (IRI).
- IZUMI, T., YOKOZAWA, M., HAYASHI, Y. AND KIMURA, F., 2008. Climate Change Impact on Rice Insurance Payouts in Japan. *Journal of Applied Meteorology and Climatology*, 47 (9), pp.2265-2278.
- IPCC, 2007. Summary for Policymakers. In: Solomon, S., Qin, D., Manning, M., Chen, Z., Marquis, M., Averyt, K.B., Tignor, M. and Miller, H.L., eds. 2007. *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, New York: Cambridge University Press.
- ITABASHI, C., IWAZAWA, Y. AND WATANABE, Y., 2007. *Recommendation of Weather Derivatives*. Working Paper 12. Aizu, Japan: University of Aizu.
- KANZ, M. AND ROBERT, C., 2011. What does debt relief do for development? Evidence from a large scale policy experiment. In: Indira Gandhi Institute of Development Research, *The Emerging Markets Finance Conference*. Bombay, India 20-21 December 2011, Bombay, India: Indira Gandhi Institute of Development Research.
- KATO, N., 2009. Reports of practitioners: Post-disaster recovery and risk finance. *Studies in disaster recovery and revitalization*, 1 (1), pp.143-166.
- KATO, N., 2011. *Utilization of Private Fund for Disaster Finance*. [pdf] Nishinomiya, Japan:

Kwansei Gakuin University. Available at:

<http://www.fukkou.net/e-japan/contribution/files/contribution_03.pdf> [Accessed 21 Novemebr 2011].

KUNREUTHER, H. AND MICHEL-KERJAN, E., 2007. *Climate Change, Insurability of Large-Scale Disasters and the Emerging Liability Challenge*. Cambridge, USA: National Bureau of Economic Research.

MANUAMORN, O.P., 2007. *Scaling up microinsurance: The case of weather insurance for smallholders in India*. Agriculture and Rural Development Discussion Paper 36, Washington D.C.: The World Bank.

MCII (Munich Climate Insurance Initiative), 2009. *Climate Risk Management Mechanism including Insurance, in the context of Adaptation to Climate Change*. [pdf] Available at:
<<http://unfccc.int/resource/docs/2009/smsn/ngo/132.pdf>> [Accessed 12 November 2010].

MECHLER, R., 2004. *Natural disaster risk management and financing disaster losses in developing countries*. Karlsruhe, Germany: Verlag Versicherungswirtschaft.

METI, 2006. *Report of Risk Finance Study Group: Toward the Prevalence of Risk Finance*. [pdf] Tokyo: Ministry of Economy, Trade, and Industry of Japan, Government of Japan. Available at:
<<http://www.meti.go.jp/english/report/downloadfiles/0607riskfinancereport.pdf>> [Accessed 12 December 2011].

MILESI, C., GEETHALAKSHMI, V., RAO, G.S. et al., 2011. Producing Valid Meteorological Data Using Terrestrial Observation and Prediction System (TOPS) and Ecological Forecasting. In: ASCI (Administrative Staff College of India), *Weather Insurance: Addressing the Risk Mitigation Needs of Weather Sensitive Industries in India*. Hyderabad, India 28 – 29 January 2011. *Journal of Management*, 41 (1), pp.102-107.

MINISTRY OF INTERNAL AFFAIRS AND COMMUNICATIONS OF JAPAN, 1966. Law related to Earthquake insurance. [online] Available at:
<<http://law.e-gov.go.jp/htmldata/S41/S41HO073.html>> [Accessed 12 December 2011].

MUNICH RE, 2010. *Topics Geo - Natural catastrophes 2009: Analyses, assessments and positions*. Munich, Germany: Munich Re.

- MUNICH RE, 2011. Protecting cooperatives and their low-income members in the Philippines against extreme weather events through microinsurance. [press release] 11 October 2011, Available at:
 <http://www.munichre.com/en/media_relations/press_releases/2010/2010_10_11_press_release.aspx> [Accessed 13 June 2012].
- MUNICH RE GROUP - RISK TRADING UNIT, 2011. *Muteki: Japanese Earthquake Protection for Zenkyoren*. [pdf] Available at:
 <http://www.munichre.co.jp/public/PDF/Topics_MutekiLtdAsia1.pdf> [Accessed 12 December 2011].
- NEMANI, R., HASHIMOTO, H., VOTAVA, P. et al., 2009. Monitoring and forecasting ecosystem dynamics using the Terrestrial Observation and Prediction System (TOPS). *Remote Sensing of Environment*, 113 (7), pp.1497-1509.
- NJEGOMIR, V. AND MAKSIMOVIC, R., 2009. Risk transfer solutions for the insurance industry. *Economic Annals*, 54 (180), pp.57-90.
- O'CONNOR, P.M., 2005. Recent trends in the catastrophic risk insurance / Reinsurance Market. OECD Publishing, doi: 10.1787/9789264009950-20-en.
- O'DONNELL, O., VAN DOORSLAER, E., RANNAN-ELIYA, R.P. et al., 2008. Who pays for health care in Asia?. *Journal of Health Economics*, 27 (2), pp.460-475.
- OECD, 2011. *Economic Outlook Statistic Database*. [online] Available at:
 <http://www.oecd.org/document/0,3746,en_2649_201185_46462759_1_1_1_1,00.html> [Accessed 12 December 2011].
- ONO, M., 2004. *Weather Derivatives*. Japan: Sigmabase Capital Publishing.
- RAO, K.N., 2011. Crop Insurance and Mitigation Tool. In: Institute of Development Studies, *National Seminar on Agriculture at Crossroads: Issues and Challenges*. Jaipur, India 28 – 29 September 2011. Jaipur, India: Institute for Development Studies.
- SIAMWALLA, A. AND VALDES, A., 1986. Should crop insurance be subsidized? In: P. Hazell, C. Pomareda and A. Valdez, eds. 1986. *Crop insurance for agricultural development: Issues and experience*. Baltimore: John Hopkins University Press.
- SINGH, S. AND JOGI, R.L., 2011. *Managing Risk for Indian Farmers: Is Weather Insurance Workable?* IDSJ Working Paper 157, Jaipur, India: Institute of Development Studies.

SOMPO JAPAN INSURANCE INC., 2010a. *Weather Index Insurance Launched for Drought Risk in Northeast Thailand: Provision of adaptation measure for climate change utilizing insurance*. Tokyo, Japan: Sompo Japan Insurance Inc..

SOMPO JAPAN INSURANCE INC., 2010b. *Weather Derivative*. [online] Available at: <http://www.sompo-japan.co.jp/hinsurance/art/weather_derivative/> [Accessed 21 November 2011].

SWISS RE, 2010a. *Weathering climate change: Insurance solutions for more resilient communities*. Zurich, Switzerland: Swiss Reinsurance Company Ltd..

SWISS RE, 2010b. *World Insurance in 2009: Premiums dipped, but industry capital improved*. Zurich, Switzerland: Swiss Reinsurance Company Ltd..

TOKIO MARINE AND NICHIDO FIRE INSURANCE CO., LTD., 2011. *Weather Derivatives*. [online] Available at: <<http://www.tokiomarine-nichido.co.jp/hojin/risk/weather/index.html>> [Accessed 21 November 2011].

TSUJI, H., 1986. An economic analysis of rice insurance in Japan. In: P. Hazell, C. Pomareda and A. Valdez, eds. 1986. *Crop insurance for agricultural development: Issues and experience*. Baltimore: John Hopkins University Press.

UNFCCC, 2007. *Bali Action Plan*. [pdf] Bali, Indonesia: United Nations Framework Convention on Climate Change. Available at: <http://unfccc.int/files/meetings/cop_13/application/pdf/cp_bali_action.pdf> [Accessed 10 October 2010].

UNFCCC, 2011. Views and information on elements to be included in the work programme on loss and damage. [pdf] In: UNFCCC, *Subsidiary Body for Implementation: Thirty-fourth session*. Bonn, Germany 6 – 16 June 2011. Bonn: UNFCCC. Available at: <<http://unfccc.int/resource/docs/2011/sbi/eng/misc01.pdf>> [Accessed 14 June 2012].

UNFCCC, 2012. Report on the expert meeting on assessing the risk of loss and damage associated with the adverse effects of climate change. [pdf] In: UNFCCC, *Subsidiary Body for Implementation: Thirty-sixth session*. Bonn, Germany 14 – 25 May 2012. Bonn: UNFCCC. Available at: <<http://unfccc.int/resource/docs/2012/sbi/eng/inf03.pdf>> [Accessed 14 June 2012].

UNITED NATIONS, 1992. *United Nations Framework Convention on Climate Change*. [pdf] Available at: <<http://unfccc.int/resource/docs/convkp/conveng.pdf>> [Accessed 28

October 2010]

UNITED NATIONS, 2007. Developing Index-Based Insurance for Agriculture in Developing Countries. *Sustainable Development Innovation Briefs*, 2. New York: United Nations.

UNU-EHS/MUNICH RE, 2007. *Social Vulnerability: Summer Academy 2007 - Megacities as Hotspots of Risk*. [pdf] Available at:
<<http://www.munichre-foundation.org/NR/rdonlyres/5FC116A6-B33F-4370-A047-71AE170339B3/0/PosterLoewNaturalHazardRiskIndex.pdf>> [Accessed 12 December 2011].

VATSA, S.K., 2004. Risk, vulnerability, and asset-based approach to disaster risk management. *International Journal of Sociology and Social Policy*, 24 (10/11), pp.1-48.

YAMADA, R., 2010. *Risk Finance 2: Role of Reinsurance Market*, 'Risuku fainansu 2 [Saihoken Shijo no Yakuwari]'. [Online via internal VLE], Keio University Faculty of Commerce. Available at: <<http://www.fbc.keio.ac.jp/~tyabu/risk4.pdf>> [Accessed 12 December 2011].

YAZICI, S., 2005. The Turkish Catastrophe Insurance Pool (TCIP) and Compulsory Earthquake Insurance Scheme. In: OECD, 2005. *Catastrophic Risks and Insurance*. Paris: OECD Publishing, doi: 10.1787/9789264009950-20-en.

YEANDLE, M., 2011. *The Global Financial Centres Index 10*. [pdf] Available at:
<<http://www.zyen.com/PDF/GFCI%2010.pdf>> [Accessed 12 December 2011].

YOKOUCHI, A., 2007. *Introduction of Weather Risk Management Technology in Farm Management*. Tokyo, Japan: Agricultural Information Research, Japan Weather Association.

YUCEMEN, M.S., 2008. Turkish catastrophe risk insurance pool. [pdf] In: Organization for Economic Co-operation and Development, *International Conference on Financial Education*, Washington D.C., USA 7 - 8 May 2008. Washington D.C., USA: Organization for Economic Co-operation and Development. Available at:
<www.oecd.org/dataoecd/16/40/40607615.pdf> [Accessed 21 November 2011].