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Discussion paper
Microinsurance aspects in agriculture

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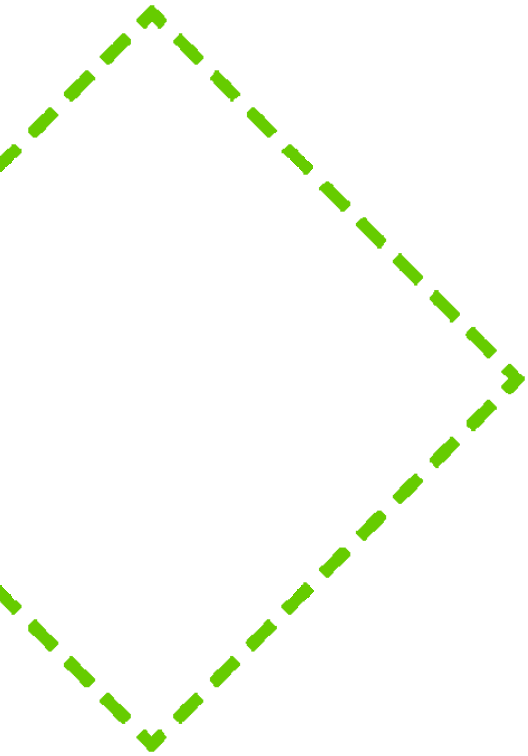

Microinsurance aspects in agriculture

Agricultural **micro**insurance in the context of this discussion paper involves the broad question of how low-income farmers close to or below the poverty level can be indemnified for agricultural losses due to severe weather conditions – regardless of the level of the insured (micro: individual; meso: community, farmer association, etc.; macro: national institution, government). In other words, it should be differentiated from the term "microinsurance" used purely to describe the level of the insured (individual).

This paper is a joint effort between GTZ (Thomas Levin) and the Munich Re Foundation (Dirk Reinhard) to provide a short overview of the current discussions about agricultural insurance in developing countries. It is based on literature research and analysis of more than 70 publications as well as on interviews with reinsurance experts from Munich Re, a global reinsurance company. This discussion paper is not intended to be an exhaustive compendium. However, it can serve as a basis for more detailed research and for triggering further discussion on the way forward for the CGAP Sub Group on Microinsurance in Agriculture. CGAP, the Consultative Group to Assist the Poor, is a consortium of 33 public and private development agencies working together to expand access to financial services for the poor, referred to as microfinance.

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1 Introduction

Low-income households are much more vulnerable to risks and economic shocks than households with risk management options such as savings and access to credit. This especially applies to poor households in developing countries. Microinsurance as one of the strategies of coping with risk has gained more and more importance for these households in recent years.

While people prioritise risk differently from country to country, low-income households consistently identify income security as their greatest concern. Ranked first, insurance against the loss of a household income earner is of greatest importance. Sickness of a family member, especially of the income earner, is second on the list, as low income households mostly depend on their daily income. Ranked third is insurance against income insecurity due to external circumstances. With agriculture being the predominant livelihood of the rural population in developing countries, farmers and their families are exposed to a wider range of perils (see 7.1 Annex I: Perils in agriculture) than people working in other sectors. External shocks such as droughts, hail, heavy rainfall or plant diseases leading to high agricultural losses pose a substantial risk to the livelihoods of these families. They can easily knock households below the minimum asset threshold and keep them in the poverty trap. The wide range of risks in agriculture requires a comprehensive risk management strategy including not only insurance solutions but also risk prevention measures such as crop diversification and asset accumulation (e.g. enhanced distribution and storage systems)[1] which additionally contribute to increased production. Other measures such as governmental disaster relief, precautionary savings or commodity futures and insurance systems supplement the risk management portfolio in agriculture.[2]

Microinsurance demand priorities[1]

1) Life insurance
2) Health insurance
3) Agricultural insurance

It is therefore very important to assess the farmer's risks and the appropriate coping strategies and instruments. Especially risks resulting in small losses, with a high predictability of occurring or high frequency of occurrence, require other strategies such as savings or emergency loans rather than insurance solutions. Only exceptional risks leading to high losses are considered to be insurable. Thus, agricultural insurance is likely to complement, rather than displace, existing ways of coping with risk.

Interestingly, insurance against agricultural risks is not new at all: it was, in fact, more widespread in Latin America and other developing regions of the world during the 1960s and 1970s. But although demand for microinsurance solutions for small farmers in developing countries is great, the supply side faces several constraints and challenges which prevent the private sector from becoming involved in these solutions on the large scale. Being difficult to design and expensive in terms of administration and claims settlement, most of the comprehensive, multi-peril insurance covers encountered financial difficulties and were either scaled back or

[1] CGAP, International Labour Office ILO and Munich Re Foundation: *Protecting the poor – A microinsurance compendium*, 2006 (table 2, page 27).
[2] Skees, Jerry: Presentation on *Innovations in Risk Management: Index-Based Insurance*, USAID.

completely stopped (see also table 1, page 10).[3] Models discussed so far either require unaffordable premiums or focus on the national (macro-) level causing difficulties in measuring the benefits on the ground.[4]

New developments in the agricultural insurance arena with the introduction of index-based insurance products, risk layering and pooling strategies have recently triggered new initiatives and pilot projects. The case studies presented in this discussion paper try to give an impression of how agricultural (micro)insurance can be modelled in order to serve low-income households. As they have all been introduced recently, their sustainability and financial viability still have to be proven, but first successful and promising steps have been made since their inception.

Who are the poor?

Clear definitions of microinsurance target groups are needed before the relevant people can be identified properly and targeted with products responding to their needs. The lack of target group definitions is a common problem in microinsurance in general, but in the agriculture sector in particular.
"Who are the poor?", "What are low-income households?" and "How are small farmers defined?" are questions that have to be answered to adequately address the needs of microinsurance target groups.
Furthermore, this definition will have to factor in economic, social and cultural characteristics of regions and countries, as well as the structure of the agricultural industry.

What is still missing in the agricultural insurance sector in developing countries is a clear definition of the target group of small and poor farmers. International definitions of a "poor" person (earning less than US$ 1 a day) concentrate solely on material factors without considering the differences in living conditions and external circumstances between the rural and urban population (existence of a social safety net, free access to agricultural products). In regard to agriculture, important other factors such as land tenure and size of acreage determine the status of a farmer. Further research is required to explore the determining factors of poverty among farmers. In this process, it is not necessary to define worldwide thresholds, but to compile all the relevant factors so that every country can consider and establish its own definition of poor farmers.

[3] Inter-American Development Bank; Wenner, Mark: *Agricultural Insurance Revisited: New Developments and Perspectives in Latin America and the Caribbean*, Washington 2005.
[4] CGAP, International Labour Office ILO and Munich Re Foundation: IntoAction edition 1, *Making insurance work for the poor*, Report Summary Microinsurance Conference, October 2005.

2 Types of agricultural insurance

Agricultural insurance has various facets. Depending on the kind of farming activity (herding, crop growing), the kind of animals and crops, and the kind of perils they are exposed to, different insurance covers are applicable and appropriate.

2.1 Animal insurance

2.1.1 Livestock insurance (single animal and herd)

Livestock insurance usually covers losses resulting from death, diseases and accidental injuries. As single animal policies are very expensive to administer, herd insurance is the most common livestock insurance cover in developing countries. In some cases, diseases are covered through governmental programmes.

2.1.2 Bloodstock insurance

Bloodstock insurance covers losses resulting from death or permanent disability of individual animals of high value (e.g. pleasure horses or bloodstock) caused by disease or accident.

2.1.3 Aquaculture insurance

Aquaculture comprises the breeding and raising of aquatic animals in inland ponds or coastal waters. It usually covers losses resulting from death or loss of fish stock due to meteorological events, diseases, pollution, algae blooms and escape from damaged installations.

2.2 Crop insurance

2.2.1 Direct (adjustable) loss insurance (hail and named peril)

Direct loss insurance comprises three different covers:
Generally, the expected yield is insured per hectare as a fixed sum insured, i.e. the sum of the production cost and the expected profit. Thus, the insurance covers financial losses due to insufficient crops and fluctuating market prices. Perils and losses are adjusted individually by assessing the damage to crops on the respective fields in the case of a loss.
A modification of this kind of scheme includes an adjustable sum insured. It involves crops with several harvests per year (e.g. tomatoes), with the insurance cover being adjusted after each harvest.
A special insurance scheme under this category is quality guarantee. It covers losses resulting from damage (e.g. from hail) to fruits and vegetables leading to a product quality below commercial standards established by the reference markets.

2.2.2 Index-based insurance

Index-based insurance does not cover losses on an individual loss-adjustment basis, but according to whether they reach certain predetermined thresholds of an index highly correlated with the particular crop yield. Index-based insurance, a relatively new product in developing countries, is explained in detail in section 4.1. Index-based insurances can be distinguished according

to the different kind of triggers they use: meteorological triggers, area yield triggers and vegetation indexes.

2.2.3 Yield-based insurance

Actual Production History (APH) (often simply called “multi-peril crop insurance” [MPCI]) provides protection against a loss in yield due to natural causes. For most crops, this includes drought, excess moisture, cold and frost, wind and flood. The insurance guarantees a yield based on the individual producer's actual production history. If actual production is less than the yield guarantee, the insured will be paid indemnity.

2.2.4 Revenue coverage

Revenue coverage guarantees farmers a certain level of income regardless of the actual yield they generate with their crops. Most of the time, revenue coverage includes both price (fluctuation in market prices) and yield risks, where the yield reference can either be the regional average yield or individual historical yields.

2.2.5 Weather derivates

Weather derivates are quite similar to index-based insurances, as they also become payable when predefined thresholds are exceeded or not reached. But while index-based insurances are primarily designed to cover agricultural risks of farmers in a specific risk-prone area in countries where markets have not been developed extensively (mostly in developing countries), weather derivates are financial instruments traded in markets of highly developed countries where anyone interested in hedging weather risks or in betting on weather conditions can buy a weather derivate.

2.3 Greenhouse insurance

Greenhouse insurance is a special kind of insurance, combining coverage for losses in yields and losses caused by material damage to structure, glass and equipment as a result of fire, windstorm, hail, frost, flooding, weight of snow or equipment failure.

2.4 Forestry insurance

Similar to greenhouse insurance, forestry insurance is a special scheme covering standing timber and plantations against fire and windstorm. Extended covers are becoming increasingly popular and may include flood, hail, weight of snow, insect infestation and damage caused by domestic and wild animals.

The case studies presented in Annex 7.2 mostly concentrate on index-based insurance products recently introduced in developing countries. Among the existing agricultural insurance schemes in developing countries, the case-study examples chosen for this discussion paper provide an insight into innovative (Mongolia), comprehensive (Mexico) and verifiably sustainable (India) approaches offering lessons learned in the design of agricultural insurance schemes. Two case studies (Mongolia, India) describe agricultural insurance products on a household level, while the third (Mexico) explains the set-up of the entire agricultural insurance sector, including a national insurance fund for poor farmers.

3 Problems of traditional agricultural insurance

The reasons for the difficulties in modelling agricultural insurance schemes for low-income households are manifold. Agricultural microinsurance is thus not only affected by common problems of microinsurance (3.1), but also by problems very specific to the agriculture sector (3.2).

3.1 Common problems in microinsurance

Like many other forms of insurance, traditional agricultural insurance suffers from problems arising from asymmetric information, which means that insurers have different (mostly less) knowledge about the risks facing the insured than the insured themselves. The asymmetry of information causes adverse selection and moral hazard problems.

3.1.1 Adverse selection

Adverse selection in insurance markets means that only high-risk customers of the intended target group purchase the insurance cover. This leads to a higher loss ratio of the actual risk portfolio in comparison with the expected risk portfolio on which the premium rate was calculated. Adverse selection also refers to the situation in which insurers find it impossible or very expensive to distinguish between high-risk and low-risk insurance applicants. This results in undercharging high-risk customers and overcharging low-risk customers for identical contracts, as insurers price insurance contracts at the average premium for all individuals. Over time, the low-risk clients drop out of the market. In both cases, the insurance company is left with a pool of very high-risk clients with higher than expected indemnities, which negatively affects the insurer's profitability.[5]

3.1.2 Moral hazard

Moral hazard refers to the situation where the granting of an insurance contract can lead clients to reduce their use of good husbandry practices or completely alter their production practices, resulting in higher loss claims. For example, assured compensation for flood or hurricane damage to homes can lead to the building of more houses in flood and hurricane prone areas than prudent investors would otherwise build. Similarly, assured compensation for crop losses in drought-prone areas may encourage farmers to grow more of the compensated crops even if they are more vulnerable to drought than alternative crops or land uses.[6]

These two problems affect all insurance markets, but are worse in the agriculture sector, where obtaining information on a client's risk exposure and assessing individual losses is much more difficult. Also the monitoring of client behaviour to minimise moral hazard problems is more time-consuming and costly in this sector.[7]

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[5] Inter-American Development Bank; Wenner, Mark; Arias, Diego: *Agricultural Insurance in Latin America: Where are we?*

[6] Hazell, Peter; Skees, Jerry: *Insuring against bad weather – recent thinking*, 2005.

[7] Inter-American Development Bank; Wenner, Mark: *Agricultural Insurance Revisited: New Developments and Perspectives in Latin America and the Caribbean*, Washington 2005.

3.1.3 Education/communication

In most of the developing countries, the introduction of insurance as a risk management tool is a great challenge, as it is very hard to gain trust and understanding for insurance schemes when people previously did not have access to financial services. And it is difficult to explain that premium payments are not savings leading to repayments if the insurance cover was not needed during the year. The need for awareness-raising and trust-building campaigns leads to higher distribution costs for insurance companies.[8]

3.2 Specific problems of agricultural microinsurance

3.2.1 Correlated risk

In agricultural microinsurance, an important rule for insurability tends not to hold: risks are not completely independent and spatially uncorrelated, as weather events tend to affect a large number of farms over a widespread region. Normally, such correlated risk cannot be pooled. Especially small rural financial institutions are simply not capable of insuring risks affecting most of their customers at the same time. The diversification of the risk portfolio is therefore essential for the financial viability of the insurance companies – which in turn means that they need the possibility to transfer part of the risk to reinsurance providers or international financial markets.[9]

3.2.2 High administration cost

A major constraint of agricultural microinsurance is the high administration cost. While benefits under life insurance, for example, become due with the death of the insured (proven by the death certificate), crop insurance usually requires the assessment of the degree of damage to the insured crops by an expert, with all the cost associated with the time for travelling and dealing with the claims procedure. Additionally, the danger of fraud is higher, as the insured event can be induced by the insured (e.g. cattle life insurance). A good indicator for the financial viability of an insurance scheme is the combined ratio also known as the Hazell Ratio. Only if the average premiums paid are higher than the total of the average administration costs and the average indemnities paid (combined ratio <1) will the scheme be sustainable and financially viable in the long run. Past experience shows how far removed these initiatives have been from sustainability (see table 1, page 10).

Combined/Hazell ratio:

$$(A+I)/P<1$$

A = average **a**dministration costs
I = average **i**ndemnities paid
P = average **p**remiums paid

In the past, the problem of cost coverage led to a situation where governments heavily subsidised agricultural insurance schemes. This allowed insurers to provide insurance policies at prices which were still affordable for farmers without threatening their own financial viability. Recent initiatives based on new developments in the agricultural insurance sector, leading to reduced administration and indemnification costs (index-based insurance), have been

[8] Munich Re Foundation; Loster, Thomas: *Together we can beat the drought trap* in the 2006 report of the Munich Re Foundation, Munich 2007.
[9] GlobalAgRisk; Skees, Jerry: *Risk Management Challenges in Rural Financial Markets: Blending Risk Management Innovations with Rural Finance*, Washington 2003.

launched without necessarily requiring subsidies. Although the first successful steps have been taken in this respect, their sustainability and financial viability still has to be proven over time.

Table 1: Combined ratio for selected agricultural insurance schemes

Country	Time period	Hazell ratio
Philippines	1981–89	5.74
Brazil	1975–81	4.57
Japan	1985–89	4.56
United States	1999	3.67
Mexico	1980–89	3.65
United States	2004	3.60
Canada	2004	2.90
Costa Rica	1970–89	2.80
Japan	1947–77	2.60
United States	1980–89	2.42

Source: Inter-American Development Bank; Arias, Diego; Covarrubias, Katia: *Agricultural Insurance in Mesoamerica: An Opportunity to Deepen Rural Financial Markets*, Washington 2006.

3.2.3 Non-transparent and unequal free disaster assistance

Agricultural insurance also faces the problem that households are not willing to pay for insurance if they can expect government compensation for natural disasters heavily affecting their crops. While free disaster aid is not a problem per se (and might well be needed after all), often its non-transparent and unequal nature sets the wrong incentives. In some cases, governmental disaster assistance has also been granted for political reasons rather than in response to actual losses sustained by farmers in a specific region. Disaster assistance rules must therefore be made explicit and compensation must be accessible to every farmer. If only those farmers are compensated who decided not to buy insurance cover, the risk-sensitive farmers who have bought the insurance cover will be punished for their prudence.[10]

[10] Inter-American Development Bank; Wenner, Mark; Arias, Diego: *Agricultural Insurance in Latin America: Where are we?*
Inter-American Development Bank; Arias, Diego; Covarrubias, Katia: *Agricultural Insurance in Mesoamerica: An Opportunity to Deepen Rural Financial Markets*, Washington 2006.

3.2.4 Lack of infrastructure (information and distribution)

In order to calculate and price risks properly, insurance companies need good historical data going back at least ten (preferably 20 and ideally 30) consecutive years or more. This means that designing agricultural insurance products for poor farmers is particularly challenging, as most developing countries lack meteorological data for the last few decades, not having had the infrastructure to measure it. New plant breeding and GMOs are sometimes also difficult to insure due to the absence of historical data. Secondly, in rural areas – the target regions for agricultural insurances – the lack of infrastructure affects sales possibilities as well, since distribution channels are not in place or are underdeveloped. Thirdly, the functionality of insurances products is still new to small farmers in developing countries, which makes time-consuming customer education necessary.

4 New risk management approaches in agriculture

To overcome the shortcomings in terms of sustainability and financial viability of traditional agricultural insurance schemes, recent initiatives mainly focus on index-based insurance solutions.

4.1 Index insurance – Justified hope or exaggerated expectations?

Index-based insurances pay for losses based on an independent and objective measure that is highly correlated with the losses. The insurance becomes due if a certain value of the predefined trigger is met or passed within a specific period of time, e.g. temperature, rainfall, etc. There is no individual claims settlement, but all people or associations insured are paid from the insurance once the threshold is passed. Prerequisites for an index-based insurance are displayed in the grey text box.[11] A suitable index requires that the random variable measured meets the following criteria: it must be observable and easily measurable, objective, transparent, independently verifiable, reportable in a timely manner, and stable and sustainable over time.[12] Suitable triggers in agricultural insurance can, for example, be:

Pre-requisites for index-based insurances:

- Index must be a good proxy for the loss (high correlation).
- Event must be observable and easily measurable.
- Historical data and good infrastructure must be available to adequately price the risk.
- Measurement must involve a third party to prevent fraud.

- Lack of rainfall
- Extreme rainfall
- Freeze
- Average yields per region/municipal/etc.
- Mortality rates by county

The new approach of using correlated triggers instead of individual loss adjustments for indemnifications offers several advantages.

4.1.1 Why index-based insurance solutions stimulate expectations[13]

Unlike in traditional agricultural insurance products, asymmetric information problems play a much smaller role in index-based insurance schemes. Firstly, a farmer mostly has little more information than the insurer regarding the index value, and secondly, the index value cannot be influenced by individual farmers. Thus, less asymmetric information leads to less adverse selection and reduced moral hazard problems.

[11] USAID; GlobalAgRisk: *Index Insurance for Weather Risk in Lower-Income Countries*, Washington 2006.
[12] World Bank: *Managing Agricultural Production Risk*, Washington 2005.
[13] Hazell, Peter; Skees, Jerry: *Insuring against bad weather – recent thinking*, 2005.
World Bank, Agriculture and Rural Development Department: *Managing Agricultural Production Risk*, Washington 2005.

a) Less adverse selection

As indemnification is not based on individual losses, the insurance provider can calculate the risk more easily and more accurately, without depending on the information provided by the insured. Instead, indemnities are based on widely available information and there are few informational asymmetries to be exploited by the insured.

b) Reduced moral hazard

Management decisions are not affected by the index contract, as indemnities are not based on the extent of individual losses. Thus, farmers with index-based insurance possess the same economic incentives to produce a profitable crop as uninsured farmers.

c) Reduced administration cost

Index-based insurance policies can reduce administration cost tremendously: not only do expensive on-farm inspections to assess the individual risk exposure and costly individual loss assessments become redundant, but the standardisation of contracts and easier claims settlement also make index-based insurance schemes much more cost-efficient.

d) Standardised and transparent structure

Index-based insurance contracts can be uniformly structured, which not only reduces insurance design costs but also increases the number of potential distribution channels.

e) Availability and negotiability

Being standardised and transparent, the contracts can be traded in secondary markets by the insurance companies, which facilitates risk transfer and portfolio diversification.

f) Flexibility and adaptation

In contrast to traditional agricultural insurance products, which cannot usually be tailored to the individual needs of farmers in a certain region, index-based insurances allow insurers to provide tailor-made solutions without extensive work on the product design.

g) Reinsurance function

Index-based insurance can be used to transfer the risk of widespread correlated agricultural production losses more easily to the international reinsurance market. Microfinance institutions can use index-based insurance as a means of hedging their loan portfolio (e.g. BASIX India in 2004). An important factor is the right quotation. International reinsurers cooperate closely in the development process of such products.

h) Broader target group

Index-based insurance policies can be sold not only to farmers to hedge their agricultural risks but also to other players affected by weather events (agricultural traders, banks, shopkeepers, labourers, etc.).

i) Unproblematic linking to microfinance

Index contracts can easily be made part of a comprehensive package of services facilitating risk management, such as microfinance, technical assistance (fertilisers, seeds, pesticides), advisory services, transport and marketing facilities. In India, for example, a leading seed company bought small rainfall insurance policies to attach them to their seed packages. In some countries, cooperation with microfinance institutions has led to lower interest rates for farmers by transferring the loan default risk to the insurance market.[14]

4.1.2 Why index insurance solutions cause scepticism[15]

a) Basis risk[16]

One of the major disadvantages of index-based insurance solutions is the portion of risk that is not correlated with the measured index, called "basis risk". As indemnification is not based on actual losses, but triggered by the index, there is a potential mismatch between the insurance payout and the actual losses of the farmer. If a regional weather event does not trigger the cover, an insured farmer will get no compensation even though he is heavily affected by this event (basis risk). This will significantly impact the acceptance of insurance as a risk management tool, because people will not understand why they have to pay premiums when they receive nothing in return despite high individual losses.[17] Insurance providers therefore have to make sure that they establish close long-term partnerships with their clients and that the trigger is highly correlated with the experienced losses. Without sufficient correlation between the index variable and losses, the basis risk may be too high and index-based insurance may not be an effective risk management tool. If the weather event triggers payouts, but the insured farmer is not seriously affected, he will be over-compensated (the basis risk in this case is called the "basis chance").

b) Reputation risk for (re)insurance companies

As a result of the basis risk phenomenon and its implications for the farmers, (re)insurance companies face a considerable reputation risk. If insured farmers experience large losses without being compensated because the index-based insurance is not triggered, insurance companies will be blamed. Especially in developing countries, where agricultural losses threaten the livelihood of farmers and their families, the lack of indemnity payments has severe consequences. Negative mouth-to-mouth propaganda destroys any trust that an insurance company may have built up over a long time. But also in developed countries, where pictures of starving children in developing countries usually receive high public attention, (re)insurance companies face a high reputation risk which involves not only agricultural insurance policies but also other insurance product lines of the same company in completely different

[14] United Nations Conference on Trade and Development: *Issues of agricultural insurance in developing countries*, May 1994.

[15] Hazell, Peter; Skees, Jerry: *Insuring against bad weather – recent thinking*, 2005
World Bank, Agriculture and Rural Development Department: *Managing Agricultural Production Risk*, Washington 2005.

[16] Stoppa, Andrea: *Weather-based index insurance for developing countries*, Eschborn 2007.

[17] Munich Re Foundation; Loster, Thomas: *Together we can beat the drought trap* in the 2006 report of the Munich Re Foundation, Munich 2007.

markets. International (re)insurance companies are therefore still reluctant to use index-based insurance products on a large scale, or emphasise the long-term focus and the importance of close customer relationships in using these schemes.[18]

c) Simplicity versus reduction of basis risk

When designing an index-based insurance scheme, insurance companies have to choose between a simple trigger structure (leading to lower design and administration cost) and reducing the amount of basis risk to be borne by the insured farmer. Products with only one trigger lead to an "all or nothing" situation for the farmer, who carries a relatively large basis risk in this case. The more triggers defined in the scheme, the more complicated and costly the insurance policies are for farmers, who at the same time benefit from a reduced basis risk. The design of index-based insurance schemes is therefore crucial, requiring careful consideration and several consecutive pilot tests.

d) Forecasts

If index-based insurance contracts can be bought at any time throughout the year, forecasts can cause a situation of short-term asymmetric information about the likelihood of an event in the near future. This creates the potential for inter-temporal adverse selection. Insurers usually avoid this problem by only offering the policies up to a certain date, before weather forecasts for the critical crop period can be taken into account for the purchase decision.

e) Microconditions

Frequent, localised events which would often trigger payouts make the application of index-based contracts difficult. According to reinsurance experts, microclimates do not play a critical role in index-based insurance schemes, as they rarely exist and are usually incorporated in the index. Other microconditions such as different compositions of the soil, an uneven terrain (windward or leeward position of the field) may also lead to different crop yields under the same weather conditions which cannot be adequately reflected by index-based insurance products. Depending on the extent of the losses, other risk management tools may be more appropriate in this case.[19]

f) Weather cycles and short-term trends

Weather cycles changing the probability of the insured events (e.g. El Niño) as well as small scale, short-term trends of only a few years could undermine the actuarial soundness of the premium calculation, posing a risk to the financial viability of the insurance provider.

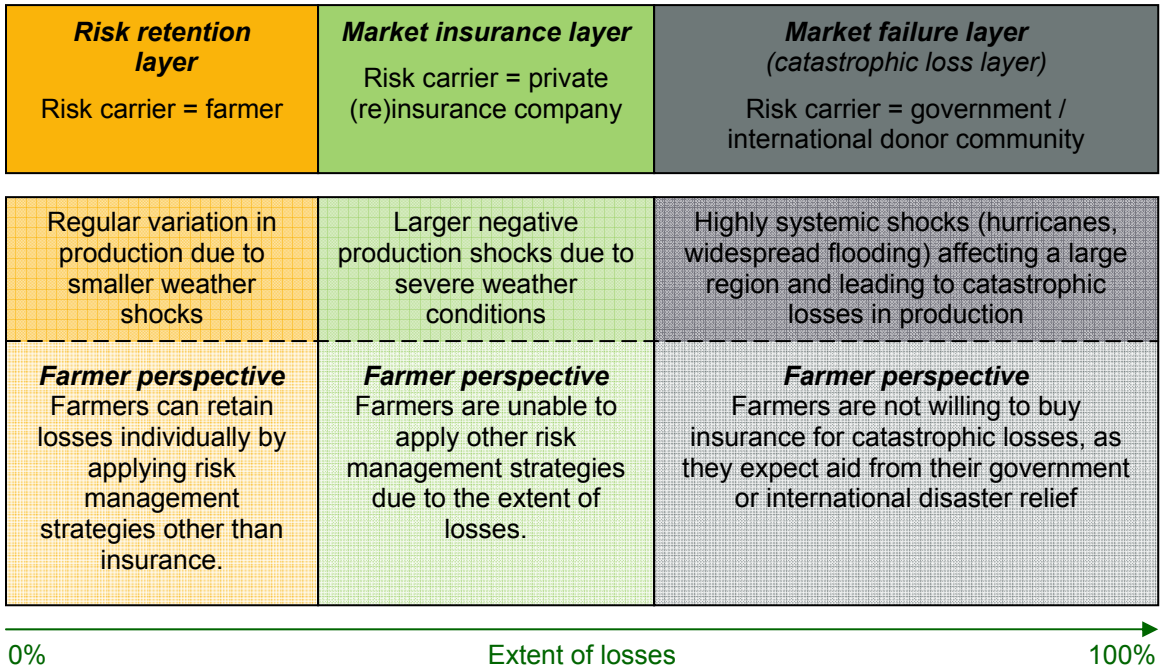
g) Timing risk

The sensitivity of plants varies heavily depending on the vegetation period, e.g. wheat needs rainfall at another point in time than corn. Therefore, triggers should not only be based on, say, absolute values during longer periods. It is more important to factor in *when* exactly rainfall, soil moisture, temperature reach a certain value.

[18] According to interviews with international (re)insurance experts
[19] According to interviews with international (re)insurance experts.

4.2 Risk layering

Although the administration cost of insurance products has been reduced tremendously under index-based insurance schemes, it is crucial to clearly differentiate the agricultural risk exposure of farmers and to find appropriate solutions for each of the different risk layers.



An illustrative example of risk layering can be found in the case study on index-based livestock insurance in Mongolia in the annex to this paper.

4.3 Risk pooling

As a new, cost-efficient risk management tool, index-based insurance schemes nurture the hope of policy-makers and development organisations that poor farmers in developing countries can be provided with better support in managing their exposure to agricultural perils. However, the existence of the basis risk is an important factor, especially for small farmers, as small variations in agricultural production can have significant consequences for them and their families.

An effective way of reducing the basis risk without increasing the administration cost of the insurance scheme is to insure pools of farmers instead of individuals. Within the pool, farmers can agree on rules as to how participating farmers are to be indemnified for individual losses – even by lending money to each other if a loss event does not trigger the pool insurance policy. This not only mitigates the basis risk of individual farmers but also contributes to lower insurance administration costs (than individual policies) and increases the "social control" among farmers, reducing moral hazard problems and the occurrence of fraud.[20]

[20] GlobalAgRisk; Skees, Jerry: *Risk Management Challenges in Rural Financial Markets: Blending Risk Management Innovations with Rural Finance*, Washington 2003.

5 Lessons learned and way forward: What needs to be done?

a) Analysis of the basis risk

The central challenge of index-based insurance products is to overcome the problems linked to the basis risk. As mentioned above, (re)insurance companies are reluctant to take the reputation risk associated with possible negative media coverage if poor farmers in developing countries are not indemnified for their losses although they bought insurance cover. Attracting private insurance companies therefore requires proper analysis of the basis risk and strategies to minimise it through, for example, insuring mutually-type farmers pools instead of individuals.

b) Defining and reaching the micro target group: Small farmers

While agricultural index-based insurance products are still in their infancy, existing pilot projects need to prove that they can successfully reach poor farmers as the main microinsurance target group. To this end, countries first need to discuss and establish a country-wide definition of small farmers, because common international definitions may not be adequate or comprehensive enough. Further research to assess the degree of market penetration in this target group segment will then contribute to gradually improving index-based insurance schemes and tailoring them to the needs of the poor.

c) Monitoring sustainability and financial viability

Initial experience with index-based insurance pilot projects seems to be very promising, as illustrated by the case studies in the annex to this paper. Nevertheless, further research and monitoring of these initiatives needs to be done to enable conclusions to be drawn about their sustainability, financial viability and implementation on a larger scale. Special attention should be given to the question of whether subsidies are required. Given its sound actuarial basis, the combined ratio will be an important indicator for measuring the success of index-based insurances and for further improving existing products.

d) The potential of index-based insurance schemes

Despite the existing challenges which need to be further explored and adequately tackled, index-based insurance products offer great potential to the insurance and reinsurance market as well as to the international development community and national governments in fighting poverty in developing countries. While the first pilot projects focus purely on the protection of small farmers affected by negative weather events, index-based insurance products are also attractive to agribusiness intermediaries, such as input suppliers, processors and traders whose business operations are correlated with agricultural products.

Advances in technology (use of satellite images, etc.) will lead to a better availability of the data needed to properly calculate and offer index-based insurance policies.21

Index-based insurance schemes offer the opportunity to cover an entire region or country. National, regional or local governments, and other groups like cooperatives, could obtain insurance and then distribute the payment to the individual farmers, since they most probably have better information on what happened where and which farmer suffered what loss.
However, despite all the potential, a great deal needs to be done to improve the availability of reliable data, which would then make the development and pricing of such products much easier.

[21] USAID; GlobalAgRisk: *Index Insurance for Weather Risk in Lower-Income Countries*, Washington 2006.

6 Literature

- CGAP, International Labour Office ILO and Munich Re Foundation: *Protecting the poor – A microinsurance compendium*, 2006

- CGAP, International Labour Office ILO and Munich Re Foundation: IntoAction edition 1, *Making insurance work for the poor*, Report Summary Microinsurance Conference, October 2005

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- Inter-American Development Bank; Wenner, Mark: *Agricultural Insurance Revisited: New Developments and Perspectives in Latin America and the Caribbean*, Washington 2005

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- Stoppa, Andrea: *Weather-based index-based insurance for developing countries*, Eschborn 2007

- Swiss Re: SIGMA No. 1/2007, *Insurance in emerging markets: sound development; greenfield for agricultural insurance*, Zurich 2007

- United Nations Conference on Trade and Development: *Issues of agricultural insurance in developing countries*, May 1994

- USAID; GlobalAgRisk: *Index Insurance for Weather Risk in Lower-Income Countries*, Washington 2006

- World Bank, Agriculture and Rural Development Department: *Managing Agricultural Production Risk*, Washington 2005

7 ANNEXES

7.1 ANNEX I: Perils in agriculture[22]

1) Natural risks
    a. Weather
        i. Storm
        ii. Hail
        iii. Heavy rainfall
        iv. Encrustation (after heavy rainfall and hot and dry weather afterwards whereby the mud on the fields prevents the seeds from growing)
        v. Flood
        vi. Fire after lightning strike
        vii. Drought
        viii. Differences in temperature
        ix. Frost
        x. Heat
        xi. Differences in humidity
        xii. Ground moisture
    b. Livestock and plant epidemics (pests and diseases)
    c. Seismic activity (earthquake, tsunami, volcanic eruption)
    d. Wild animals
2) Social risks (normally excluded)
    a. War
    b. Terrorism
    c. Looting
    d. Theft
    e. Poisoning
    f. Fire
    g. Accidents
    h. Strike
    i. Riot
    j. Vandalism
3) Economic risks (normally excluded – other "insurance" measures)
    a. Price fluctuations
    b. Interest rate movements
    c. Exchange rate movements
    d. Changes in demand
4) Policy risks (normally excluded)
    a. Trade policies incl. tariffs, embargos
    b. Changes in agricultural subsidies
    c. Changes in tax policies
5) Operational risks (normally excluded)
    a. Personnel risks
    b. Timely input of material

[22] Based on Swiss Re: Sigma No. 1/2007, *Insurance in emerging markets: sound development; greenfield for agricultural insurance*, Zurich 2007.

7.2 ANNEX II: Case studies

Several recent initiatives piloting index-based insurance schemes have been established during the last few years and their first steps are promising. However, the next few years will show whether they can respond to the needs of the small farmers without governmental subsidisation and at the same time without threatening their own sustainability and financial viability.

Existing index-based pilot schemes mostly cover loss of livestock (India, Mongolia) or lack of rainfall (India, Malawi, Mexico, Morocco). Three schemes have been selected as case studies to complement the discussion paper, each of which has unique characteristics.

Among the existing agricultural insurance schemes in developing countries, the case study examples chosen for this discussion paper provide an insight into innovative (Mongolia), comprehensive (Mexico) and verifiably sustainable (India) approaches, offering lessons learned in the design of agricultural insurance schemes. Two case studies (Mongolia, India) describe agricultural insurance products at household level, while the third (Mexico) explains the set-up of the entire agricultural insurance sector, including a national insurance fund for poor farmers.

7.2.1 Case Study I: Mongolia – Index-based livestock insurance

Key facts

Insurance type	Index-based livestock insurance
Species	Cattle and yaks, sheep, goats, camels and horses
Peril	Harsh winters leading to severe losses of animals
Start of scheme	2006
Developer	World Bank in cooperation with the Government of Mongolia
Risk carrier	Risk distributed between insureds, private insurance companies and the Government of Mongolia/World Bank
No. of people insured	2,412 in 2006
Eligibility	Any farmer regardless of herd size – voluntary
Cover period	January to June (winter period with *dzuds*)

Background and history

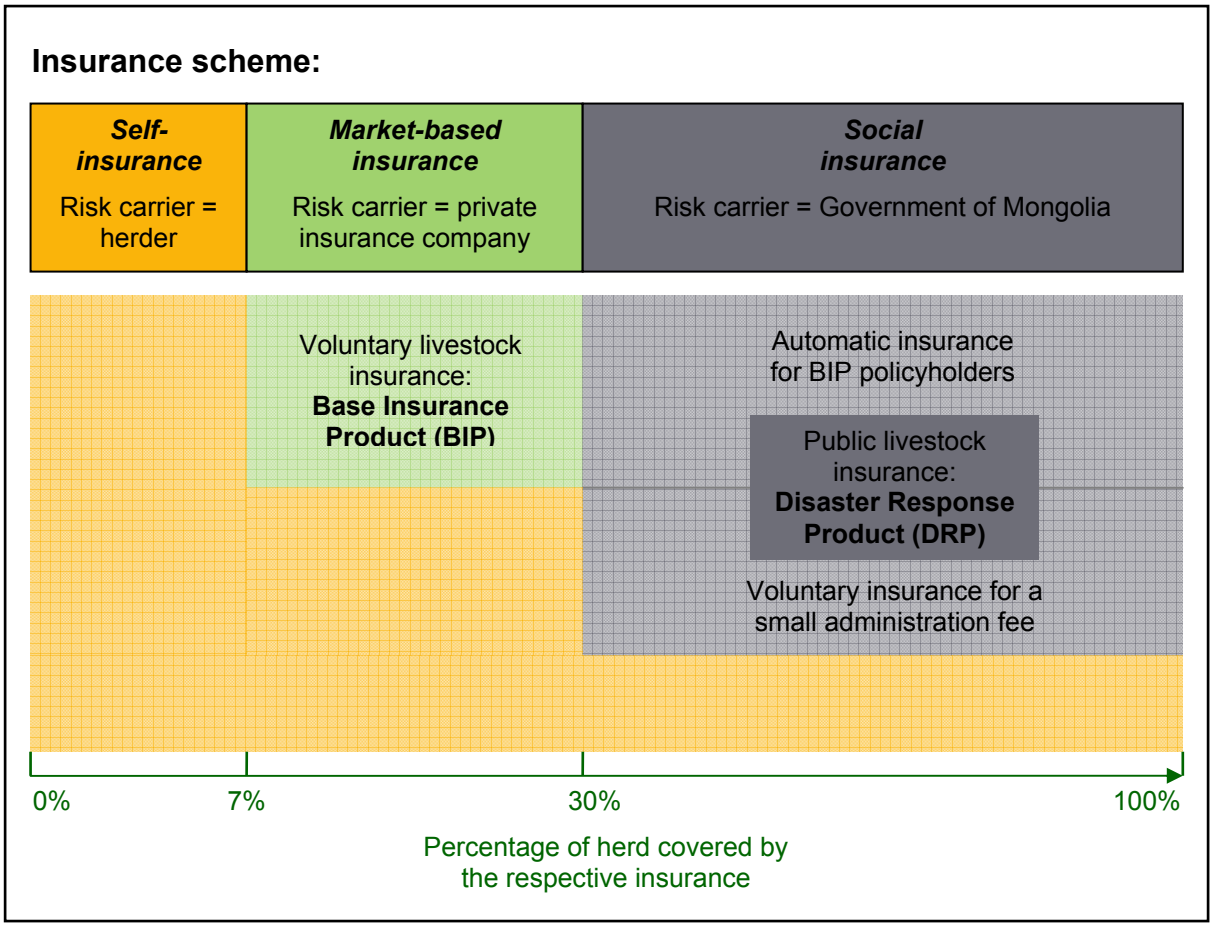
Agriculture in Mongolia accounts for nearly one third of national GDP, with herding being the major agricultural activity (>80%). For the rural poor, but also for the Mongolian economy, shocks to the well-being of animals have a severe impact. Mongolian herders and their livestock are regularly exposed to harsh winters leading to high levels of livestock mortality. In the three consecutive years 2000–2002, a third of adult livestock (over 11 million) died during severe winters called *dzuds*. Nearly half of all cattle and yaks were lost in this time. Losses of this magnitude had a significant impact on herding households. Over 10,000 households lost their entire herd, while the herd size for many others dropped below sustainable levels.[23]

As traditional livestock insurance products were not a realistic option due to their high administration cost and the informational asymmetries, the Government of Mongolia in cooperation with the World Bank introduced an index-based livestock insurance project (IBLIP) in April 2006 using mortality rates by species and county as a trigger. Pilot projects offered this new livestock insurance product to herders in three regions, covering herds of all sizes and different kinds of animals, such as cattle and yaks, sheep, goats, camels and horses.[24]

[23] GlobalAgRisk; Goes, Anne: *Index-Based Livestock Insurance in Mongolia: Potential Impact on Financial Sector Development*, 2005.

[24] World Bank: Project Information Document (PID) *Mongolia: Index-Based Livestock Insurance Project*, Washington 2005.
World Bank; Skees, Jerry; Enkh-Amgalan, Ayurzana: *Examining the Feasibility of Livestock Insurance in Mongolia*, Washington 2002.

Description



By combining social insurance with self- and private insurance, the Mongolian livestock insurance scheme tries to eliminate the shortcomings of traditional livestock insurance and make it more sustainable and efficient. As herders retain small losses that do not affect the viability of their business (self-insurance), moral hazard is reduced. Larger losses are transferred to the private insurance sector (market-based insurance) backed by the government, which steps in for substantial losses beyond 25% (or 30%, depending on the region) of the herd.

In terms of numbers, IBLIP is structured as follows:[25]

Trigger	The insurance becomes due if the average adult mortality rate in a specific region is 7% or more.
Self-insurance (Deductible)	Losses up to 7% of the estimated value of the herd are borne by the herders themselves.
Private insurance Base Insurance Product (BIP)	Herders can (voluntarily) get insurance for losses exceeding 7% of the estimated value of their herd. The cap (exhaustion point) for the private insurance company to cover losses is 25% (30%).
Social insurance: Disaster Response Product (DRP)	The Government of Mongolia indemnifies the herders for losses exceeding 25% (30%) of the estimated value of the herd.

[25] CGAP Working Group on Microinsurance: Newsletter No. 10 *Improving risk management for the poor*, July 2006.

The insurance of losses with the private insurer is voluntary, and herders can also decide to purchase insurance for only a certain percentage of the estimated value of their herd (30–100%). Premiums are not subsidised and thus fully paid by herders. An additional incentive to buy the insurance is the automatic participation in the government insurance scheme DRP, covering the final layer of catastrophic losses. But herders can also decide to only register for the governmental scheme for a small administration fee.

The premium to be paid by a herder is calculated by multiplying the estimated value of the animals reported with the percentage of the desired coverage and the relative risk in the respective region. Insurance rates in the first year of the scheme were between 5 and 10%. Indemnities are calculated by multiplying the payment rate with the value insured. DRP payments use the full value of the animal for losses beyond the exhaustion point of 25% (30%).

Participating insurers share underwriting gains and losses in the Livestock Insurance Indemnity Pool (LIIP) according to the business they bring into the pool. The premiums are accumulated from year to year to build up reserves for the overall scheme. The reinsurance reserve pays for the first layer of reinsurance losses; once it is exhausted, the government fully covers insured losses beyond the pool's reserves through an unlimited stop loss reinsurance treaty. It can call upon the World Bank contingent debt to pay for any remaining losses.[26]

Insurance cover example

Number of sheep: 36
Value of a sheep: €20
Premium rate: 6%
(trigger at 7%, cap at 30%)

Sum insured
36 x €20 = **€720.00**
Premium
€720 x 6% = **€43.20**

Indemnity
Average adult sheep mortality rate in respective region: 35%

BIP payment rate
30% – 7% = *23%*
BIP payment
23% x €720 = **€165.60**

DRP payment rate
35% – 30% = *5%*
BIP payment
5% x €720 = **€36.00**

Total indemnity
€165.60 + €36 = **€201.60**

The introduction of an index-based insurance scheme in Mongolia was possible because of the availability of good historical data, a precondition for index-based insurances. There are time series on adult animal mortality going back more than 30 years thanks to the annual national animal census.

Assessment

The approach of using an index in livestock insurance is quite new and tries to eliminate several shortcomings of livestock microinsurance experienced so far. The often expensive monitoring costs for loss adjustments usually related to individual livestock insurances can be minimised. Also the role played by informational

[26] CGAP Working Group on Microinsurance: Newsletter No. 10 *Improving risk management for the poor*, July 2006.

asymmetries and moral hazards is reduced by integrating a deductible (self-insurance) into the insurance scheme.

Advantages of the Mongolian set-up

- Insurance does not reward poor livestock management (herders who manage their herds better are rewarded, as they receive the same indemnity as other herders with higher losses).
- Insurance is affordable to a large number of herders.
- Insurance is financially sustainable and profitable to interest private insurance companies.
- Full protection of other insurance lines
- Full protection of indemnities needed to pay for losses under the pool (no risk of default on payments)
- Risk pooling of livestock insurance across several regions
- Collaboration of insurance companies to promote BIP
- BIP is a standardised product that involves the same premium rates from all companies.

According to the first progress report of the project, sales in 2006 were greater than anticipated and 2,412 herders (9%) purchased IBLI products in the pilot year 2006. While most of the herders (2,212) decided to buy the full insurance cover (BIP and DRP), 200 herders only sought protection under the DRP cover.[27] Nearly 300,000 animals (6–7%) were insured, which leads to the conclusion that, on average, herders with herd sizes smaller than average were the primary purchasers of the insurance products. While this can be a first indication that the new insurance scheme is affordable to poor farmers, further research has to be done to validate this conclusion and to determine the degree to which the product reaches them.[28]

Initial experience sounds very promising: during the pilot year, some financial intermediaries decided to provide lower interest rates to those herders purchasing the insurance product. Feedback sessions and stakeholder surveys will further improve the index-based livestock insurance scheme in the following years.

Mongolia may be among only a few countries in the world that have suffered from widespread deaths of livestock. That means there would only be a limited number of countries where a similar project for livestock mortality could be tried. Nevertheless, there are a several new aspects of what is being designed that should have wider application to natural hazard risk: the unique financing and structure of the contracts, for example, could be transferred to rainfall insurance contracts for developing countries.[29]

[27] World Bank: *Quarterly Progress Report – Period: From July 01, 2006 to September 30, 2006*, Mongolia 2006.
[28] Information received via e-mail correspondence with the World Bank.
[29] Hazell, Peter; Skees, Jerry: *Insuring against bad weather – recent thinking*, 2005.

Research issues
Although many publications provide a good insight into the index-based livestock insurance scheme in Mongolia, further research needs to be done in order to highlight the successes and challenges in reaching the small and poor farmers and protecting them against agricultural losses threatening their livelihood. Furthermore, the sustainability and financial viability of the relatively new index-based insurance schemes should be observed closely during the coming years.

Sources:

- CGAP Working Group on Microinsurance: Newsletter No. 10 *Improving risk management for the poor*, July 2006
- GlobalAgRisk; Goes, Anne: *Index-Based Livestock Insurance in Mongolia: Potential Impact on Financial Sector Development*, 2005
- Hazell, Peter; Skees, Jerry: *Insuring against bad weather – recent thinking*, 2005
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- World Bank; Skees, Jerry; Enkh-Amgalan, Ayurzana: *Examining the Feasibility of Livestock Insurance in Mongolia*, Washington 2002
- World Bank: *Quarterly Progress Report – Period: From July 01, 2006 to September 30, 2006*, Mongolia 2006

7.2.2 Case Study II: India – Index-based rainfall insurance

Key facts

Insurance type	Index-based rainfall insurance
Crops	Any crops depending on the monsoon rainfall
Perils	Insufficient or excess rainfall during monsoon season
Start of scheme	2003
Developer	ICICI Lombard in cooperation with BASIX
Risk carrier	Risk distributed between insureds and the private insurance company ICICI Lombard
No. of people insured	>125,000 in 2006 insured by ICICI Lombard/BASIX ~500,000 in 2006 countrywide by various providers
Eligibility	Any farmer regardless of farm size – voluntary
Cover period	June to October

Background and history

In India, more than 500 million people rely on agriculture as their main source of income. Most of the farmers do not have access to irrigation, which means that the rainfall of the monsoon season is essential for their income generation and survival. Alternative sources of income are limited, as all farmers in one village tend to be in the same predicament and, if rainfall is lacking, relatives or friends in the neighbouring villages may also not have the financial means to offer traditional methods of coping with risk, such as lending.

As one way of coping with agricultural risk, crop insurance has a considerable tradition in India, with the Indian Government having attempted to protect farmers against weather risk by offering such insurance for several decades. In some regions, crop insurance is even a requirement for receiving an agricultural loan.[30] Yet, the National Agriculture Insurance Scheme (NAIS) is still struggling with inefficiencies, as its indemnity only becomes payable in extreme situations, following a drought declaration for the district by the state government. The lack of objective criteria led to declarations often being the result of political manoeuvring. Furthermore, indemnification under the NAIC programme was based on minimum crop prices and in general occurred two to three years after the failed harvest.[31]

To overcome these shortcomings, ICICI Lombard in cooperation with BASIX introduced an index-based rainfall insurance in 2003. The idea of using insufficient and excess rainfall as an appropriate index scheme was based on the experience that about 90% of the variation in crop production in India is due either to inadequate or excess rainfall.[32]

[30] http://ifmr.ac.in/cmf/20070416/rainfall-insurance.
[31] ISMEA; Hartell, Jason; Ibarra, Hector; Skees, Jerry; Syroka, Joanna: *Risk Management in Agriculture for Natural Hazards*, 2006.
[32] Hazell, Peter; Skees, Jerry: *Insuring against bad weather – recent thinking*, 2005.

Description

2003

The index-based rainfall insurance product was introduced to the Indian agriculture sector in 2003 by ICICI Lombard General Insurance Company, which is a joint venture between ICICI Bank, India's largest private sector bank, and Lombard, one of the oldest property and casualty insurance companies in Canada.[33] For distribution purposes, ICICI Lombard established a cooperation with BASIX, one of the leading microfinance institution offering a wide array of financial services (microcredit, investment services) to rural customers in India. The customer base of BASIX comprises about 150,000 borrowers and 8,600 savers in 7,800 villages in ten Indian states.

The index-based rainfall insurance scheme started in 2003 as a crop-specific insurance cover for castor and groundnut farmers, who were split according to their farm size into two (<2.5 acres; >2.5 acres) and three (<2.5 acres; 2.5–5 acres; >5 acres) categories respectively. The initial weather insurance contracts designed for these farmers were based on a weighted rainfall index, calculated on the basis of rainfall collected and recorded at the Indian Meteorological Department (IMD) official district weather station. If the index fell below the predetermined threshold, farmers participating in the programme received a payment to cover lost production and input costs as a result of lower-than-expected yields. Insurance cover was limited depending on the type of farmer wanting to buy the insurance. The index was defined as a weighted sum of cumulative rainfall during the average calendar dates for the groundnut growing season from 11 May to 17 October. Additionally, individual weights were assigned to consecutive ten-day periods of the growing season to take account of the critical periods during the crop's evolution. Furthermore, excessive rain not contributing to plant growth was included in the insurance scheme by introducing a ten-day cap on rainfall of 200mm.[34]

Although the overall feedback from farmers was very positive (especially in regard to the timely payment of claims), some important adjustments of the insurance scheme had to be made to enhance the benefits for the farmers for the following year 2004.

2004

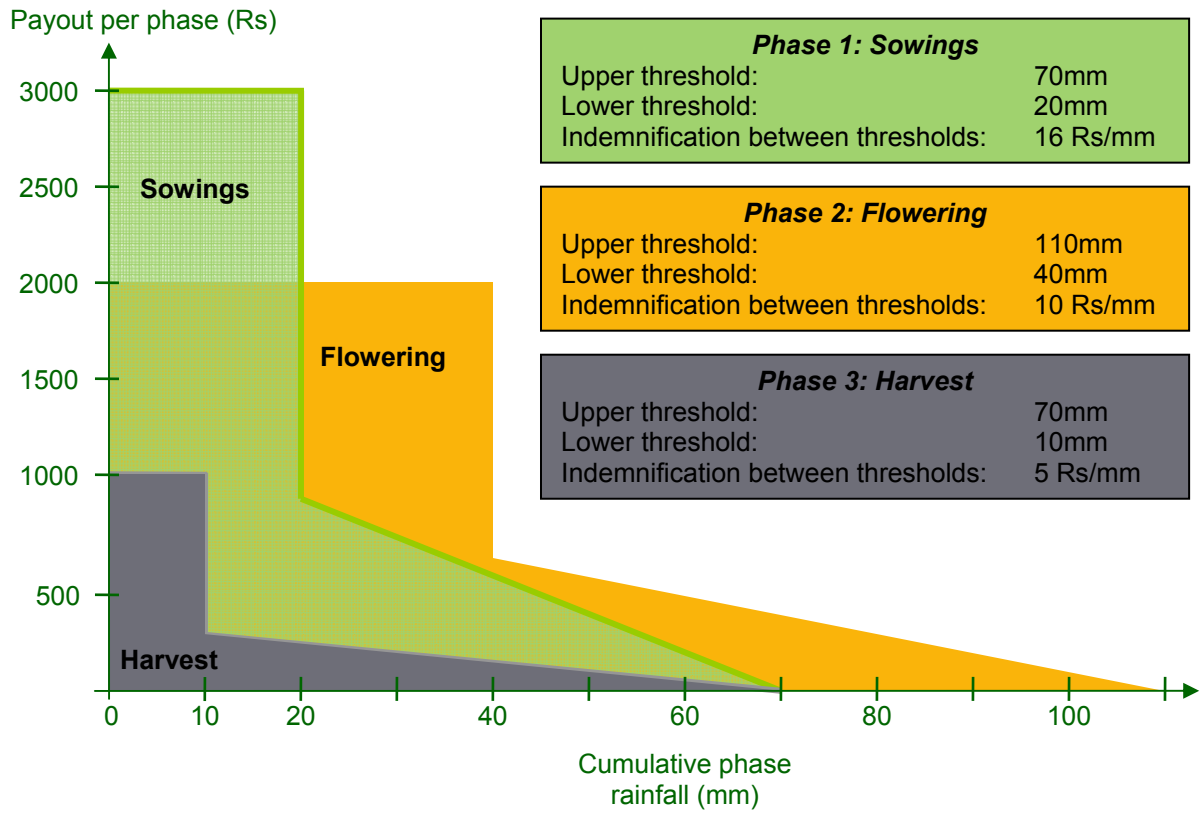
In light of the farmer feedback on the monsoon season 2003, the rainfall index insurance was completely restructured. The growing season of groundnut and castor was divided into three phases corresponding to the three critical growing periods: sowings, flowering (vegetative growth) and harvest (maturity). Moving away from a weighted index design, the new contracts specified a cumulative rainfall trigger for each of the three phases, with an individual payout rate and limit for each phase. Furthermore, the contracts were redesigned to be sold per acre and a farmer could buy as many acres of protection up to 100% of his cultivated area as he desired. By transforming the crop-specific insurance scheme into an area-specific "monsoon failure" insurance scheme, insurance cover could be offered to a wider range of

[33] http://www.basixindia.com/insurance.asp.
[34] ISMEA; Hartell, Jason; Ibarra, Hector; Skees, Jerry; Syroka, Joanna: *Risk Management in Agriculture for Natural Hazards*, 2006.

farmers cultivating diversified agricultural portfolios with different kinds of crops, such as cotton, oranges or coriander and others.[35]

The concrete structuring of the rainfall insurance product depends on the crop(s) covered and the region where it is sold. The following boxes show an example of a realistic set-up for the insurance scheme.

Insurance scheme example (part 1):



For each of the three phases, an upper and lower threshold was specified. If the accumulated rainfall exceeds the upper threshold, no indemnification would be paid out. Accumulated rainfall below the lower threshold would trigger a fixed payout to indemnify farmers for severe crop losses associated with the lack of rainfall. Between the two thresholds, farmers would receive indemnification according to each millimetre of rainfall below the upper threshold. The total payout for the whole monsoon season would then simply be the sum of the payouts across the three phases. Additionally, the insurance cover includes a payout if rainfall exceeds a daily threshold for several consecutive days, as excess rains can seriously damage the harvest.[36]

[35] ISMEA; Hartell, Jason; Ibarra, Hector; Skees, Jerry; Syroka, Joanna: *Risk Management in Agriculture for Natural Hazards*, 2006.
[36] Gine, Xavier; Townsend, Robert; Vickery, James: *Patterns of Rainfall Insurance Participation in Rural India*, 2007.

Insurance scheme example (part 2):

Product description	**Phase 1**	**Phase 2**	**Phase 3**
Excess rainfall cover			
- Trigger	10mm/day for 4 consecutive days	10mm/day for 6 consecutive days	10mm/day for 7 consecutive days
- Payout	1,500 Rs/acre	3,000 Rs/acre	6,000 Rs/acre
Drought cover			
- Upper threshold[37]	70mm	110mm	70mm
- Lower threshold	20mm	40mm	10mm
Indemnification			
- Above upper threshold	0	0	0
- Between upper and lower threshold	16 Rs/(mm*acre)	10 Rs/(mm*acre)	5 Rs/(mm*acre)
- Below lower threshold	3,000 Rs/acre	2,000 Rs/acre	1,000 Rs/acre

Payout scenario	**Phase 1**	**Phase 2**	**Phase 3**
Actual rainfall	104mm (thereof 10mm/day for 5 consec. days)	72mm	8mm
Insurance payout			
- Excess rainfall	1,500 Rs/acre	0	0
- Drought	0	380 Rs/acre[38]	1,000 Rs/acre
Total payout	**2,380 Rs/acre**		

Assessment

For ICICI Lombard and BASIX, the established cooperation for the promotion of the index-based rainfall insurance scheme led to a win-win situation. ICICI Lombard was able to sell its policies via the BASIX network without setting up a costly distribution channel of its own and at the same time without expensive awareness-raising and trust-building efforts. BASIX, on the other hand, was now able to combine its loans with weather insurance contracts in one product, e.g. a weather-indexed groundnut production loan. Loans then included a weather insurance premium leading to a slightly higher interest rate, but at the same time protecting the farmer and BASIX against loan defaults due to insufficient rainfall leading to bad crops.

With the restructuring of the rainfall insurance scheme, BASIX can also offer rainfall policies to other clients whose livelihoods suffer from the vagaries of the monsoon, such as agribusiness intermediaries. In contrast to the governmental insurance scheme, which sometimes does not release indemnification payments until more than two years after a drought, the rainfall insurance scheme of ICICI Lombard and

[37] Cumulative rainfall during the respective phase.
[38] Calculation: (110-72)mm*10Rs/(mm*acre) = 380 Rs/acre.

BASIX settled indemnifications promptly within 30 days of the end of the calculation period in the first two years of operation.[39]

Crop	Risk Details	States	Number of Farmers	Area Covered (acres)	Sum Insured (Rs mn)
Soybean	Deficit rainfall	RJ, MP	4,112	16,418	66
Oranges	- Deficit rainfall - Prolonged dry spell	RJ	453	1,223	6
Generic Product for all field crops	Deficit & Excess rainfall	Ap, Mp, MH, Jharkhand, KK, Orissa, RJ and TN	19,100	22,000	66
Grapes	Deficit & Excess rainfall, Temp	MH, AP	365	395	20
Paddy	- Prolonged dry spell - Excessive rainfall	Punjab	1,625	7,643	30
Cumin	High relative humidity	RJ	686	688	6
Coriander	- Frost like temperature - Unseasonal rainfall	RJ	2,075	2,200	6
Fenugreek	Excessively high temperature during days with high RH	RJ	70	260	2
Kinnu	- Excessively high temperature - Deficit rainfall	RJ	62	80	4
Wheat	- High temperature - Unseasonal rainfall	Punjab, Haryana	874	875	4
Cotton	Deficit rainfall	MH	100,018	100,084	160

ICICI Lombard: *Emerging trends in farm insurance – Weather Insurance*, presentation at the Agriculture Summit 2006, Delhi.

Since 2003, the Indian weather insurance market has grown rapidly. During the financial year 2005/06, ICICI Lombard offered index-based weather insurance for a wide range of crops and perils to more than 125,000 clients.[40] Initially the only company offering index-based weather insurance, ICICI Lombard faced competition from three additional insurance providers in 2004. Indian weather risk has also been reinsured in the international risk markets.[41]

Research issues

Although many publications provide a good insight into the index-based agricultural insurance schemes in India, further research needs to be done in order to highlight the successes and challenges in reaching the small and poor farmers and protecting them against agricultural losses threatening their livelihood. Furthermore, the sustainability and financial viability of the relatively new index-based insurance schemes should be observed during the coming years with a special focus on the role and importance of subsidies provided by the Indian Government.

[39] ISMEA; Hartell, Jason; Ibarra, Hector; Skees, Jerry; Syroka, Joanna: *Risk Management in Agriculture for Natural Hazards*, 2006.
[40] ICICI Lombard: *Emerging trends in farm insurance – Weather Insurance*; presentation at the Agriculture Summit in Delhi 2006.
[41] UN Department of Economic and Social Affairs: Sustainable Development Innovations Briefs, Issue 2, *Developing Index-Based Insurance for Agriculture in Developing Countries*, March 2007.

Sales of index-based weather insurance policies in India[42]

Year / Insurer	2003	2004	2005	2006
ICICI Lombard in cooperation with BASIX	230[43]	720	>25,000 (+100,000[44])	
IFCCO Tokyo	0	>3,000	>16,000	
Agricultural insurance company	0	~13,000	~125,000	
Government of Rajasthan	0	>1,800[45]		
Countrywide	**230**	**~18,000**	**~250,000**	**~500,000**

Sources:

- Gine, Xavier; Townsend, Robert; Vickery, James: *Patterns of Rainfall Insurance Participation in Rural India*, 2007
- Hazell, Peter; Skees, Jerry: *Insuring against bad weather – recent thinking*, 2005
- ICICI Lombard: *Emerging trends in farm insurance – Weather Insurance*; presentation at the Agriculture Summit in Delhi 2006
- ISMEA; Hartell, Jason; Ibarra, Hector; Skees, Jerry; Syroka, Joanna: *Risk Management in Agriculture for Natural Hazards*, 2006
- Stoppa, Andrea: *Weather-based index insurance for developing countries*, Eschborn 2007
- UN Department of Economic and Social Affairs: Sustainable Development Innovations Briefs, Issue 2, *Developing Index-Based Insurance for Agriculture in Developing Countries*, March 2007
- http://ifmr.ac.in/cmf/20070416/rainfall-insurance/
- http://www.basixindia.com/insurance.asp

[42] ISMEA; Hartell, Jason; Ibarra, Hector; Skees, Jerry; Syroka, Joanna: *Risk Management in Agriculture for Natural Hazards*, 2006;
UN Department of Economic and Social Affairs: Sustainable Development Innovations Briefs, Issue 2, *Developing Index-Based Insurance for Agriculture in Developing Countries*, March 2007.
Stoppa, Andrea: *Weather-based index insurance for developing countries*, Eschborn 2007.

[43] Most clients fell into the small farmer category.

[44] For the 2005 monsoon season, a leading Indian seed company bought a bulk weather insurance policy in order to attach free weather insurance coupons for a minimal level of drought coverage to its cottonseed packets. Packages were sold to approximately 100,000 farmers. (UN Department of Economic and Social Affairs: Sustainable Development Innovations Briefs, Issue 2, *Developing Index-Based Insurance for Agriculture in Developing Countries*, March 2007).

[45] Index-based rainfall insurance for orange and coriander farmers (ISMEA; Hartell, Jason; Ibarra, Hector; Skees, Jerry; Syroka, Joanna: *Risk Management in Agriculture for Natural Hazards*, 2006).

7.2.3 Case Study III: Mexico – Agricultural insurance sector and Catastrophic Farming Insurance for Climatic Events

Key Facts

Insurance type	Index-based rainfall insurance
Crops	Maize, beans, sorghum, barley and other crops which depend on sufficient rainfall
Peril	Drought (absence of rainfall)
Start of scheme	2005
Developer	Government of Mexico
Risk carrier	National fund and reinsurance company
No. of people insured	Not available
Eligibility	All farmers (including subsistence and semi-commercial farmers) who have sent the "farmer profile" form to the government
Cover period	Not available

Background and history

In Mexico, the agricultural industry provides employment to almost 21% of the total labour force. Besides big commercial producers using state-of-the-art equipment in specialised export-oriented agriculture, there is also a broad segment of the rural population whose production is aimed at self-consumption and who only cultivate crops on non-irrigated fields in small plots. 15 million of the 22 million hectares cultivated in Mexico are non-irrigated.[46]

Of all the countries in Mesoamerica, Mexico has the best penetration of insurance in the agricultural sector. Levels of premiums and hectares covered are large and a broad range of risks and crops are insured.[47] Several insurance schemes for different kinds of agricultural entrepreneurs ensure a wide market coverage. Due to the interesting set-up of the Mexican agricultural insurance market, the case study focuses both on the general structure of the insurance market in Mexico and on a product called "Catastrophic Farming Insurance for Climatic Events" providing insurance protection to small farmers.

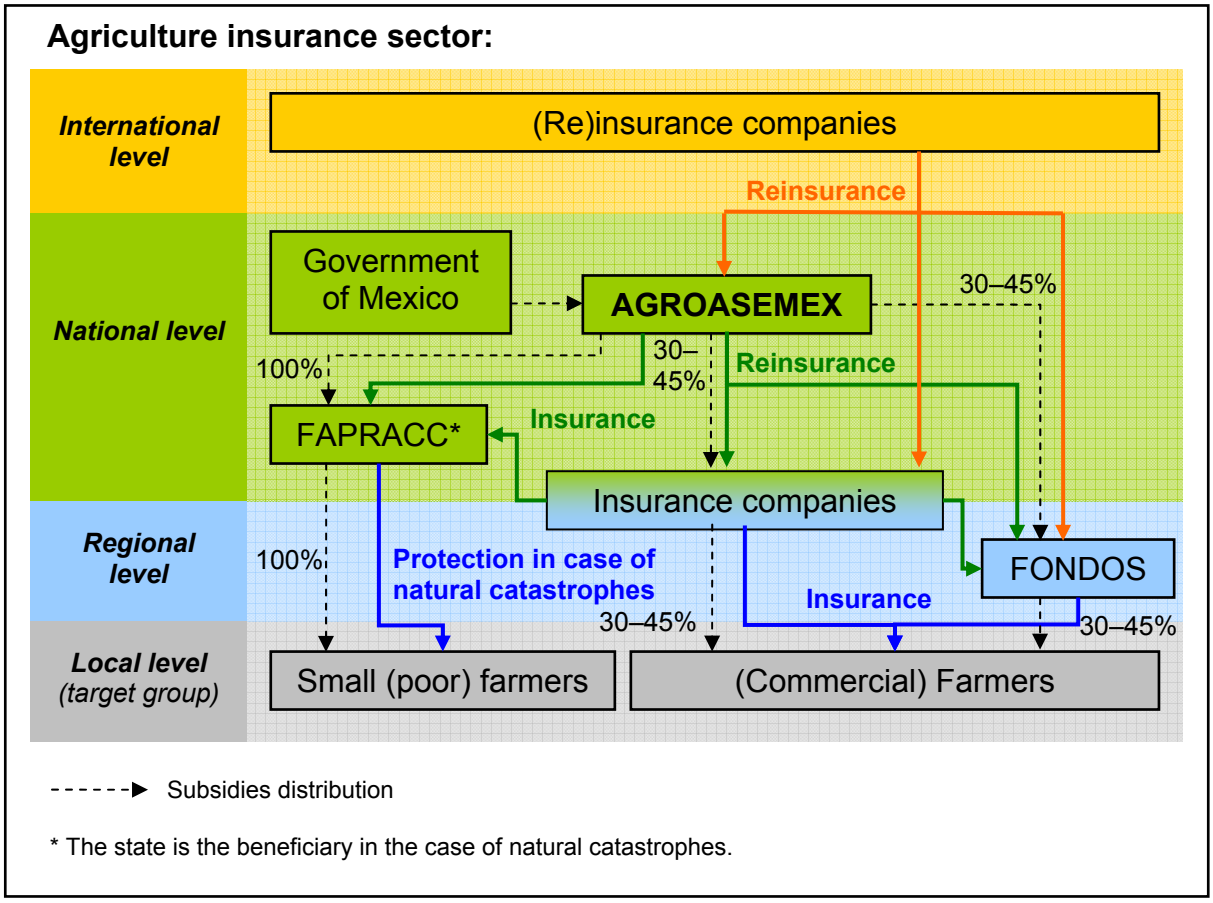
AGROASEMEX

A key role in the Mexican set-up is played by AGROASEMEX, a public reinsurance company created by the Mexican Government in 1991. Its mandate has changed over time from providing reinsurance and insurance directly to farmers to solely reinsuring the sector. Additionally, AGROASEMEX is mandated to provide technical assistance to FONDOS DE AUTOASEGURAMIENTO (see next page) and to develop new products, while private-sector insurance companies are free to sell any kind of product and service. As the state-owned reinsurance vehicle, AGROASEMEX is also responsible for distributing the premium subsidies allocated to the agricultural

[46] AGROASEMEX: *The Mexican Experience in the Development and Operation of Parametric Insurances Applied to Agriculture*, August 2006.
[47] Inter-American Development Bank: Arias, Diego; Covarrubias, Katia: *Agricultural Insurance in Mesoamerica: An Opportunity to Deepen Rural Financial Markets*, Washington 2006.

sector by the Mexican Government. All AGROASEMEX insurance products generally include a premium subsidy of 30% to 45%, whilst poor farmers get insurance cover via a special fund (FAPRACC) for free (100% premium subsidy). Moral hazard problems usually related to agricultural insurance are diminished by only insuring 60–80% of the expected yield instead of providing 100% coverage of losses.[48]

Internationally, the role of AGROASEMEX is discussed ambivalently. While development experts widely recognise and promote AGROASEMEX's role and mandate to further develop the agricultural insurance market and to pilot innovative schemes, international (re)insurance experts criticise its form of monopolistic market position, which may cause inefficiencies in the agricultural insurance market.



In its role as a reinsurance institution, AGROASEMEX not only provides reinsurance to the private insurance sector but also to non-profit organisations called FONDOS DE AUTOASEGURAMIENTO.

[48] Inter-American Development Bank, Mark Wenner: *Agricultural Insurance Revisited: New Developments and Perspectives in Latin America and the Caribbean*, Washington 2005 and information obtained in discussions with international reinsurance experts.

FONDOS DE AUTOASEGURAMIENTO

FONDOS DE AUTOASEGURAMIENTO are constituted by the farmers as civil associations. While using sound insurance market approaches in developing insurance products (e.g. underwriting of risks based on technical principles, loss adjustment procedures based on technical guidelines and rates developed according to sound actuarial methodologies), FONDOS at the same time take advantage of mutual-type organisational principles and structuring of incentives to control transaction costs. Especially in regard to the problems of index-based insurance products in dealing with the basis risk, the concept of mutual insurance funds offers the opportunity to pool risks across farmers and to indemnify heavily affected farmers more adequately. The products offered by FONDOS have multi-peril coverage, aimed at hedging both yield- and revenue-related risks.[49]

Since FONDOS usually do not have capital to guarantee their solvency, they need to buy enough reinsurance to guarantee members the full amount of indemnity in the case of a severe loss. Reinsurance treaties have to ensure unlimited coverage beyond the reserves of FONDOS, which therefore request an unlimited stop loss reinsurance treaty. The agricultural reinsurance market was opened recently and AGROASEMEX now faces competition with private (re)insurance companies. The first reinsurance contract from a FONDO to a private reinsurance company took place in 2006.[50]

20% of the premiums collected by FONDOS (including Federal subsidy) is paid to reinsurance companies as the average cost of reinsurance coverage. Another 20% is used to pay for operating expenses. The remaining 60% goes to current reserves to pay losses.

If there is anything left over after all losses have been paid at the end of the year, 70% of the remainder goes to a social fund for the benefit of the members. A quarter (25%) goes to the special contingency reserves and 5% to the social reserve for labour-related obligations. In the event of a loss, current reserves are withdrawn first, followed by contingency reserves, before reinsurance covers all outstanding losses.[51]

In 2003, the Government of Mexico founded FAPRACC, a fund for the care of rural population affected by weather contingencies *(Fondo para Atender a la Población Rural Afectada por Contingencias Climatológicas).* The fund provides insurance to the very small farmers working in the subsistence or semi-commercial farming sector.

FAPRACC

As a reserve pool for catastrophic weather events affecting small farmers, FAPRACC is aimed at providing support to low-income rural producers who do not have access to public or private insurance and who do not have the solvency to be members of a FONDO. Without FAPRACC, these farmers – who are mostly engaged in non-irrigated crop, livestock and aquaculture activities – would remain exposed to

[49] Saldaña-Zorrilla, Sergio; Advanced Institute on Vulnerability to Global Environmental Change: *Stakeholders' Views in Reducing Rural Vulnerability to Natural Disasters in Southern Mexico: Hazard Exposure, Coping and Adaptive Capacity*, 2006.

[50] Inter-American Development Bank: Arias, Diego; Covarrubias, Katia: *Agricultural Insurance in Mesoamerica: An Opportunity to Deepen Rural Financial Markets*, Washington 2006.

[51] Swiss Re: Sigma No. 1/2007, *Insurance in emerging markets*, Zurich 2007.

disasters without any insurance coverage.[52] FAPRACC is based on a system aimed at reaching only the poorest farmers and hedges the farmers' risks in two ways: ex-post, by paying indemnities after a disaster, and ex-ante, by subsidising crop insurance premiums.

The insurance policies are usually index-based (AGROASEMEX) or yield-loss-based (private insurance companies) and cover perils such as drought, frost and hurricanes. Indemnities are payable to the insured state government, which in turn distributes the indemnities to the small farmers in the region.

In the case of natural disasters, losses are assessed on the local level. Loss assessment reports are prepared by a technical committee and sent to the national government, which is the beneficiary of the indemnity payments in the first instance. All damaged agricultural producers listed as low-income population are eligible to receive the support upon request, up to the amount of hectares they have insured. Being responsible for the initial selection, the provinces request the resources from the Federal Ministry of Agriculture. The system is programmed to provide the resources to the state authorities within three weeks. The federal and state governments share disbursements 70–30%, mainly focusing on direct support to agriculture, livestock, and fisheries, granting per crop hectare, livestock unit, or damaged boat; by wage in the case of mitigation works; and for provision of catastrophe insurance.[53]

Formerly, the federal government made a payment of a fixed amount per hectare to the affected state government in the case of a catastrophic weather event. But as the amount of the reserve turned out to be insufficient to compensate all small farmers in the affected region, a few years ago the federal government allowed the use of FAPRACC resources to buy insurance cover instead of compensating losses. Some state governments then sought insurance protection from private insurance companies.

FAPRACC eligibility:

Eligibility for FAPRACC is based on the size and location of the farm and the kind of crops produced or livestock husbandry.

Annual crops

- Max. 20 hectares per farmer in the states of Baja California, Baja California Sur, Campeche, Coahuila, Colima, Chihuahua, Durango, Jalisco, Nuevo Leon, Sinaloa, Sonora, Tabasco, Tamaulipas, Veracruz and Zacatecas.
- Max. 10 hectares per farmer in the states of Aguascalientes, Chiapas, Guanajuato, Michoacan, Nayarit, Quintana Roo, San Luis Potosí and Yucatan
- Max. 5 hectares per farmer in the states of Guerrero, DF, Hidalgo, Mexico, Morelos, Oaxaca, Puebla, Queretaro, and Tlaxcala

Perennial crops or fruit trees

- Max. 5 hectares per farmer

Livestock husbandry

- Max. 25 cows or horses
- Max. 75 pigs
- Max. 125 sheep or goats
- Max. 125 bee houses
- Max. 2,500 poultry animals

Fishery

- Boat size: max. 10 tons

Aquaculture

- Max. 2 hectares

[52] AGROASEMEX: *The Mexican Experience in the Development and Operation of Parametric Insurances Applied to Agriculture*, August 2006.
[53] Saldaña-Zorrilla, Sergio; Advanced Institute on Vulnerability to Global Environmental Change: *Stakeholders' Views in Reducing Rural Vulnerability to Natural Disasters in Southern Mexico: Hazard Exposure, Coping and Adaptive Capacity*, 2006.

Description and assessment
Catastrophic Farming Insurance for Climatic Events is an index-based insurance intended to protect farmers via the insured state government in the case of extreme lack of rainfall (drought). The scheme covers basic crops such as maize, beans, sorghum and barley in non-irrigated areas. If the minimum amount of rainfall needed for successful development or production does not occur, indemnity is paid immediately.[54]

The following pre-requisites have to be established before the index-based insurance can be designed and distributed:

- Comprehensive and consistent database containing historical weather statistics
- Sufficiently developed infrastructure to correctly measure the index value
- Involvement of an independent third party to guarantee that measurements are not manipulated

The set-up of the Mexican agricultural insurance sector takes into account that there is no "one size fits all" insurance solution for the diversified agriculture sector, with all its various kinds of farmers, farm sizes and crops. There are not only tailor-made products available for each category of farmer: the institutional set-up is also adapted to the specific needs of the different categories.

The Mexican system centred around AGROASEMEX is attributed the following strengths and advantages:

- Promotion of the development of the agriculture sector as part of the mandate of AGROASEMEX
- Reinvestments in the sector, mainly through the FONDOS structure
- Increase of affordability of insurance via the premium subsidy (up to 100% for FAPRACC)
- Governmental promotion of research and development of new and innovative products that could lead to better and tailor-made insurance protection.
- Reduction of moral hazard and undue payments through FONDOS

Swiss Re: Sigma No. 1/2007, *Insurance in emerging markets*, Zurich 2007.

Reality has shown that the intention of creating FONDOS as an ideal vehicle to insure low-income farmers has not been realised. Instead, they compete with private reinsurance companies for entrepreneurial farmers, due to their reduced reserving requirements. They were mostly founded by richer farmers with larger farm sizes in the very fertile areas of Mexico. Nevertheless, mutual-type organisations such as FONDOS in Mexico seem to be a potentially viable institutional arrangement to deliver agricultural insurance to small-scale farmers. While moral hazard is reduced by peer monitoring, the basis risk usually related to index based insurances is spread among group members, so that substantial losses of one farmer can be more adequately compensated.
FONDOS have performed well in the past decade. Their combined ratio has been 0.78 (including the government subsidy of 30% of the premium) and 1.08 (not

[54] AGROASEMEX: *Drought Monitoring Approaches for Parametric Agro-reinsurance in Mexico*, October 2006

including the subsidy). This is a good performance by international standards for multi-peril agricultural insurance (see table 1, page 10).[55]

FAPRACC increased protection in terms of the acreage covered from 273,600 hectares in 2003 to 1,038,000 hectares in 2005. Livestock insurance was provided for 2,592 animals in 2003, increasing to 113,590 animals in 2005. 64% of the regions that received FAPRACC support were located in the poorest areas of Mexico. In 2006, 18 states in Mexico participated in the FAPRACC programme, with three of them buying private catastrophe insurance cover from the FAPRACC resources.[56]

Private insurance cover under FAPRACC in 2006

State	**Total acreage insured** (ha.)	**Total sum insured** (Pesos)	**Premiums** (Pesos)	**Indemnities** (Pesos)
Jalisco	126,901	63,450,500	9,758,687	8,819,183
Tamaulipas	151,482	88,313,773	13,664,478	1,674,119
Hidalgo	175,156	140,124,792	10,826,414	3,571,064
Total	**453,539**	**291,889,065**	**34,249,579**	**14,064,366**

According to international (re)insurance experts, the sustainable establishment of the index-based rainfall insurance still requires further improvement and extension of the necessary infrastructure and organisational design that guarantees measurements are not manipulated.

Research issues

Although many publications provide a good insight into the Mexican agricultural insurance sector, further research needs to be done in order to highlight the successes and challenges of the system. The scepticism of international (re)insurance experts about the use of index-based insurance products indicates that existing pilot schemes have to be well analysed, documented and further developed. The promotion of mutual-type organisations such as FONDOS as an opportunity to provide cost-efficient agricultural insurance to small farmers while at the same time reducing the individual basis risk requires more research to overcome the existing obstacles (e.g. lack of customer education, financial resources required to found a FONDO, etc.). Finally, indemnification procedures for small farmers insured under FAPRACC should be further examined to find out whether trigger definitions are adequate and indemnities absorb the agricultural losses threatening the livelihood of small farmers and their families.

[55] Swiss Re: Sigma No. 1/2007, *Insurance in emerging markets*, Zurich 2007.
[56] According to interviews with international (re)insurance experts.

Sources:

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