



THE EMERGENCE AND DEVELOPMENT OF AGRICULTURE MICROINSURANCE

A Discussion Paper

By Thérèse Sandmark, Jean-Christophe Debar, and Clémence Tatin-Jaleran

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Thérèse Sandmark, Jean-Christophe Debar, and Clémence Tatin-Jaleran

List of Acronyms

AFD	French Development Agency
CCE	Crop-cutting experiment
CIMA	Intrafrican Conference on Insurance Markets
CIRC	China Insurance Regulatory Commission
CNAAS	National Company of Agricultural Insurance of Senegal
CNCAS	National Fund for Agricultural Credit of Senegal
CRMG	Commodity Risk Management Group
ECGM	EARS Crop Growth Model (EARS is the name of the company)
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
FCFA	West African CFA Franc (currency)
FESR	Stability Fund for Rural Insurance
GDP	Gross Domestic Product
GPS	Global Positioning System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
ha	Hectare
IFAD	International Food for Agriculture Development
IRB	Brazilian Reinsurance Institute
MAD	Moroccan Dirham (currency)
MAMDA	Moroccan Agricultural Mutual Insurance Company
MCMA	Moroccan Central Mutual Insurance Company
MPCI	Multi-Peril Crop Policy
MFI	Microfinance Institution
mNAIS	Modified National Agriculture Insurance Scheme of India
NDVI	Normalized Difference Vegetation Index
NEPAD	New Partnership for African Development
NGO	Nongovernmental Organisation
OECD	Organisation for Economic Co-operation and Development
PICC	Peoples Insurance Company of China
PPP	Public Private Partnership
SEAF	Insurance for Family Agriculture
TBH	Thai Baht (currency)
USD	USA Dollar (currency)
USDA	U.S. Department of Agriculture
WII	Weather Index Insurance
WFP	World Food Programme
WTO	World Trade Organization



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Introduction



Efforts to improve farmers' access to agricultural insurance products are more substantial now than ever. Concerns for food security, in the context of rising demand, commodity price volatility, and climate change, have increased the interest in agricultural insurance. Concerns for food security – in the context of rising demand, commodity price volatility, and climate change – have increased the interest in agricultural insurance, been the subject of several official and unofficial reports, and given birth to several pilot projects run by private entities alone or in the context of private public partnerships. These concerns are mentioned in the Action Plan on Food Price Volatility and Agriculture, released by the G20 in Paris in June 2011 (see Appendix D – Coordination initiatives). New technologies are contributing to progress and opening up new opportunities. In the emerging world, the premium volumes for agriculture insurance are increasing significantly in a handful of countries – India, China, Mexico, and Brasil – due to heavy government support. As a result, the number of premiums underwritten in agriculture is reaching record high levels. Where there is no generous government support, however, markets are growing slowly. Moreover, index products have not been successfully commercialised at scale for smallholder farmers outside of India.

Interest in agriculture insurance stems from its potential impact on the sustainability of farms, as despite a bad harvest insurance would allow farmers to keep their productive tools (assets) and maintain their capacity to reinvest in preparing for the next crop cycle. Insurance is also expected to open up access to credit markets and encourage agricultural loans, which can lead to further investments in productivity. The stabilisation of the farmers' purchasing power also can, in turn, stimulate nonagricultural economic activity in rural areas. Agriculture insurance cannot, however, be seen as a substitute for climate change adaptation, for which a full range of interventions will be needed.

This paper provides an overview of the current debates and developments in the agricultural insurance sector in emerging markets, with particular attention to the special challenges of index insurance products.

The paper starts by setting the context, describing how agriculture insurance emerged in Europe and North America and later spread to other continents, then discusses the state of agriculture markets at present. Recent developments have seen the increase of index-based insurance schemes which are detailed under the following chapter. This is followed by a discussion about the actors involved in the provision of these insurance contracts, integrating recent literature covering this topic, and underlining what can be learned about the value of these products. Four case studies – in Brasil, Morocco, Senegal, and China – describe different country examples and their approaches to developing agriculture insurance, focusing on the value proposition of each system.

Definitions

This paper generally addresses the agriculture insurance sector as a whole and makes no distinction between insurance and microinsurance, as most developing countries still need to lay the foundation for the emergence of a healthy insurance sector for agriculture in general. It is, however, understood that microinsurance targets smallholder, low-income farmers in particular. In order to address the insurance needs of smallholder farmers, the authors adopted the approach that the first step is to create a long-term, efficient, and sustainable insurance system for the agricultural sector and, thereafter, reflect on how to integrate the small and more vulnerable farmers. The exact definition of smallholding farms is different in every country and established by the size of the landholding, the degree of market orientation, and the levels of vulnerability to risk and competitiveness.

Following the government classification of farmers, they can decide how to address their country's particular insurance needs, whether they chose to do so through a general system with particular advantages targeted at the smallholder farmers, or through a separate system for this group altogether.

The development of agricultural insurance mechanisms for smallholder farmers should be seen as part of a long-term ambition to integrate these economic players into the agricultural value chain by providing them with access to risk management tools that would allow them to act as entrepreneurs.



Context



Why is agriculture insurance important?

With the majority of the population of the developing world living in rural areas, agriculture can be a key driver of economic and human development.¹ However, agriculture is a risky business, especially in developing countries where small-scale farmers often have to deal with a series of risks related to the weather, market, production, and political environment. Risk has both positive and negative aspects, as on one hand, upward price variations for crops and livestock offer market and investment opportunities. On the other hand, climate hazards, decreases in commodity prices, and/or increases in input prices create a very uncertain environment for the farmers, with unfavorable economic and social consequences. This downside risk distorts investments, puts assets in jeopardy, and makes farmers unattractive clients to financial institutions. As a result, farmers are limited in their capacity to invest in improved and innovative agriculture methods. Banks are very reluctant to lend to farmers and do so only at very high interest rates. As a result, farmers are limited in their capacity to invest in improved and innovative agriculture methods.

These effects are even more disastrous for poor farmers in developing countries, where formal safety nets are absent or very limited. An unstable environment makes it impossible or very hard for them to escape the poverty trap. Overall, the agricultural sector tends to produce less than its potential, with a negative impact on society in terms of growth, rural employment, and food security.

Indeed, without managing weather risks, farmers' integration in value chains, which gives

them access to markets, is compromised. This is especially important for operators of small and medium-sized farms who could have a surplus to sell on the market.

Climate hazards will intensify as climate changes, resulting in more frequent extreme weather events in terms of temperature, rainfall, and storms. These events increase both the need and the cost of risk management. Small-scale farmers will need to invest in adapting their farming techniques. Moreover, climate hazards put pressure on traditional risk coping mechanisms, as all members of the community will be affected by the adverse climate events.

Following the human and geopolitical effects of the food crisis, international awareness has drastically increased regarding the challenging situation of the farmers. As a result, important resources have been mobilised in order to tackle this global challenge and find a system that protects and improves local food production. In response, traditional agricultural risk management policies and strategies have been reviewed and now put more emphasis on the role of agriculture insurance. Indeed, taking away the risk for farmers could open space for innovation, unlock financial markets, and improve productivity. A key question remains, however: how to set up agricultural insurance systems that are both efficient and affordable to farmers?

The study called *The Potential for Scale and Sustainability in Weather Index Insurance for Agriculture and Rural Livelihood*, published by IFAD/WFP, looks at index agriculture insurance

¹ 3.1 billion people, or 55% of the total population and 70% of the African population live in rural areas according to the "Rural Poverty Report 2011," (Rome: IFAD, 2010), 16.

in particular and identifies it as a tool for disaster relief or for development:²

Index insurance for disaster relief would protect people – their lives, health, and assets – against catastrophic losses. It could help save lives and livelihoods through faster, more cost-effective responses to disasters.

Index insurance for development has the potential to help farmers protect their investments, can open doors to methods for increasing incomes (e.g., contract farming, access to

credit), and can be part of a wider strategy to help farmers escape poverty.

Although the sector is still missing systematic impact studies demonstrating the agricultural insurance contribution to agricultural development, the current rise in awareness around this topic reflects that there is a widespread belief that there is a link. As a brief history of the emergence of agriculture insurance will illustrate, the first schemes in Europe and North America evolved hand in hand with the agricultural expansion.

Brief history of the emergence of agriculture insurance schemes

The first agricultural insurance markets emerged over 200 years ago as a protection against the risk of livestock mortality and climate risk, mainly hail. Hail insurance, the oldest type of agriculture insurance, has existed in Germany since the late 1700s. Livestock insurance emerged in the 1830s. The first insurance schemes were implemented primarily by small cooperative structures that provided cover against a single identified risk. It was not until 1930 that multi-peril insurance emerged in the United States, and later in Japan and Canada, in 1939 and 1959 respectively. Today, these products are common in most of Europe.

The last fifty years have been marked by a significant expansion in the supply of insurance solutions brought on mainly by increasing government support, whether in the form of premium subsidies or as a reinsurance provision. The development of the private agricultural insurance sector has increased with the countries' development levels. For example, coinsurance pools that usually rely on Public Private Partnership (PPP), have been established,

mainly in middle-income countries, as a way to strengthen the supply of agricultural insurance.

The volume of global agricultural premiums increased dramatically between 2004 and 2007, rising from US\$8 billion to about US\$15 billion. This stunning increase is, in part, due to rising agricultural commodity prices and sum insured values on which premiums were paid. Additionally, the expansion of agricultural insurance and increasing government subsidy support in major countries like China, India, and Brasil have contributed to the increase in premiums.³

Although mature, the markets in Europe and North America are still changing, often influenced by evolving agriculture policies and regulations. In the European Union (EU) for instance, the regulation changed in 2008, to allow crop insurance premiums to be subsidised both by the EU and national governments, opening up opportunities to encourage new players to enter the field. Other changes in national agricultural policies also impact the sector, pushing new models to emerge. In France, for instance, the

² P. Hazell et al., "The Potential for Scale and Sustainability in Weather Index Insurance for Agriculture and Rural Livelihood," (Rome: WFP/IFAD, 2010), 22.

³ O. Mahul, and C. J. Stutley, *Government Support to Agricultural Insurance: Challenges and Options for Developing Countries*, (Washington, D.C.: World Bank, 2010), 6.

government is reassessing the risks covered by the calamity funds and gradually requesting insurance companies cover new types of crops for risks traditionally categorised as "uninsurable." In this context, the use of new technologies, such as satellite imagery, are being explored. The first satellite-based index insurance in France will be piloted in 2013 for tracking forage.

Area yield index insurance has been tried for some years in the United States, Canada, Brasil, Ukraine, and India, whilst the indirect indices (like the satellite-based index insurance in France) are quite new and only running as pilot projects in some countries (see Appendix C – Index-based insurance programmes – for examples).



BOX 1

The Indian example

As one of the first countries to develop agriculture index products, India today offers a wide diversity of agricultural insurance products. This is also a result of their constant search for improvement and innovation, and a long-term commitment from the government. After implementing an area yield index insurance and a weather-based insurance, India recently launched a hybrid product, the mNAIS, combining both indices to limit basis risk and shorten the claim settlement process. Often cited as an example, the Indian case is already extensively documented and will not be detailed in this paper. For further information about the Indian case, the authors recommend reading Mahul, Verma, and Clarke's *Improving Farmers' Access to Agricultural Insurance in India*, published by the World Bank in March 2012.

Agricultural insurance markets – developed and developing nations

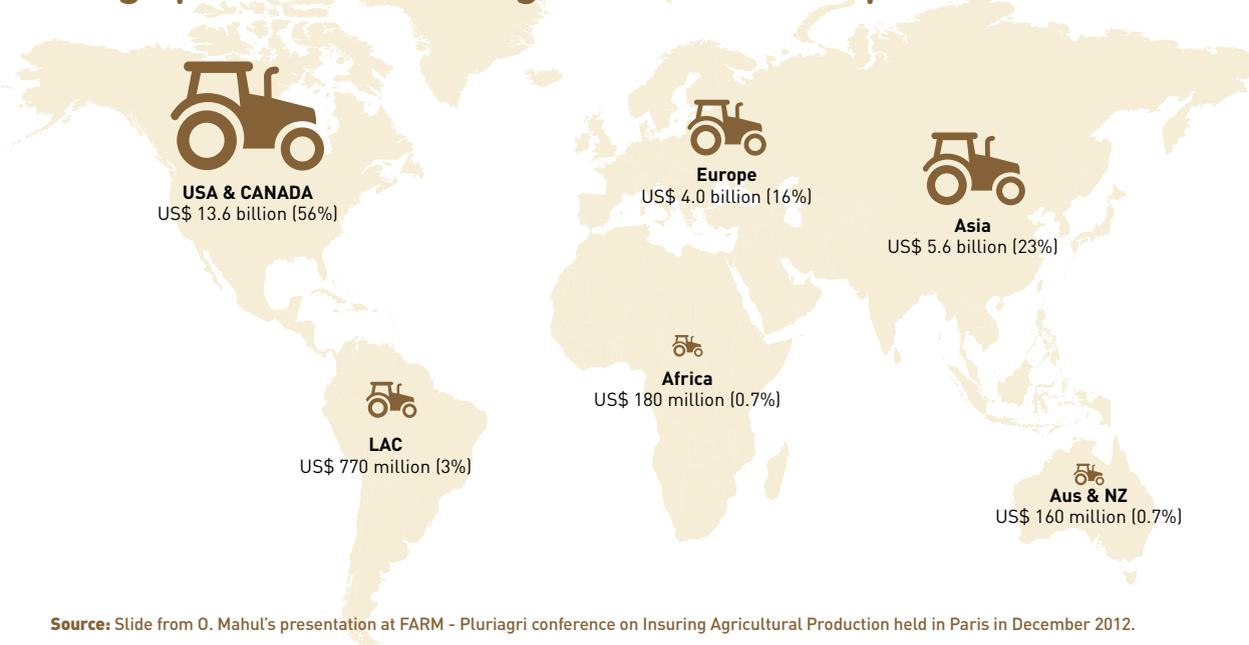
A World Bank study in 2010 reported that the global agriculture insurance premiums amounted to US\$24.31 billion.⁴ The breakdown by geographic area is illustrated by Figure 1.

Agricultural insurance provision is dominated by high-income countries, and by China and India. In 2008, the agricultural insurance premium volume in China was estimated at US\$1.75 billion, making this middle-income country the second largest agricultural insurance market after the United States.⁵

As mentioned earlier, the United States and many European countries have had some form of crop or livestock insurance for more than a century. They are now mature markets with high penetration rates and offer comprehensive risk coverage for farmers. In contrast, in many developing countries, agricultural insurance has been operating for only five to ten years (even less in some countries), and agricultural insurance demand and uptake have yet to take off. India can be considered an early starter in this category, launching its first agriculture insurance products targeting small-scale farm-

FIG 1

Geographic distribution of agricultural insurance premiums



Source: Slide from O. Mahul's presentation at FARM - Pluriagri conference on Insuring Agricultural Production held in Paris in December 2012.

⁴ Ibid., 8.

⁵ Ibid., 8.

ers in the 70s. Around 30 million Indian farmers are covered by such products today.

Figure 2 shows the relationship between the level of premium subsidies and market development. The regions with the highest volumes of premium are also the ones with the most financial support from the government. Government support of agricultural insurance exceeds 50% of agricultural insurance premium volume and the largest agriculture market in the world (North America) subsidises premiums up to 73%.

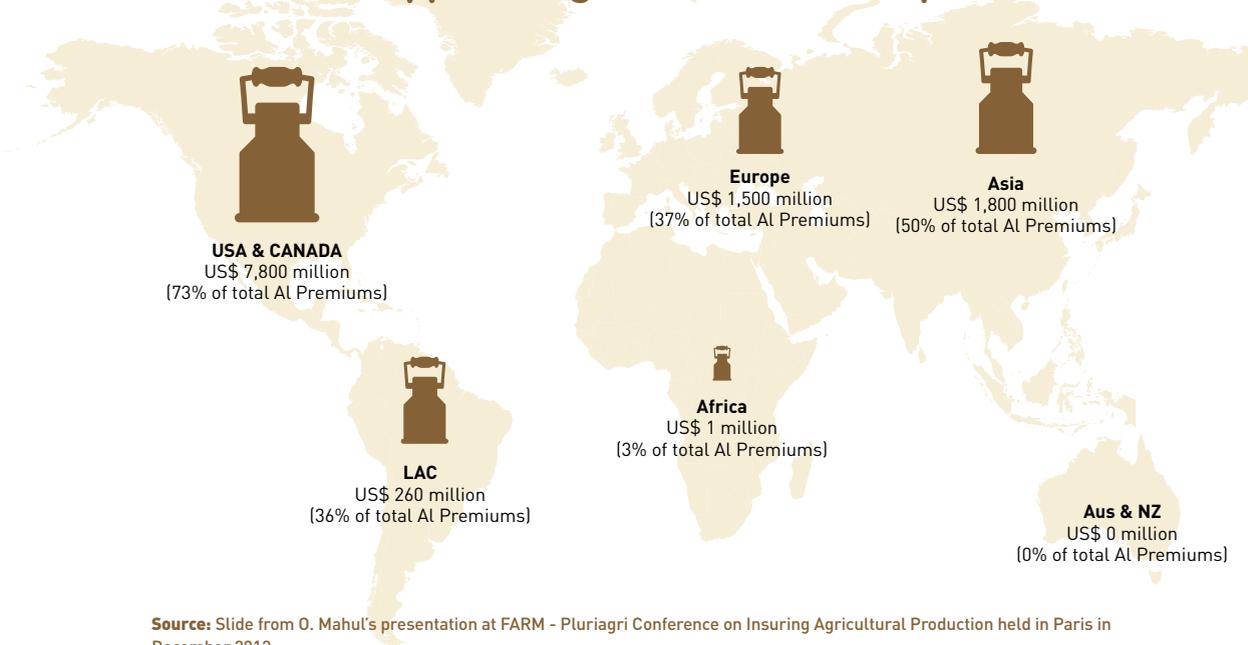
Developed countries, and developing countries that have succeeded in setting up a strong crop insurance system (India, China), show that this success has been due, in large part, to public

support granted through premium subsidies or reinsurance. This long-term commitment of the government has also led to investments in public goods, such as the human and material infrastructure needed to produce and disseminate long time series of reliable data on climatic events and crop yields, experts, and a favorable public policy.

The European Commission's report from 2008 on Agriculture Insurance Schemes also underlines the important role of public funds in the development of agricultural insurance products, stating that, in Europe, there is no comprehensive yield insurance without public support. For nonsystemic risks, like hail, the private sector offers suitable insurance products; but for insurance products offering a wider

FIG 2

Government support to agricultural insurance premiums



Source: Slide from O. Mahul's presentation at FARM - Pluriagri Conference on Insuring Agricultural Production held in Paris in December 2012.

coverage for yield reduction, there is a direct relationship between development of the system and public support.⁶ Governments, indeed, need to choose between keeping underdeveloped agricultural systems or high budgetary expenditures.

As demonstrated by the experience in the United States, policies under the Agreement on Agriculture at the World Trade Organization (WTO) that are supposed to limit trade-distorting farm support, including crop insurance subsidies, provide ample room for risk management schemes. The flexibility is even greater for developing countries, which benefit from less constraining disciplines for agricultural subsidies at the WTO.

However, Africa has very low levels of government subsidies and, consequently, very low levels of market development, particularly for small-scale farmers. The latest figures regarding agricultural microinsurance from the continent come from the *Landscape of Microinsurance in Africa* study.⁷ This study reported that in 2011, only 220,000 households were covered by agricultural microinsurance in Africa (approximately half being in Sudan), representing US\$6.61 million in premiums. The study identified agriculture microinsurance in the following countries: Ethiopia, Kenya, Tanzania, Rwanda, Zimbabwe, Sudan, Algeria, Morocco, Ghana, Benin, Burkina Faso, as well as Senegal and Mali, which have fewer than 50 policies each. The study did not identify any agriculture microinsurance products in Southern Africa. Although more prevalent in the East and Central regions of Africa, overall agriculture microinsurance has remained limited. Similar to the emergence of agriculture insurance in Europe, the study noted that cooperative insurance structures

offered the majority of the products - nearly 60%.⁸ Developing countries also distinguish themselves, as the index insurance model is much more prominent in these countries than in developed nations where it is emerging at a slower pace.

A similar study for Latin America and the Caribbean found that, in 2011, only two agriculture microinsurance products were identified in the region. One product in Paraguay covered 142 people, and another in Bolivia covered 8 people. The study, however, does not include products for which the government is the risk-carrier.⁹

In summary, the agricultural insurance sector is quite mature in developed countries and present in all its forms (private insurance and public insurance). It is characterised by the coexistence of many systems: yield, income, index insurance, etc. The sector is provided mainly in the form of indemnity-based insurance (not index), and is heavily subsidised, either directly, through premium subsidies, or indirectly, through public reinsurance. There is a clear correlation between the longevity of the schemes and government support to the comprehensiveness of the coverage and the market penetration.

Agricultural insurance is making breakthroughs in developing countries, even if it is still at an experimental stage in many cases. The entities driving development of the agriculture insurance market in Europe, North America, and India were, at first, the cooperatives and the public sector; the private insurance market came in at a later stage. In developing nations, the main driver of this development seems to be rural cooperatives and, to some extent, international donors.

⁶ M. Bielza et al., "Agricultural Insurance Schemes," (Ispra: European Commission, 2008): 32.

⁷ M.J. McCord, R. Steinmann, and M. Ingram, "Briefing Note: The Landscape of Microinsurance in Africa 2012," (Bonn: GIZ; Munich: Munich Re Foundation, 2012).

⁸ Ibid.

⁹ M.J. McCord, C. Tatin-Jaleran, and M. Ingram, "The Landscape of Microinsurance in Latin America and the Caribbean: A Briefing Note," (Bonn: GIZ; Munich; Munich Re Foundation, 2012).

BOX 2

A brief note on the bibliography

A review of the literature available on the topic of agricultural insurance led to the following key observations:

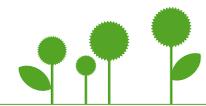
The available documents on agricultural insurance in the development context are often academic. Definitions and concepts are generalized and mostly focus on broadly describing the economic model of insurance systems. The documents overlap and tend to focus on index insurance.

Generally, based on numerous examples of projects in developing countries, these projects would gain credibility with improved detail on financial aspects addressed systematically and comprehensively. Important elements to include are the calculations of premiums, insurers' margins, and the profitability of the insurance systems. Also important are contract design, resolution of disputes, and reviews of applicable laws. A good example of a very well-developed publication is *Government Support to Agricultural Insurance – Challenges* by the World Bank.

Regarding the country case studies, experiences in Africa are sparsely well-documented. Examples of implementation of insurance systems are confined to Ethiopia, Malawi, and Kenya (without further precision). There is, however, little information about Morocco or Senegal, which the authors of this report have tried to consolidate in the case studies later in this paper. In Latin America, the case of Brasil is sometimes mentioned, but rarely developed. Mexico has been more documented. Asia, India, Mongolia, and China appear as the pioneering countries in agricultural insurance. Apart from the Ukraine, no country in former Eastern Europe is mentioned in case studies on agricultural insurance.

It should be noted that assessing the level of profitability of agricultural insurance systems is a challenge, as data is neither very numerous nor very homogeneous.





Index-based agricultural insurance

Agricultural insurance products are usually classified into three main groups: indemnity-based insurance, income insurance, and index insurance. In view of recent developments, this

chapter focuses on index insurance. A brief description of indemnity-based insurance and revenue insurance can be found in Appendix B – Product types.

Main features of index-based insurance

The payout for index-based insurance relies on the value of an index and not, as for indemnity-based insurance schemes, on measurable losses. A threshold is set, below which the insurer will compensate the insured. There are two types of categories – direct and indirect indices:

- Area yield index insurance, for which the index is *directly* an area average of yield, live-stock mortality, or income.
- *Indirect* index insurance, which relies on other kinds of underlying data, such as rainfall, temperature or vegetation indices (computed from weather stations or satellite images) correlated with losses the farmers incur on the ground.

The United States, Canada, Brasil, the Ukraine, and India have experienced area yield index insurance for some years, whilst the indirect indices are quite new and only running as pilot projects in some countries. Appendix C – Index-based insurance programmes, provides a list of agriculture index insurance schemes in the world.

Two important preconditions for index insurance are the existence of sufficient and reliable data for its construction. The objectivity and transparency of the underlying index helps the stakeholders (e.g., the farmer, insurer, and government) trust the index. Objectivity means that

no party (the insured, insurers, or reinsurers) can influence the index measurement. Transparency means that the data and methodology used for constructing and measuring the index is reliable.

The main advantage of index-based insurance is that it avoids problems of moral hazard and adverse selection inherent in the classic indemnity-based insurance. Each farmer represents one entity in a large number of producers whose combined performance (calculated by objective measures provided by meteorological stations, satellite data, or regional-level yield data) determines the value on the index. Moreover, individual loss assessments are no longer needed, which decreases the administrative costs and makes the payout process fast and inexpensive. The transparency of the system can also facilitate the access to international reinsurance markets.

Despite these announced advantages, the aggregate premium volume for agriculture index insurance remains very low and markets remain underdeveloped, with only a few insurance contracts offered and with low take-up. The sustainability of these schemes, however, requires a very large number of clients to subscribe to the policies in order to maintain low-cost premiums. Except in India and Mexico, most of the index-based crop insurance programmes are still under pilot implementation,



with only few farmers insured.¹⁰ Another disadvantage is that index insurance is hardly suitable for complex and/or multiple risks, such as price risk.

Current debates

Index-based insurance schemes draw more and more interest, as evidenced by the numerous studies and research about the topic and the raising of awareness fostered by international organisations. Between 2007 and 2009, IFAD reports there were at least 30 programmes in 19 countries, reaching 1.2 million beneficiaries.¹¹ In Appendix C, the list is updated and complemented with other sources, and includes a total of 40 countries that are currently implementing or piloting index insurance schemes for agriculture.

Prospects for index-based insurance seem promising, but the challenges are equally important. After the recent surge in number of projects, the critics of index insurance for small-scale farmers are now emerging, raising important issues that need to be addressed for the sector to fulfill its potential, particularly for small-scale farmers. The main issues highlighted and discussed in this paper are taken from the following three sources:

This paper discusses the current debates on the challenges of the development and take-up of index insurance and basis risk, which constitute the major technical challenge.

- The blog entry of Daniel Clarke¹², researcher at Oxford University, which summarises and provides references on the lessons to date from the pilots in agriculture index microinsurance projects;
- Discussions by Joachim Herbold¹³ at Munich Re, presented in his article, "Crop insurance in developing economies- the insurers' and reinsurers' perspective"; and,
- The IFAD and WFP report, *The Potential for Scale and Sustainability in Weather Index Insurance*.

For further reading on current debates, this paper recommends the 2013 publication, *How to provide sustainable insurance for low-income farmers*, by Reinhard and Qureshi. The publication summarises the presentations and discussion at the plenary session of the 8th International Microinsurance Conference, which dealt with the state of agriculture insurance for the poor and how its shortcomings may be addressed.¹⁴

¹⁰ O. Mahul, and C. J. Stutley, *Government Support to Agricultural Insurance: Challenges and Options for Developing Countries*, (Washington, D.C.: World Bank, 2010), 8.

¹¹ Hazell et al., "The Potential for Scale and Sustainability," 33.

¹² CSAE blog entry, November 2012, blogs.csae.ox.ac.uk.

¹³ In *Rural 21 - The International Journal for Rural Development*, April 2010.

¹⁴ http://www.microinsuranceconference2010.org/dms/MRS/Documents/20130801_Reinhard-Queeshi_Trendmonitor-Sustainable-Insurance/20130801_Reinhard-Queeshi_Trendmonitor-Sustainable-Insurance.pdf "[sic]".

Basis risk

The major technical challenge for index insurance is basis risk, an important issue leading to questions about the real value of these products. Basis risk refers to the differences that may occur between the actual loss incurred by the farmer and the loss determined by the index, entailing claims for nonexistent losses and no claims for effective losses. Individuals may suffer losses, but not receive payouts, or not suffer losses, but get payouts. Basis risk is mainly caused by perils such as pest, disease, wind, flood, frost, hail, and localised weather that can cause catastrophic losses but are typically not well captured by weather indices. Farmer behaviour (e.g., planting date) is very difficult to capture in a formula set at the beginning of the season and creates the second-most common basis risk. This may mean that the weather index insurance contract is particularly sensitive to rainfall during the wrong periods. More and more practitioners are raising the issue of the sowing date, underlining the importance that monitoring of the index begins when the farmer plants.

Theoretically, basis risk is divided into three types of risks:

- Spatial: For example, two villages dependent on the same weather station may suffer different losses.
- Temporal: There may be some time between the event and the detection by the index and vice versa.
- Loss-specific: The index may be ill-correlated to the real yield, not capturing all factors affecting crop.

Reducing basis risk is key to creating a product that is as efficient as possible (and approved by clients). Improvements in product design allow the reduction of the impact of each component of basis risk. Following are three examples of how basis risk can be reduced through contract design:¹⁵

- Firstly, and foremost, is the choice of the index (and the identification of growth phases). The closer the correlation between the index and the yield, the less likely basis risk is.
- Secondly, contracts with double scale/trigger can focus on real losses whilst still avoiding moral hazard. A primary trigger at a smaller scale (village) allows a close correlation with individual losses. As this trigger level could lead to moral hazard, it is coupled with a second trigger on a larger scale (several villages, a cooperative) to which the payout of indemnities is conditional, thus reducing the occurrence of moral hazard. An example is the double trigger yield index insurance that was developed for cotton in Mali.
- Thirdly, is to promote the development of a mutual insurance pool at the community level. This pool would play the traditional role of an insurer for idiosyncratic risks, having the individual loss rates assessed by the community. On a second level, the community subscribes an index insurance policy for correlated risks. The index acts like a reinsurance contract in this case. This type of insurance contract is further discussed under meso-level insurance.

These examples illustrate that there are many ideas to be explored for improving the accuracy of index-based loss detection. This opportunity for improving accuracy underlines the need to complement indices with more field data for a more accurate measure and correlation. The technological advances in satellite imagery and telecommunications, for example, are rapidly bringing down the costs of more precise information, which could improve basis risk. New innovations and experimentations are continually attempting to address this issue.

Clarke¹⁶ states that basis risk remains too high, as there is currently no convincing statistical

¹⁵ M. R. Carter, "Innovations for Managing Basis Risk under Index Insurance for Small Farm Agriculture", *Ferdi Policy Brief* 41 (2011).

¹⁶ CSAE Blog Entry, November 2012, blogs.csae.ox.ac.uk.

evidence from any programme suggesting that weather index insurance can be relied on to pay in years that are bad for smallholder farmers. Whilst statistical analysis of basis risk has not been conducted for most pilot weather index insurance programmes, available evidence is very negative. The existence of quality production data remains an issue hindering model calibration.

Although the causes of basis risk are known and innovations in technology and contract design are driving the improvement and increased

accuracy of indices, little is known about how basis risk is actually handled and approached by current index insurance programmes. The authors of this paper recommend further studies on this topic. Are there systems in place for clients to challenge the result of the indices? Are there systematic ground verifications exercises that validate the index results? Are there contingency funds in place to compensate the clients who were exposed to basis risk and, if so, how are these managed? How accurate do index products need to be in order to provide value for the farmers?

Area yield index insurance (direct index)

In traditional indemnity-based insurance, the insured yield is that of the subscriber. In area yield index insurance, a reference yield is taken, which is the same for every farmer in the area (the size of the area can range from a village to a whole region). This type of index allows building multi-peril policies, as it covers all types of catastrophe (climatic, pests, diseases, etc.) entailing a loss of yield in the defined area. The advantages of an area yield index are that temporal and loss-specific basis risk are nonexistent, but the spatial risk may be important,

depending on the size and homogeneity of the area for which the reference yield is established. The concept of area yield insurance is also easier understood by farmers, as it is not far from traditional insurance. The disadvantages are that it is costly to verify and depends on reliable historic data provided by local government, which is difficult to find. The payout may also take time to establish because it depends on the availability of the yield data after the harvest period.

Weather-based index insurance (indirect index)

The main features of weather-based index insurance are that compensation is not determined by the actual loss of yield at the individual level (each farmer) but by a defined weather event that is correlated with the lifecycle of the insured crop. The payout is triggered by changes in an index correlated to crop yield, such as rainfall, temperature, soil humidity, number of storms a year, or wind velocity.

There are several constraints of weather-based index insurance. Research costs remain high, due to the need to gather and analyse a considerable amount of climatic data. The process is

labour intensive and the cost of expertise is high. Weather-based index insurance also necessitates thorough studies on the link between the index and the lifecycles of the crops in order to reduce temporal and loss-specific basis risk. Moreover, additional weather stations need to be built to improve the index accuracy (limit spatial basis risk) by reducing its area of coverage. Building takes time and money. Another important point is that weather-based indices can only form part of named peril policies, as they do not capture variables such as soil quality, diseases, and pests that also greatly impact the actual yield.

Satellite-based index insurance (indirect index)

Founded on the weather-based index model, insurance products have been developed using satellite imagery instead of data collected by weather stations. Unlike other sources of information, satellite imagery offers detailed data for entire continents over many years. From those images, indices are built and are correlated with the lifecycle of the crop. Just like weather-based indices, satellite-based indices necessitate thorough studies on the link between the index and the actual yield. These models are expensive to set up.

An example of a satellite-based index is the Normalized Difference Vegetation Index (NDVI). This index provides an assessment of plants' absorption of moisture through their ability to perform photosynthesis. Charted on a scale between -1 and 1, the closer the index is to 1, the higher the absorption capacity. Since the mid-2000s, five countries (United States, Spain, Canada, Mexico, and, to a lesser extent, Kenya) have been experimenting with NDVI-based insurance aimed at covering the loss of grazing land due to natural disasters (particularly drought).¹⁷

Another example of a satellite-based index is the evapotranspiration index derived from the fluid balance of the plant. This index has been constructed by the Dutch research institute EARS. When used as an input in the EARS Crop Growth Model (ECGM) together with other parameters, such as light use efficiency and dry

matter production, it allows crop yield forecasting¹⁸. The spatial basis risk depends on satellite resolution; the temporal and loss-specific basis risks lie in the accuracy of the ECGM. Insurance contracts based on this technology are currently distributed in Africa.

A review of all vegetation indices from 1995¹⁹, created either for quantitative or qualitative use, concluded that these indices are very useful in a wide range of fields; however, they depend on numerous parameters (solar luminance, angle) and are affected by several factors (soil type, soil humidity, atmosphere effects) which explains the numerous published papers and studies still being conducted on these indices. The authors concluded that quantitative applications are to be made with the highest cautions.

In 2013, IFAD is evaluating opportunities and constraints for different remote sensing methodologies for indexed crop insurance (weather or, if possible, yield). Based in central Senegal the study will be comparing a selection of remote sensing methodologies based on five approaches: vegetation indices, rainfall estimates, estimation of evapotranspiration via energy balance, radar-based crop monitoring, and radar-based estimation of soil moisture. The results from the study will be available in early 2014 and will contribute to understanding the reliability of different indices.

Meso-level insurance²⁰

The two main challenges of current index-based agricultural microinsurance pilots are distribution and the inherent basis risk. A model that

addresses both of these issues is meso-level index insurance (group contracts). It provides portfolio or group cover to an aggregator, such

¹⁷ Mahul and Stutley, *Government Support to Agricultural Insurance*. 6.

¹⁸ A. Rosema et al., *FESA Micro-Insurance: Methodology, validation, contract design*, (Delft, NL: EARS Earth Environment Monitoring, 2010).

¹⁹ A. Bannari, D. Morin, A. R. Huete, and F. Bonn, "A Review of Vegetation Indices," *Remote Sensing Reviews* 13 (1995): 95-120.

²⁰ This section is partly inspired by a 2011 unpublished paper by the Agriculture Working Group, led by K. Morsink and co-authored by R. Steinmann, M. Patankar, T. Sandmark, and G. Ramm.



BOX 3

Indices as public goods

At the 8th International Microinsurance Conference held in Dar es Salaam, Tanzania, in November 2012, Clarke suggested in his presentation the creation of indices as public goods that are independently verifiable and can be used by all (similar to the Indian model). This approach would promote transparency in the construction of indices and also make sense in the current context where almost all research on index insurance is being funded by public sources.

as a financial service provider, farmers' association, input supplier, local government or non-governmental organisation (NGO), based on an index. In turn, the aggregator retails its benefits to farmers through a variety of services. This concept is not well documented yet, but is generating interest.

Meso-insurance could avoid some of the pitfalls of microinsurance. Firstly, basis risk is reduced as policies cover a larger portfolio through a single index written at the aggregate level. Portfolios are then more dispersed geographically and in terms of crops covered.

Clarke²¹ suggests categorising shocks into systemic shocks (affecting a large number of farmers) and idiosyncratic shocks (affecting a small number of farmers) and addressing these two kinds of shocks differently:

Idiosyncratic shocks: The formal sector cannot offer affordable protection for idiosyncratic shocks (individual indemnity insurance suffers from very high moral hazard and high costs), but communities may be able to offer protection against large idiosyncratic shocks through farmer groups, cooperatives, mutuals, etc.

Systemic shocks: The formal sector can and should offer reliable protection for large sys-

tematic shocks. Area yield (the mNAIS, for example) or group multi-peril crop insurance (i.e., Mexican Fondos) may be able to adequately capture aggregate shocks. If the basis risk is improved for weather or satellite index insurance, they could also be used. The idea is to mutualise, i.e., share, the idiosyncratic risk.

Individual index insurance would pay the same claim proportion to everyone dependent on the same index, but in the meso-insurance scheme, claims may be distributed conditionally to the effective loss of each group member, reducing basis risk.²² This is because, unlike the external insurer, they are supposed to have perfect information about each other and trust each other; they have a claim-distribution agreement and are able to enforce it. This way, the group enhances the meso-insurance product efficiency.²³

An example of this synergy between group and individual insurance is the Ethiopian experiment run by researchers Vargas-Hill using a randomised control approach. Farmers were taught how to mutualise the payouts received from the external insurer to compensate for intra-group differentials in basis risk. They observe that doing this improves the uptake by individual group members.²⁴

²¹ CSAE Blog Entry, November 2012, blogs.csae.ox.ac.uk.

²² S. Dercon, D. J. Clark, and R. Hill, "Basis Risk and Trust in Index Insurance Provision: Can Groups Provide an Alternative?" *Ferdi Policy Brief* 31 (2011).

²³ A. deJanvry, E. Sadoulet, "From Indemnity, to Index-based, and to Group Weather Insurance Contracts," *Ferdi Policy Brief* 25 (2011).

²⁴ Ibid.

Distribution is also expected to be easier and more cost-effective, as the education process only has to reach aggregators. It has several consequences. One is that meso-insurance customers have a stronger financial capacity and are better positioned to understand the challenges of agricultural insurance. The index can therefore be more complex to allow for a more suitable payout scheme.

Another advantage is that once convinced, the aggregator will, in turn, advocate for the product which can raise trust of insurance products amongst the other group members.²⁵ From the organisational point of view, the aggregator is in charge of collecting premiums and redistributing claims, which saves administrative costs compared to the individual insurance scheme. Because the sold policies are group contracts, significant sales volumes should be quicker to achieve.

The potential of meso-level insurance lies in the fact that it takes away the agricultural risk from the balance sheet of lenders by transferring it to the insurer. In this way, meso-level agricultural insurance could allow lenders to increase their exposure to the agricultural sector without being too exposed to large agricultural shocks. In turn, this could support farmer investments (fertiliser, improved seeds, and machinery, and the like) in agricultural productivity.

Individual farmers may benefit from such arrangements directly, for example if they get insurance attached to an agricultural loan or other agricultural input product. It may also reduce insurance premiums. Indirect benefits are, however, equally valuable, as it could allow lenders to increase their agricultural portfolio without being too exposed to large agricultural shocks. In turn, this could support farmer investments in agricultural productivity, such as fertiliser or improved seeds.

One example of meso-level index insurance is a product in the Philippines, which is underwritten by Munich Re. Policies are offered at the cooperative level and cover torrential winds and high rainfall. The insurance payout is based on the average accrued loan of the cooperatives. The payouts are expected to help cooperatives maintain liquidity at the time of disasters and extend loans to its members.

However, the meso-insurance products also have some disadvantages. A meso-level insurance product will most likely be mandatory (bundled) for the farmers who will bear the extra cost of the product. Clear information will ensure that the farmers understand the benefits they are entitled to. Since aggregators are the primary insured party, the farmers' value offered by meso-level insurance is questioned. Another major concern regarding farmers' value is the interactions within the group. The main disadvantage of these schemes lies precisely in the dependence on the aggregator/group to responsibly implement the product and retail its benefits to the farmers. Groups with lack of trust between members, weak leaders, or showing sympathy by paying claims to members who did not pay their premiums, may fail.²⁶ In China, for example, where groups follow this system of conditional redistribution, 50% of the rice producers say they would prefer a uniform compensation. This suggests lack of trust by half the villagers in fairness of the leader in making payouts, at the cost of an efficiency loss in the quality of the insurance product.²⁷

Meso-level and group contracts, however, remain relatively unexplored to date, and the product design needs to overcome the problem of how to distribute the indemnity amongst the individual beneficiaries, e.g., lenders or cooperative members. The distribution of the indemnity must be addressed in the insurance agreement. Ultimately, it is the farmers who need to benefit from the scheme.

²⁵ S. Dercon et al., "Marketing Weather Insurance Products to Informal Risk-sharing Groups: Lessons from Ethiopia," *Ferdi Policy Brief* 28 (2011).

²⁶ J. P. Platteau, "Some thoughts on Microinsurance," *Ferdi Policy Brief* 33, (2011).

²⁷ J. Cai, A. de Janvry, and E. Sadoulet, "Enhancing the Long Run Sustainability of Microinsurance Programs: Lessons from Randomized Experiments in China," (presentation, Meeting of ASFEE, Lyon, June 20-21, 2013).



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Client-value of index insurance



Farmers need to endorse the products for the schemes to survive in the long-term. It is, hence, of high importance that the farmers perceive the value of products. As mentioned in the introduction, in this paper the concept of “value” includes:

- Scope of cover - the extent to which the farmers’ actual risk is covered;
- Affordability - the extent to which the products are financially accessible to the farmers;
- Additional benefits - the extent to which the insurance gives access to any additional services that might make the farmers “better off.”

TABLE 1

Comparative overview of agriculture insurance product types

Product Type	Pros +	Cons -
Indemnity-based	<ul style="list-style-type: none"> - Indemnity = actual loss (no basis risk) - Good understanding and acceptance from clients - Multi-peril insurance 	<ul style="list-style-type: none"> - High loss assessment costs - Slow claim settlement - Historical data often unavailable - Prone to moral hazard
Revenue	<ul style="list-style-type: none"> - Covers all risks entailing financial losses, including price risk 	<ul style="list-style-type: none"> - Complex to design, price, and understand, linked to the financial markets
Weather-based index	<ul style="list-style-type: none"> - Indisputable and transparent - Faster claim settlement - Lower loss assessment costs (reduces administrative costs, thus the premium) - Objective (no moral hazard) 	<ul style="list-style-type: none"> - Basis risk - Requires a good network of weather stations - Complex to understand - Named-peril insurance - Requires studies and expensive expertise to design
Satellite-based index, NDVI	<ul style="list-style-type: none"> - Indisputable and transparent - Faster claim settlement - Lower loss assessment costs (reduces administrative costs thus the premium) - Product available in large areas (whole countries) - Objective (no moral hazard) 	<ul style="list-style-type: none"> - Basis risk - Complex to understand - Named-peril insurance - Requires thorough studies to design - Satellite imagery expertise and information is costly to acquire
Area yield index	<ul style="list-style-type: none"> - No basis risk from modeling - Easy to understand - Multi-peril insurance 	<ul style="list-style-type: none"> - Challenge of historical data which is needed for pricing - Slow claim settlement - High loss assessment costs - Spatial basis risk as areas may be vast

For each product type, some trade-offs exist that will affect the value to the client. It's of interest to first compare index insurance to other product types. Table 1 gives a comparative overview of the product types by summarising advantages and disadvantages.

In view of the mix of advantages and disadvantages of each product, hybrid products can be considered a solution; combining product features and improving the value to the farmers. An example of a hybrid product is the mNAIS in

India, which combines a yield index to reduce the basis risk with a weather-based index. This combination allows the insurer to make a faster claim settlement. The product is also making innovative use of technology in speeding up and increasing the reliability of crop cutting experiment data (video recording crop cutting experiments with Global Positioning System(GPS)-enabled cell phones, sending data to the insurers in real time, etc.). Hybrid design is also used by the Kilimo Salama scheme in Kenya.



BOX 4

Technology, innovation, and data²⁸

Technology is progressing rapidly. Today satellites capture images of up to 50cm/pixel and create 3-D, high-definition images. Cloud treatment is also improving image quality. Image processing, however, remains expensive and difficult to leverage in current insurance schemes. China, an important client for the European Earth Observation industry, has recently launched its own satellites, increasing the competition of the supply of services, prompting innovation and lower prices in the future.

Satellite imagery is most valuable when enhanced with data, such as GPS points, from the field. Referenced aerial photos can also be used to this effect. Google Maps, for example, is a system which combines satellite imagery with street views (field data) to create an enhanced understanding of the area being explored. The cost of aerial photography is decreasing and other technologies such as radar sensing and drones are becoming increasingly accessible. In the near future, insurance product designers may conclude it more pertinent and cost-effective to use aerial photography for livestock mortality products than remote sensing.

Innovations in social media and telecom contribute to provide cheaper and better field data. One recent example is *crowd mapping* which calls on volunteers to contribute with field data to mark and complete maps via satellite imagery. Crowd mapping was used in Kibera, a populated slum in Nairobi, to locate the most dangerous spots for women. Its usage is spreading and can be used in different contexts. Loss assessors, for example, might ask for GPS-referenced photos of crops instead of travelling to the field themselves; reducing costs of indemnity-based insurance, currently one of the main arguments for promoting index insurance.

These technological advances have the potential to merge index-based and indemnity-based insurance, especially as precision images and field data evolve.

²⁸ Inspired by the conference organised by AFD: "Satellites, a tool for development," www.afd.fr/home/presse-afd/evenements/des-idees-pour-developpement?actuCtnId=97724.

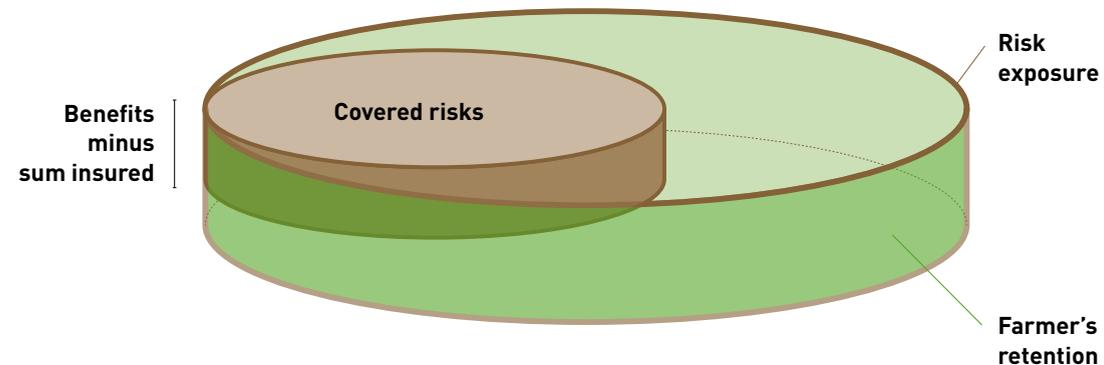
Scope of cover

When analysing product from the client-value perspective it's important to look at the *scope of cover*. The more comprehensive and inclusive the scope of the product is, the more value the product is likely to bring to the farmer. The scope of the product cover includes four components—risks covered, sum insured, level of risk retention, and aggregation level.

The first element, which defines the value proposition for the farmer, is the value of the risks covered. This determines how well the product actually protects farmers from the financial hardships, which result from one or various events impacting the crops, as summarised in Graph 1.

GRAPH 1

Illustration of the level of covered risks compared to the farmers' risk exposure



In this perspective, the revenue insurance is the most valuable product type as it covers all risks that impact the revenue, followed by area yield index-based insurance, which does not include the price risk. The value of the index covers and the indemnity-based insurance depends on the number of risks covered: the more comprehensive the covers are, and the more value they bring to the farmers. The risks covered, of course, have to be pertinent to the farmers' activities. Index insurances also have inherent basis risk that reduces the value of the cover as the farmers' risks might not be accurately covered.

Herbold²⁹ of Munich Re questioned the results of index insurance experience to date and suggests that area yield index products have a higher potential to protect farmers than weather-based indices as they are easier to understand and have lower basis risk. New and more accurate technology will lead to advances in yield-based insurance products and loss assessment and he suggests that future research should focus on the different aspects of yield assessments.

Clarke³⁰ also suggests that area yield and area revenue indices are attractive in that they are

²⁹ J. Herbold, "Crop Insurance in Developing Economies" (2010).

³⁰ CSAE blog entry, November 2012, blogs.csae.ox.ac.uk.

designed to accurately capture aggregate shocks. When creating these indices, Clarke emphasises the need for constant innovation.

Any initiative that reduces the basis risk increases the value of the product. If the starting point of the cover is flexible and, for example, can be correlated with the actual sowing date or a sowing window, then the extent of the cover is greater for the farmer than if this date is fixed, as this reduces the temporal basis risk. Thus, the starting point of the contract also determines whether the risks stated in the policy are accurately covered. Products that take into account the sowing calendar and local practices offer better adapted and more comprehensive covers to farmers. Concerns with such initiatives include additional expenses for the management of the product and highlight the importance of innovation to improve the cover and process without impacting the price.

The *sum insured* is an important element of the scope of the cover as it will determine the level of compensation paid to the farmers. The direct benefits of the products are the claim settlements paid to the farmers in case of loss of harvest or income. Most microinsurance products only cover the value of production inputs or the loan amount granted by the intermediary. However, as illustrated by Graph 1, the farmers face additional risks to poor harvest, such as poor income. As such, once again revenue insurance is the most comprehensive cover possible for the agricultural risks since it includes elements of yield and of price. Although this product type is very rare today and considered very complex, it is worth developing.

The scope of the cover also includes *the level of risk retention*, which, in the case of index insurance depends on the trigger applied. The trigger can correspond to high frequency or low frequency events.

It is often argued that due to the costs involved, formal sector insurance makes more sense for

extreme, low probability shocks (Layer 2 and 3 of Graph 2). Risk retention through savings or credit, or risk sharing with friends and family can be more cost-effective for less extreme, more frequent shocks (Layer 1). In developed countries, it is generally thought that these risks are part of the normal business activity and should be borne by the farmers. Moreover, investments in risk mitigation (e.g., irrigation or flood resistant seeds) are often more cost-effective than insurance for fairly frequent events. This reasoning is illustrated by Graph 2 showing that insurance mechanisms (i.e., risk transfer) are best suited for events that are characterised by low frequency and medium to high losses, although other risk coping mechanisms, such as government aid, must also be triggered when the losses are very high.³¹

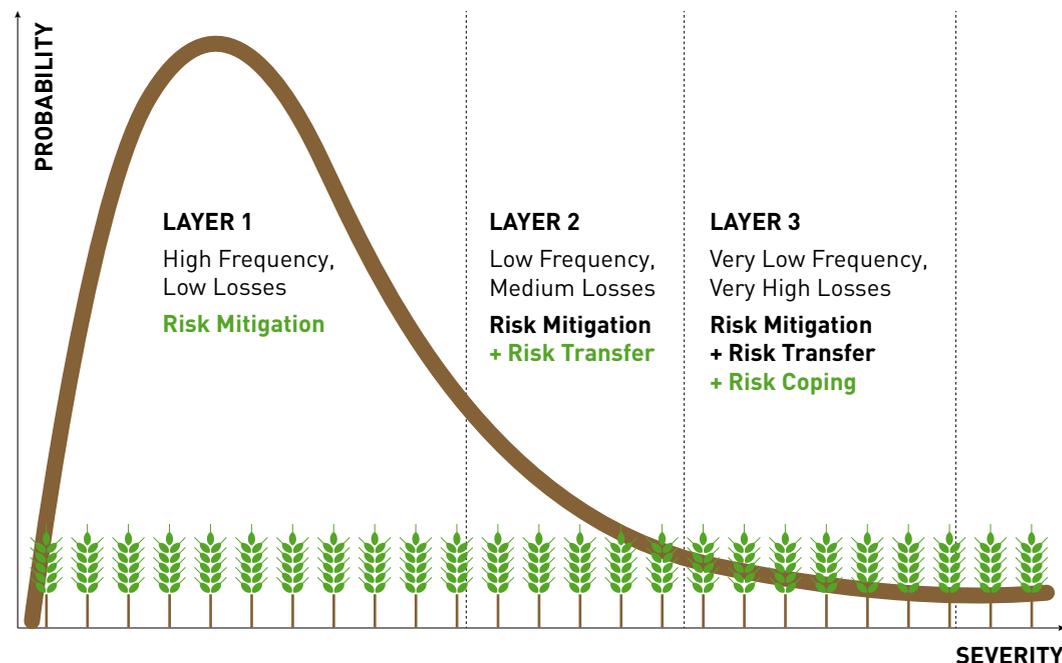
In practice, most agriculture index-based microinsurance products are low frequency. For individuals with low financial literacy, scarce financial resources, and little trust for insurance companies, a high frequency product cover may seem more appealing as it will allow the farmer to test the reliability of the product. A study recently undertaken by IRI showed that this was evidenced by the Harita project in Ethiopia.³² Insurers may also tend to prefer the high frequency products – at least at the start-up of programmes – as it allows them to have more regular interactions with the clients. This interaction can help build trust, and the demonstration effect contributes to insurance education. It's difficult to draw general conclusions regarding the link between the frequency of the trigger and the product's value, as it varies subjectively from the perception of the farmer, the insurer, and the theoretical perspective. The perception of the farmer also depends on the farmer's risk aversion and access to other risk management strategies (whether formal or informal, ex-ante, or ex-post). One has to keep in mind that high frequency products and products with a larger scope increase premiums, can discourage adaptation and innovation, and reduce the efficiency of the farmers.

³¹ Ibid.

³² D. Osgood, "Evidence of Demand for Index Insurance: Experimental Games and Commercial Transactions in Ethiopia, International Research Institute for Climate and Society" (presentation, International 8th Microinsurance Conference, Dar es Salaam, November 2012).

GRAPH 2

Risk management solutions according to frequency of risk and extent of loss



Source: Work Bank Disaster Risk Financing and Insurance Programme (2012).

The aggregation level of the product, whether the product is microinsurance or meso-insurance/group contracts, has an impact on the scope of the product because it affects the events covered and the payout received. This

was previously discussed under meso-level insurance. Additionally, the aggregation unit of the index will determine how the index fits the actual situation of the farmer.

Affordability

The value the farmer will attribute to a product will not only take into account the scope of the cover, but also the cost at which this cover is sold. Evidently, the direct cost of the cover is the quantifiable value of the product from the risk-carrier's perspective. The gross premium depends on the benefits and exposure offered and also on the cost structure. The cost-elements the product has to cover are: the incurred claims, the expenses, and the loadings/margins (security, profit).

The expenses depend on the delivery channel and how processes are set up. The more efficient they are, the lower the cost of the product for the farmer. If a large percentage of the premium goes toward process inefficiencies, the value for money is reduced. Technology may decrease the cost in servicing the product by improving the process and hence increase its affordability. Products with efficient processes offer higher value.

Overall, the adequacy of pricing for the target population is an important factor in the client-value and can determine whether it is worth it for the farmers to take up insurance. For an agriculture product, the affordability of the premium can be assessed by comparing the cost of insurance with:

- The other expenses the farmer has to bear at the beginning of the crop cycle
- The expected financial return on his harvest
- The costs of the ex-post and ex-ante risk management alternatives to which the farmer has access.

Most of the agricultural insurance products receive subsidies. Extra subsidies may target the farmers that the government identified as vulnerable and allow them to access the products. Subsidies, however, have to be guaranteed in the long run or decrease gradually in order to avoid ruining the programmes. An example of a subsidised scheme is the paddy indemnity-based insurance offered in Thailand, which offers benefits between US\$20 and US\$45 for a premium of US\$4 plus tax per rai (0.4 acre) through a PPP. This premium is subsidised by the government at 50% and the farmers get an additional US\$0.30 in subsidy if they are clients of the national agriculture bank. The farmer thus pays US\$1.70-2 for this cover, which makes it a much better value. If the premium amount is compared to the reported farmer's typical budget for one rai of paddy, the following balance is obtained:

TABLE 2

Illustration of the harvest balance sheet of a rice farmer in Thailand



Production cycle expenses	Harvest income
Insurance premium TBH 129 (subsidised at 50%)	Good year: 600 kg Sales: TBH 10,000
Input and wages TBH 2000	Bad year: 400 kg Sales: TBH 7,000

The cost of the subsidised insurance is very low per rai for the farmer in comparison to other product costs and expected returns. Yet, the uptake remains low, with only appreciatively 56,000 farmers insured.

Apart from subsidies, the risk-carriers also play an important role in determining the price of the risk. The premium rate depends on the reliability of the following factors:

- **Reliability of historical data.** If the data is not quite reliable, the probability of the trigger being hit may not be assessed properly, and if it is overestimated, the price will not be fair.
- **Reliability of the infrastructures.** Similarly if the weather data collected during the term is not quite reliable, the actual weather pattern may not be recorded properly and the promised cover not delivered.
- **Impact of climate change.** The detrending of historical weather and yield data is difficult to assess considering the uncertainties of the impact of climate change. If the detrending is not correct, then the rate of the cover may be over or under-estimated.
- **Margins.** Margins are the contingency added onto the "net risk premium" that make up the cost of a product. If risk-carriers do not have accurate information to gauge this factor, they may load the premium rate excessively and reduce the value of the product for the farmers. Such additions also form a part of the margin.

Any improvement in these factors should decrease the price of the product, hence improving the affordability of the product for the farmers. Often, further complicating the situation is the fact that the product may be bundled with a mandatory agriculture production credit. In this case, the product value and the farmers' options are reduced because the farmer might already have invested in another ex-ante or ex-post risk management strategy (see the Beneficiaries section for examples of such strategies). However, bundled products can also easily facilitate the provision of improved seeds, fertilisers, and crop protection products. Mandatory products make sense from the client-value perspective

only when they are highly subsidised. Bundling of products is, however, often recommended in order to reach the necessary scale of sales of insurance, illustrating one of the choices operators need to make between sustainability and client-value.

Additional benefits

Finally, in order to assess the client-value of the insurance cover, noninsurance characteristics should be taken into account. Insurance lets farmers remain productive despite a bad harvest by providing support for the next harvest and allowing the farm to keep assets. Insurance impacts the sustainability of the farm and the farmer's community.

Agricultural insurance products also bring indirect benefits for the farmers, which increases the client-value. Indirect benefits include increasing access to credit, lower interest rates, higher credit amounts, weather information, risk mitigation techniques, agriculture technical training, and discounts. Allowing farmers to increase their investments in their agricultural activities enables them to take on riskier ventures and maximise profits. In Bangladesh, for example, farmers were not willing to engage in cattle rearing activities that were more profitable in the area than the traditional crops they were growing. With no previous education about

The premium payment mode also impacts the cost for the farmer (e.g., premium financed by a loan, at an interest rate that may be high) and the perceived value of a product.

beef fattening techniques and without proper veterinarian attention, they considered cattle rearing too risky to undertake. In response, a microfinance institution (MFI) developed a bundled product that included cattle rearing training, vaccination of cattle, and insurance on the loan amount. The added services and the insurance included in the package were the decisive elements leading the farmers to switch to the more profitable agricultural activity. This example illustrates that insurance can have an effect on the risk taking behavior and the strategies undertaken by the farmers.

Some of these benefits represent prerequisites to undertaking sustainable cropping or livestock activities. Such value-added benefits may, on the one hand, lower risk (e.g., vaccination of livestock, which is sometimes impossible to obtain for farmers), and thus make the farmer insurable; on the other hand, they ensure the sustainability and chances for success of the farmer.



Overview of the players and their roles



TABLE 3³³

Structure and players involved in the development of a typical agriculture insurance scheme

Government

Facilitates:

- Legislative and regulatory framework
- Supervision (consumer protection, monitoring the stability of the sector)
- General support to agricultural development

Sometimes takes on the role:

- As a reinsurer
- As a provider of subsidies

Reinsurer	Insurer	Distribution channel	Beneficiary
Carries part of the risk Designs product	Carries risk Funds payouts Receives premiums Designs product	Sells insurance policies Receives insurance claims Collects premiums Distributes payouts	Buys insurance Receives payouts

Coordinators

Coordinate the different players and often play an important role in the product design. For agricultural index insurance programmes, this role is often played by a broker or an NGO.

Support organisations

Enhance the value of the product, provide data, and give access to extra services such as education, research, farming inputs, training, weather information etc. Examples of such organisations are: Meteorological agencies, agriculture inputs distributors, insurance associations, agribusinesses, agriculture extension services provider, NGOs, research institutions, etc.

Donors

Finance the development and implementation programmes of agricultural insurance.

³³ Adapted from Roth and McCord 2008, fig. 2

Governments

Government intervention can be motivated by market imperfections (e.g., index definition and data collection is effectively a natural monopoly in low-income countries) or government's national policies to stimulate economic growth for the benefit of poor people (e.g., agricultural insurance as a market mechanism used to target social objectives). The most successful large-scale agricultural insurance programmes have typically been public private partnerships (PPP) with a strong correlation between the level of subsidies and uptake. As underlined in Map 2, regions showing the highest volumes of premium are also the ones with the most financial support from the government. Governments are, hence, faced with the trade-off between keeping underdeveloped agricultural systems or potentially high budgetary expenditures.

Insurance needs to be seen as part of a wider approach to address agricultural risk, beginning with a risk assessment of the target population. Ideally, all products should constitute part of a wider, income-enhancing package of services.³⁴ The problem of appropriate risk management tools in agriculture cannot be solved with an insurance product alone. Herbold advocates for a process approach before a product approach; a cooperative approach rather than a competitive approach; a national wide approach instead of pilot project approach; and a combination of insurance with credit.³⁵

At present, Herbold³⁶ sees the key obstacle to the success of index insurance as the lack of cooperation between stakeholders infused with a disproportionate focus on developing individual insurance products. He suggests beginning by establishing the appropriate institutional framework needed. He advocates for a process approach ensuring an institutional framework

in place in the form of a PPP between state, farmers, (re)insurance industry, and the banking sector. Mahul stated, at the FARM - Pluriagri conference on Insuring Agricultural Production, held in Paris in December 2012, that agricultural insurance systems based on public private partnerships will lead future development.

Complementary to the system approach, Herbold encourages a cooperative approach by founding a common coinsurance pool; by centralising technical expertise; and establishing uniform terms and conditions for the agriculture insurance products. Associated with the process approach, a national approach is suggested instead of a pilot project approach, as insurance is a mechanism to spread and share risk.

Similarly, in their report *The Potential for Scale and Sustainability in Weather Index Insurance (2010)*, IFAD and the WFP summarise their vision for the sector, which starts with government and donor support to develop the necessary infrastructure needed to create stable data and a rational market for index insurance. Once the framework is in place, private insurers can step in to extend the market along existing delivery channels, and to stabilise the risk through objective standards and reinsurance. Ultimately the report states that index insurance can not only be a profitable industry but it can aid governments to make better choices about poverty and disaster management.³⁷ Mitchell also underlines this, as well as the dangers with a product approach, by stating that insurance is not a panacea but an effective risk management tool when it is combined with other risk management measures (e.g., early warning, provision of risk information, preparedness, and measures to reduce vulnerability).

³⁴ Hazell et al., "The Potential for Scale and Sustainability," 38.

³⁵ J. Herbold, "What Could Schemes in Developing Markets Learn from Existing Agricultural Insurance Schemes in Developed Markets?" (presentation, 8th International Microinsurance Conference, Dar es Salaam, November 2012).

³⁶ J. Herbold, "Crop Insurance in Developing Economies" (2010).

³⁷ Hazell et al., "The Potential for Scale and Sustainability" (2010).

Where insurance is applied without adequate risk reduction, insurance can convey a feeling of security whilst actually leaving people overly exposed to impacts.³⁸

As a facilitator of market development, the government needs to put in place the right incentives and motivations for all the above mentioned players to engage in agriculture insurance and encourage its development. In many developing countries, this entails starting with laying the foundation to establish a long-term reliable insurance system for the agricultural sector. A well-specified regulatory regime and legal framework is required to define the insurance companies' field of activities, guarantee their financial integrity, and inspire confidence to all the actors involved.

The role of a government is essential in defining the market segmentation between large-scale commercial farmers and small, vulnerable farmers. Governments need to identify vulnerable farmers and those in need of particular assistance. How to address those particular insurance needs – through a general system with particular advantages targeted at the smallholder/low-income farmers or a separate system for this group altogether – is the next step. Targeting can be effective in reaching the farmers that are the most in need of government support, although the exercise is often complex. Brasil has developed a targeting system, combining socioeconomic data of the population. The data gathered in Brasil reveals the challenges of such an operation. The gathering alone of data needed for targeting can be an expensive affair and needs to be weighed into the decision making and design around targeting.

As an example of governments as facilitators in the sector, the CIMA (Interafrican Conference of Agriculture Credit of Senegal) code covers 14 francophone African countries and sets

the basic regulations for the insurance sector in the region. In 2011, the code was reviewed in order to encourage the emergence of microinsurance. The new code allowed insurance companies to apply for microinsurance licenses with less strict criteria in regard to the capitalisation needs and distribution. The desired result was the creation of new insurance structures that could provide access to insurance products for poor people in the region. Based on the general guidelines, each member country should define its own criteria for accrediting microinsurance companies.³⁹ The result of this initiative is yet to be demonstrated and it would be of interest for the sector to carry out a follow-up study in each country on how many new microinsurance operators have been accredited and how the accreditation criteria differ from country to country.

The Indian government, in order to achieve scale, made it mandatory to purchase agriculture insurance policies for all subsidised agricultural loans provided by it. This mandatory policy increased the number of farmers insured and premiums paid. To keep the premiums affordable, the premium levels were capped. One of the key features of the Indian model is the strong intent to innovate and experiment inherent in the sector. Hence, for each successful pilot, there were at least 8 failed pilots. In order to achieve this level of innovation, the government encouraged competitiveness and all insurance companies in the sector were obliged to produce a percentage of their revenue from the rural areas—a so-called forced familiarisation.

Another example of regulation comes from the United States, where policies were not made mandatory. Instead, farmers are offered incentives to buy insurance, as it is conditional if they want to benefit from the government calamity fund. Like India, the United States and Canada

³⁸ T. Mitchell, "Seduced by Disaster Insurance? Don't Dive In," Climate & Development Knowledge Network (2012).

³⁹ For a more extensive review of the CIMA code, the authors recommend reading "Etude sur la Microassurance dans la Zone CIMA - Etats des Lieux et Recommandations," Desjardins Développement International (June 2011).

also have a high innovation rate in the agriculture insurance sector, achieved through regular, publicly funded calls for proposals to develop new solutions and products. The academic world is highly involved in this process, underlining the essential link between insurance and research.

The concept of index insurance is still fairly new in most countries and the regulatory framework has not had time to catch-up. As these products are not indemnity-based, the traditional insurance regulatory framework does not automatically apply because they can also be viewed as financial derivative products. As a facilitator and a regulator, the government needs to understand the new insurance mechanisms being deployed. Education of both parties will encourage and protect the farmers against any abuse. The EU, for example, recently communicated new regulations for index insurance products in Europe, where the first products are starting to emerge. Included in these regulations is a guideline stating that the indices cannot exceed 3% of basis risk. This makes little sense as there is no reference for the basis risk. Recognising the importance for regulators to have a full understanding of the sector, activities are being sponsored by international donors to educate and to build the knowledge base of regulators. An example of such an initiative is the one-week study visit to India that was organised in 2012 by Grameen Crédit Agricole Microfinance Foundation, where regulators from Uganda, Kenya, Senegal, and Benin were able to learn about the Indian experience. The Access to Insurance Initiative (A2II)⁴⁰ and the World Bank also focus considerable efforts on capacity building of regulators.

Reinsurance is another form of government support to the sector and is typically higher in high-income than middle-income economies. Forms of support range from national reinsurance companies to agreements under which governments act as excess-of-loss reinsurers (in such cases, the government charges no rein-

surance premium). Premium subsidies are, however, the most common form of public intervention in agricultural insurance. Almost two-thirds of the 104 countries surveyed in the World Bank report (at all levels of development) provide agricultural insurance premium subsidies, usually around 50% of the original gross premium. Premium subsidies are a popular type of support although other forms of support offer more cost-effective alternatives. Once introduced, it is difficult to get rid of premium subsidies. One smart design includes phasing out subsidies on a fixed time schedule with declining rates. The ILO's Microinsurance Innovation Facility is currently exploring how to design smart subsidies with a particular focus on agriculture insurance, and their work is likely to shed more light on this topic.

Investments in public goods, like human and material infrastructure needed to capture reliable data on climatic events, crop yields, etc., are important and much needed. So are incentives granted for research on innovative insurance products and for educating farmers on risk management. The government also needs to assure that the issue of consumer protection is properly addressed as the sector evolves. Clarke⁴¹ states that government, in its role as regulator, needs to hold the sector responsible by demanding more statistical analysis regarding payout frequency and compensation amounts, as insurance for the vulnerable should be safe.

As mentioned earlier, public policy influences the insurance sector as some risks formerly categorised as uninsurable are being removed from calamity funds, encouraging the insurance sector to develop new products covering these risks. This was, for example, the case for forage in France. If accurately designed, the insurance product offers a more precise estimation of the farmers' losses (less basis risk) and also creates an awareness of the cost of risk for the farmer (as contributions to calamity funds are often seen as hidden costs and insurance has a

⁴⁰ www.access-to-insurance.org

⁴¹ CSAE Blog Entry, November 2012, blogs.csae.ox.ac.uk.



BOX 5

Public Private Partnerships

The creation of agricultural insurance schemes requires a long-term effort that needs strong political commitment and strong technical counterparts. Governments heavily rely on the private sector in the development of these schemes, leveraging the expertise and efficiency often inherent in private insurance companies. As such the PPP model is favored and advocated for in the sector. Mahul proposes the following balance between the private and public as follows:⁴²

1. Underwrite agricultural insurance through private commercial insurers whenever possible.
2. Important areas of government support:
 - Data infrastructure: speed, reliability/quality and transparency
 - Education, training and capacity building
 - Technical support on product design and rating
 - Creation of enabling legal and regulatory framework
3. Exercise caution with agricultural insurance premium subsidies to include smart subsidies to support well-defined social objectives.
4. In some circumstances, government support as a reinsurer of last resort may be justified.

tangible premium). The political responsibility in this scenario is to decide which risks are appropriate for insurance mechanisms and which risks remain uninsurable. It is in the public's interest to cover risk to a certain extent, but public policy needs to be balanced, as farmers should not be encouraged to adopt too risky

behaviours. This balance can often be difficult to find. Governments also heavily rely on the private sector in the development of these schemes, leveraging the expertise and efficiency often inherent in private insurance companies.

Reinsurance

Agricultural reinsurance is purchased mainly from private reinsurers to allow domestic agricultural insurers to secure enough risk capital in case of a major disaster causing catastrophic insurance losses. In two-thirds of the 104 coun-

tries surveyed by the World Bank report, the provision of agricultural reinsurance is from private reinsurers. Some countries, however, (including Costa Rica, Iran, Japan, and Kazakhstan) rely only on public reinsurance.⁴³

⁴² O. Mahul, "Agricultural Insurance for Developing Countries: The Role of Governments" (presentation, FARM - Pluriagri Conference on Insuring Agricultural Production, Paris, December 2012), www.fondation-farm.org.

⁴³ Mahul and Stutley, *Government Support to Agricultural Insurance*. 6.

Agriculture insurance is a complex affair (see Appendix A - Agriculture insurance and microinsurance). The design of suitable agricultural reinsurance programmes requires considerable skill and expertise. The agricultural insurance industry requires services that go beyond the provision of financial capacity. Reinsurers involved in agricultural reinsurance often work with the insurance companies to do risk assessment, risk modeling, pricing, risk structuring,

loss adjustment design, create operational manuals, build risk rating and risk accumulation control software, and edit the wording of insurance contracts. This explains why the global market for agricultural risk insurance is limited, with only twenty regulators, as few are able to provide these services.⁴⁴ The supply of agricultural reinsurance is limited and is accompanied by large barriers to entry.

Insurance

Local insurance companies are well aware of the opportunities in microinsurance. Most local insurers perceive the risks as being too high and too difficult to calculate and are scared off by the low productivity and profitability of the agricultural sector. The focus of the local insurance companies, hence, still remains on the urban rich, with little will to expand out to rural areas, let alone into crop insurance.

Government regulations require all insurance products be issued by a nationally accredited insurance company. When looking into the details of current agriculture insurance schemes in developing countries, very few of

these companies actually carry any of the risk. The products are actually reinsured at 100%.

Little by little, the private sector is responding to these challenges. This is the case in India. There are numerous reasons for private companies to administer insurance operations, most of these reasons being efficiency-related. In countries where agriculture insurance has existed for a long time, the schemes are now managed by private companies and are working relatively well. As insurers will start to carry more of the risk, the cost of the reinsurance will also come down although the insurance companies still need to be encouraged to participate.

Distribution channels

The distribution channels play a key role in the delivery of agriculture insurance products as they are the link between the client (the farmer) and the product. The design of the distribution channel highly influences the farmers' perception of the value of the product.

An ideal distribution channel is:⁴⁵

- Engaged in financial transactions with the target group
- Serving large volumes of clients
- Maintaining trust with clients
- Representing the interest of clients
- Convinced of the value of the product

⁴⁴ R. Iturrioz, "Agriculture Insurance," in *Primer Series on Insurance*, Issue 12 (Washington, D.C.: World Bank, 2009).

⁴⁵ C. Churchill, comments delivered in a speech to the 5th International Microinsurance Conference, Dakar, Senegal (November 2009).

Bundling the insurance with credit makes the related product distribution more efficient, although the sum insured is often the loan covering the credit, hence the lender, rather than the farmer. It is, however, expected that bundled products will, in the long run, facilitate farmers' access to credit, make financial institutions more willing to finance agriculture, and ultimately decrease the cost of credit.

Distribution channels highly vary according to the level of maturity of the private insurance markets. In developed insurance markets in high and upper-middle-income countries, insurance is traditionally marketed through insurance agents employed by insurance companies or insurance brokers. This role is evolving. In the United States, for example, insurance is being increasingly bundled with other products and services and retailed by players such as John Deere, as they are already engaged in providing agriculture products and extension services to the farmers.

Beneficiaries

In many developing countries, in Africa, but also in Southern Asia and Latin America, smallholders make up the majority of the agricultural population and provide a large share of agricultural production. They are also the most vulnerable and the most affected by hunger and malnutrition. In the perspective of improving food security and reducing poverty, a key question is how to set up agricultural insurance systems that are both efficient and affordable to these smallholder farmers.

Although the level of awareness of agricultural microinsurance is increasing amongst various stakeholders, it still remains low amongst the target client group. A good understanding of the product is crucial for it to be appreciated and used properly, otherwise the clients might become disappointed, will not renew, and take-

In low-income countries, where the insurance market is underdeveloped, agricultural insurance is provided mainly through cooperatives and farmers' groups. The provision of agricultural insurance through rural banking networks, including microfinance institutions, is still very limited. Several initiatives are underway in Africa and Asia to change this provision.⁴⁶ NGOs and MFIs remain a fairly new category of distribution channels. For these new distribution channels, educating the sales staff on quite complex products is key. In order to provide the clients with the necessary explanations and information prior to the purchase of the product, agricultural needs must be well understood by the sales force. Providing this type of training could be achieved by an organisation already involved in the provision of agriculture extension services and could be incorporated into the staff incentive structure.

The distribution channels and the delivery mechanisms have yet to prove their effectiveness and efficiency. More innovation and progress is indeed needed in this area.

up will remain low. Insurance education, consumer protection, and trust need to improve.

Smallholder farmers in developing countries are also weary of paying for insurance, as they often tend to underestimate the severity and the frequency of risks (as shown by World Bank studies). In addition, purchasing power remains low, making it difficult for farmers to afford the actual cost of the insurance products.

The farmer may also be using other available coping mechanisms. The value proposition of the insurance product must be compared to the alternatives the farmers have to hedge their production risk, whether ex-ante or ex-post, formal or informal. For some examples of alternate coping mechanisms see Table 4.

⁴⁶ Mahul and Stutley, *Government Support to Agricultural Insurance*. 6.

TABLE 4

Strategies farmers use to manage agricultural risks



		Informal mechanisms	Formal mechanisms	
			Market based	Publicity provided
Ex-Ante strategies	On-farm	<ul style="list-style-type: none"> - Crop diversification - Inter-cropping & Mixed-cropping - Staggered planting - Mixed farming - Buffer stock accumulation of crops or liquid assets - Adoption of advanced cropping techniques (fertilisation, irrigation, resistant varieties) 		<ul style="list-style-type: none"> - Agricultural extension - Supply of quality seeds, inputs, etc. - Integrated pest management - Infrastructures (roads, dams, irrigation system) - Weather advisories
	Sharing risk with others	<ul style="list-style-type: none"> - Crop sharing - Sharing of agricultural equipment, irrigation sources, etc. - Informal risk pool 	<ul style="list-style-type: none"> - Contract farming/direct marketing - Futures contracts 	
Ex-Post Strategies	Coping with shocks	<ul style="list-style-type: none"> - Reduced consumption patterns - Deferred/low key social & family functions - Sale of assets - Migration - Mutual aid/borrowing amongst relatives, affinity groups 	<ul style="list-style-type: none"> - Consumption credit 	<ul style="list-style-type: none"> - Social assistance (calamity relief, food-for-work, etc.) - Rescheduling/waiver of loans - Agricultural insurance - Simplified/relaxed procedures of grain procurement - Supply of fodder - Cash payment

Source: Rao, K.N. (2008) "Risk Management of Small Farms in India," Unpublished Report from Consultancy Work for Food and Agriculture Organisation of the United Nations taken from the report *Agricultural Livelihoods and Crop Insurance in India*, GIZ, January 2013.

Coordinators

With the large number of important players involved in the provision of agriculture insurance, planning and organisation are essential. This is the role of the coordinator. Often, the coordinator will also take on several additional tasks such as product designer, lobbyist (in underdeveloped markets) putting agriculture insurance and index insurance on the governments' agenda, and advocating for public involvement and support. The coordinator ensures that each player contributes to maximising the value of the products to the farmers.

In developed markets, this coordinator role is covered by insurance companies, brokers, or governments. In the numerous pilot projects of agriculture index insurance, this role is typically carried out by microinsurance brokers or NGOs.

Coordinators, as implementers of insurance schemes, invest considerable efforts in innovation, attempting to improve the indices and find the best possible cover they can offer the farmers under the circumstances. Echoes from these organisations operating in developing countries seem to suggest that there is a consensus regarding the desire for more public-backing in terms of enabling regulations and financial support in terms of subsidies, reinsurance, and tax breaks. Implementers, however, often raise additional challenges of agriculture microinsurance products that are worth considering:

- **Finding an effective distribution model.** Distribution through MFIs has often been the favored approach for pilot projects, although numerous attempts show that they have not met all expectations as subscriptions remain low and important resources need to be invested in order to train the staff. Liquidity

for the timely disbursement of the agricultural loans and payment of insurance premiums has also shown to be an important challenge for these institutions. Further advances are clearly needed on the aspect of distribution; further exploring meso-level insurance could offer an alternative. Time is also a factor because distribution channels need to witness and internalise the benefits of agriculture insurance for their institutions and clients before fully embracing the concept.

- **Increasing the commitment from local insurance companies.** Currently reinsurers typically carry nearly 100% of the risk and hardly any risk is retained locally (increasing the cost of reinsurance). Local insurance companies still invest very little of their own resources in research and training in agriculture insurance.

- **The high costs of awareness raising campaigns.** Not only the financial, but also the human resources needed to properly educate and inform the target group on insurance cannot be overstated and should receive more support from the local apex organisations, such as the insurer's associations and farmer organisations.

- **Numerous partners.** In view of the complex and costly nature of agriculture insurance schemes, in order to gather the necessary financing and expertise needed to bring the product to the market, implementers often find themselves needing to manage an important number of players involved. Partnership management suddenly becomes one of the main tasks for the implementers with all the known challenges that this involves.

Support organisations

Lack of qualified and committed local institutions (finance and risk management providers, qualified sales staff, etc.) is also an issue often mentioned by support organisations.

The complex nature of agriculture insurance schemes, and particularly index schemes, allow for involvement from a variety of support organisations. For example, gathering quality meteorological data is a challenge in developing countries but essential to adapt the indices to the local contexts and to calibrate them when expanding to new climatic zones. The involvement of meteorological agencies is, hence, of essence.

Financial education is also crucial to the development of the sector, although cumbersome and costly to both develop and rollout, espe-

cially in the more remote rural areas. Microinsurance providers express the need for more cost-effective ways to educate the clients and start building an insurance culture. Insurance associations or agricultural advisory service providers can get involved here.

Technological advancements have the potential to contribute to the improvement of the accuracy of indices. It can also lead to improvements in the communication and servicing of the clients. Any organisation involved in driving technological developments leading to improvements of the indices, such as administration management, communication, and service provision to the clients (farmers) has an important role to play in enhancing the value of the products and the service delivery to the clients.

Donors

This category does not exist in developed markets and in developing countries donors often take on part of the role of the government, giving both entities similar roles. The WFP/IFAD report on *The Potential for Scale and Sustainability in Weather Index Insurance for Agriculture and Rural Livelihood* proposes seven key support areas for governments and donors.⁴⁷

1. Providing ongoing technical assistance, training, and product development;
2. Educating clients about insurance;
3. Promoting innovation;
4. Facilitating access to reinsurance;
5. Developing national weather services, infrastructure, data systems and research;

6. Creating an enabling legal and regulatory environment, and designing sound national rural risk management strategies; and

7. Supporting impact studies.

All current agricultural index schemes in developing countries are funded by donors.

A new type of player that is also interested in financing the development of the sector is social investors which are increasingly getting involved in the microinsurance sector. Although the number of experiences is limited, a discussion group has been formed by the Microinsurance Network to discuss and explore possible opportunities for social investors to assist the sector evolve.



⁴⁷ Hazell et al., "The Potential for Scale and Sustainability," 36.



Case studies



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The following case studies describe four different examples from four different countries – Morocco, Brasil, Senegal, and China. Each country has its own approach to developing agriculture insurance and is at a different stage of the process. The case studies for Morocco and Brasil have been documented by FARM and the case study for Senegal by FARM in partnership with Grameen Crédit Agricole, through interviews, field visits, and literature reviews. The case study on China was compiled by the authors through a literature review.

The case studies were chosen in part because they contribute fresh insight. They describe the products available and highlight the role of the

government in each country. The case studies also underline the difficulty in collecting and assessing details regarding the complete procedures and financials of agricultural insurance programmes. As noted, assessing the level of profitability of agricultural insurance systems is a challenge, as data is not numerous, available, or very homogeneous. Each conclusion discusses the value of each programme to the farmer on the extent to which the:

- Farmers' actual risk is covered
- Products are financially accessible to the farmers
- Additional services make the farmers "better off"

Morocco⁴⁸

Context

The main player of the Moroccan agricultural insurance market is the Moroccan Agricultural Mutual Insurance Company (MAMDA), created at independence in 1956. The MAMDA is the main insurer for small-scale farmers, as its principal competitors (Axa or Attijariwafa) target the big farms and agro-industry. The MAMDA is the first-ranked insurer amongst the Moroccan agricultural sector, with almost 70% of the market share in 2006. Its counterpart for farmers' nonagricultural risks is the Moroccan Central Mutual Insurance (MCMA), created in 1969. In 2008, the group MAMDA/MCMA had a turnover of €0.1 billion⁴⁹, with a €0.5 billion

equity. In 2009, they had almost 160,000 customers.

The Moroccan insurance sector is relatively mature. It is the second biggest market of Africa and has a leadership position in the Arab world. In 2010, the total premiums amounted to €1.95 billion in Morocco, whereas it amounted to €821 billion in Algeria and €550 million in Tunisia.

History

Previously, there was an imbalance in the Moroccan agriculture insurance landscape as the climatic risk for the production (the dominant risk) was poorly covered, whereas insur-

⁴⁸ This case study was written by Billy Troy at Foundation for World Agriculture and Rurality (FARM) and is based on interviews carried out during a field mission in September 2012.

⁴⁹ 24/09/2012: 1 euro = 11.1104 Dirham (MAD).

ance products existed for downstream segments like transport. This situation stems from the high risk related to climate, which no insurer wanted to bear.

A drought insurance programme for cereals was launched in 1994 in some regions of Morocco. It was largely supported by the government, MAMDA only managed the programme on behalf of the state. This product proved unsuccessful because premiums were considered too high and claims too low.

Within the framework of the new agricultural strategy launched in 2008, the Green Morocco Plan, the state organised the launch of two new heavily subsidised products.

Market structure

Agriculture insurance in Morocco dates back to the protectorate period and developed through one central player, the Moroccan Agricultural Mutual Insurance Company, although other insurers are now active in the sector.

TABLE 5

Characteristics of agricultural insurance programmes in Morocco

Type	Hail insurance (2009)	Climatic multi-peril insurance (2011)
Role	Replaces a nonsubsidised (thus expensive and with low take-up) product of the MAMDA. May be replaced by the climatic multi-peril insurance	Replaces the previous drought insurance on cereals and leguminous plants
Covered risks	Hail	Drought, hail, frost, excess of water, violent winds, sand winds
Insured crops	Cereals (withdrawn since the launch of a climatic multi-risk insurance for cereals in 2011), arboriculture (citrus fruits, olive trees, fruit trees), truck farming, vineyard, seeds, seedlings	4 cereals (durum wheat, common wheat, corn, and barley) and 5 leguminous plants (broad beans, lentils, peas, chickpeas, and beans)
Beneficiaries	All farmers in 5 regions (north and centre of the country) particularly exposed to hail events	All farmers, small farmers highly subsidised
Management	Ministry of Agriculture, MAMDA	Ministry of Agriculture, MAMDA
Distribution	MAMDA	Mainly MAMDA, with Credit Agricole and BanquePopulaire involved as well
Premium	Depends on the area and crop, between 1.62% and 4.50%	Highly subsidised 2011-2012 Premiums: €21 million
Conditions		The State defines the damaged areas, and MAMDA assesses the yield losses
Premium subsidies	20% to 40% of the premiums depending on the size of the farm Total amount: €240 thousand per year for 20 000 ha insured (2011-2012)	53% to 90% of the premiums depending on the size of the farm Total amount: €20 million for the agricultural year 2011-2012
Reinsurance		Partner Re reinsures the MAMDA

The insurance sector, including agricultural insurances, is regulated by the insurance law. In this framework, every new product has to be approved by the Ministry of Finance before its launch. However, agricultural insurance products regarding climatic risks have been difficult to set up and have undergone several reforms over the last twenty years.

Products

Indemnity-based hail insurance was launched in 2009. In 2011, a new programme of indemnity-based climatic multi-peril insurance was set up, which may replace the hail insurance. The development of an index-based scheme against drought is scheduled to reach the market in 2012-2013 to improve the cover for cereals and forage. The design of this product, which could be based on rainfall, statistics of agricultural production, and remote-sensing estimation of the vegetal cover, is implemented by the Ministry of Agriculture, the MAMDA, the meteorological office and the INRA.

Market penetration

In 2011-2012, around 20,000 ha were covered by hail insurance. This is to be compared with the climatic multi-peril insurance scheme which covered 326,000 ha (80% cereals) by 20,000 policyholders in 14 regions in 2011-2012. Small farmers represent 77% of the surface insured. The objective for 2014-2015 is to cover 1 million ha, one fifth of the total cereal farmlands, representing 5 million ha.

Role of the government

Within the framework of the new agricultural strategy, the Green Morocco Plan, the state reformed the agricultural insurance system to offer a more effective cover for climatic risks. Premiums are highly subsidised by the State, particularly for small-scale farms, but the MAMDA is the insurer, marketing the product and bearing the payout costs.

On top of agricultural insurance, the Moroccan State sets up diversified schemes for the climatic risks management in agriculture. The measures are of two kinds: risk mitigation (especially water management), and post-damage management

(subsidies for seeds and feed for livestock or debt rescheduling for example).

In 2011-2012, the state support for measures against drought amounted to around €81 million, amongst which €18 million were dedicated to the exemption of customs fees for barley import.

Moreover, the Moroccan government is preparing a national strategy for risk mitigation and management in Morocco with the support of the World Bank and the Swiss Development Cooperation.

Issues

The Moroccan strategy for climatic risks insurance in agriculture has the following characteristics:

- Transfer of the insurer's role from the state to MAMDA, yet the government role remains important, as premiums are massively subsidised and the damaged areas are defined by the state.
- Change from named-peril insurance to a multi-peril insurance, with the future possibility of an index-based insurance, with an ambitious implementation schedule.
- Support from the government for small farms to access insurance as outlined in the Green Morocco Plan and the premiums paid by the farmers are symbolic. The objective is to allow the farmers to reinvest in their production following a meteorologically bad year.

After the first year of implementation of the new multi-peril insurance, the objective in terms of area covered for this first year was met. Nevertheless, the objective for 2015 is more ambitious. In this context, along with technical and financial options, the coordination and dialogue between the different players (the state, MAMDA, and agricultural profession) is certainly a key factor in sustainably extending the area and farms covered, especially for small-scale farms that represent a priority for this new insurance system.

Conclusion on the value proposition

Since 2008, Morocco has been implementing an ambitious project, the Green Morocco Plan, combining risk mitigation, insurance, and post-damage management services. This integration of services gives the farmers access to both ex-ante and ex-post risk management tools that can assist in improving their vulnerability. The partnership with the MCMA covers the non-agricultural risks of the farmers allowing them to access a very inclusive insurance package.

The insurance in itself has evolved from single peril insurance to multi-peril policies, extending the scope of cover of the farmers to better cover their actual risk. Premium subsidies have also been introduced for the insurance products, which both increase the value of the cover and improve affordability of the products.

Senegal⁵⁰

Context

Senegalese agriculture employs more than 70% of the labour force. The sector is well diversified, with commercial crops (groundnut, cotton, sugar cane) and food crops (millet, rice, corn, sorghum). Europe is the main export destination for fruits and vegetables 70% of the exports being beans, cherry tomatoes, mangoes, and melons). Nevertheless, Senegal is not self-sufficient and is the second biggest African rice-importing country. The country counts 200,000 km², more than 80,000 km² of which are farmlands, and 60,000 km² are dedicated to livestock. The main issues faced by Senegalese agriculture are drought in the Sahelian area, irregular rainfall, poor lands, and pests.

Senegal is the third insurance market of the CIMA (Interafrican Conference of Insurance Markets) region after Cameroun and the Ivory Coast, with €143 million of turnover, 23% of which come from life insurance.

Particularly high subsidies have been introduced for smallholder farmers targeting support to vulnerable farmers. Which has proven successful as 77% of the insured surface is now represented by these smallholder farmers.

There is one main player, the MADMA, but the fact that the market has been opened up to competition might lead to a new push for innovation and improvements of the products available to the farmers, extending the scope of products.

However, market penetration remains low as only 7% of farmlands was insured in 2011-2012. In order to improve this figure, the Moroccan government could consider increasing farmer involvement in the product design in order to create more buy-in from this group.

History

Since the early 2000s, the Senegalese State has placed two funds in the National Fund for Agricultural Credit of Senegal (CNCAS). The first is a calamity fund to cover some agricultural risks. The second is a fund that guarantees 75% of potential losses on agricultural loans. The government also supports agriculture by reducing interest rates of agricultural loans (from 12.5% to 7% for farmers that are eligible for agricultural loans at the CNCAS).

After some experiments to encourage agriculture insurance with mixed results, the Senegalese government initiated in 2008-2009 the creation of the National Company of Agricultural Insurance of Senegal (CNAAS). The government holds 36% of the capital, whereas private insurance companies and some farmers' organisations hold respectively 56% and 8% of the capital. The objective is to create a private tool for agricultural risk management involving the farmers themselves. Gradually the government intends to transfer its shares to the farmers' organisations.

⁵⁰ This case study was written by Fabrice Larue at FARM and is based on interviews carried out during a field mission in August 2012.

TABLE 6

Characteristics of agricultural insurance programmes offered by CNAAS in Senegal

Product	Insured	Amount insured	Premium	Indemnity trigger
Comprehensive livestock mortality insurance	Horses, oxen, cows, sheep, goats, all depending on their age	80% of the animal value	Between 6% and 9% of the animal value, depending on the livestock type	Death (natural or accidental) and authorised butchering
Specified-crop insurance	Mil, sorghum, groundnut, cotton, corn, and rice	Depends on the crop and production methods, may not exceed the real crop value	Between 0.5% and 1% of the declared crop value, depending on the insured risk (subsidised only if a comprehensive crop insurance is also subscribed)	Fire, excess of rainfall, flood, losses due to wild animals, or birds, other risks specified by the insured
Comprehensive crop insurance	Mil, sorghum, groundnut, cotton, corn, and rice	Depends on the production methods, may not exceed 125% of the real crop value	From 1.5% to more than 10% of the declared crop value, depending on the crop, department, and deductible	Departmental yield inferior to an average departmental yield
Livestock accidental mortality insurance	Horses, oxen, cows, sheep, goats, all depending on their age	Declared value of the animal	Between 2% and 3% of the animal value, depending on the livestock type	Death by road accident, drowning, bush fire, or poisoning
Lack of rainfall insurance	Mil, sorghum, groundnut, cotton, corn, and rice	Chosen by the policyholder, may not exceed 80% of the crop value	From 1.5% to more than 10% of the declared crop value, depending on the department, and deductible	Low level of rainfall at the reference station between 01/06 and 31/11
Poultry mortality insurance	Poultry	Buying or selling value according to the animal		Death by accident or illness

Source: CNAAS⁵¹

⁵¹ www.cnaas.sn

Market structure

The CNAAS is the only insurance company in Senegal to cover agricultural risk. It is accredited by the CIMA and the Senegalese government. There have been local attempts to create mutual risk pooling mechanisms for agricultural risk, but these initiatives now need to be accredited by the CIMA, or join an existing accredited company.

At the national level, the CNAAS is regulated by the Insurance Directorate of the Ministry of Economy and Finance, which approves any new agricultural insurance products. The CNAAS is a company with a 1.5 billion FCFA capital (circa €2 million). It is reinsured by Swiss Re up to 55% and by African reinsurers (Cica-Re, Africa-Re, Aveni-Re) up to 45%.

Products

Below are some examples of policies:

Tomato (2012). The tomato insurance product is an indemnity-based multi-peril policy (floods, heat wave, wild animals, granivorous birds, grasshoppers, out-of-season rainfall). The premium is included (24 euros per ha) in the input loan (of 1,300 euros per ha) contracted with the National Bank for Agricultural Credit of Sénégal (CNCAS), which pays premiums to CNAAS.

Rice (2012). The rice insurance product is an indemnity-based named-peril insurance for rice against granivorous birds, nocturnal birds, and rainfall. The premium is of 15 euros per ha, the insured amount is 457 euros (not far from the campaign loan amount).

Livestock (2013). This is a pilot programme for insurance for livestock. The premium is 8% of the animal value and the claim amounts to 80% of its value.

In 2012, CNAAS launched its first index-based insurance products in partnership with the project Assurance Récolte Sahel, which is implemented by PlaNet Guarantee. These products are weather-based insurances for lack of rainfall for maize and groundnut.

Role of the government

The government subsidises 50% of insurance premiums. The Ministry of Finance has also passed a tax break for agricultural insurance products of the CNAAS making them exempt of tax (estimated to a minimum of 10%).

CNAAS can cover up to €10 million per department and up to €2.3 million per region in case of natural catastrophe. If the claims exceed these amounts, the government will intervene. At the African Union level, a project concerning the states coverage when natural catastrophes occur is under consideration.

Issues

Policies (premium and claim amounts, claim triggering) are not always well understood by farmers, and claims settlement may take a long time (more than a year), which may lead to mistrust. This situation underlines the important role cooperatives or farmers' organisations can play. The market penetration also remains very low.

Conclusion on the value proposition

In 2008, a private insurance company (partly owned by farmers' organisations, the government, and insurance companies) was created with the specific mandate of insuring the agricultural sector. The creation of CNAAS was a big leap forward, as previously there were no agriculture insurance products available, only a public calamity fund that paid for losses to a very limited extent. The ownership structure was an attempt to include the farmers in the product and process design and to leverage the expertise from the insurance sector. However, the use of these sources has yet to reach its full potential. Senegal is currently building up its insurance market for agriculture, highly inspired by the Indian model. With a 50% subsidy contribution to the premiums, the value of the cover is increased and access is encouraged. The products are exempt from tax. The government also takes on part of the risk lowering the cost of reinsurance.

TABLE 7

Market size per product type in Senegal

STOCKBREEDING	YEAR			
	2009	2010	2011	2012
Stockbreeding - Insured farmers	34	135	226	154
Poultry Farming - Insured farmers	0	11	06	02
Cattle - Insured farmers	378	1 174	11 799	30 587
Cattle - Insured animals	195	282	1 461	2 854
Ovine - Insured animals	5	595	6 516	8 888
Goat - Insured animals	139	160	3 672	18 674
Equine - Insured animals	39	137	150	171
Poultry - Insured animals	0	21 093	44 025	30 984

CROP	YEAR			
	2009	2010	2011	2012
Crop - Insured farmers	1 621	1 348	1 348	600
Total area insured (ha)	27 907	2 680	2 617	4 560
Tomato (ha)	2 050	2 617	2 617	0
Groundnut (ha)	12	32	0	0
Cotton (ha)	25 845	0	0	0
Mil (ha)	0	14	0	0
Corn (ha)	0	17	0	0
Rice (ha)	0	0	0	1 943

Source: CNAAS, (ha = Hectares)

Insurance education, however, remains low and claim settlement may still take a long time, resulting in low take-up. In spite of the affordability provided by the subsidy, processes might be an issue of this diversified agriculture product offer.

Senegal is now in the process of creating its first experiences with index-based insurance expanding insurance to new crops that had previously not benefited from any insurance cover. Innovation is encouraged to keep on improving

these products and increase the cover offered to the farmers. The indemnity-based insurance schemes should, however, continue to be developed in parallel with the new index-based covers, as this might open up opportunities for making hybrid products in the future.

The high rate of innovation has been a key driver of the evolution of the Indian schemes, but might be hampered in Senegal because of the lack of competitors which also limits the number of products offered.

Brasil⁵²

Context

Brasil is one of the biggest agricultural countries in the world, one of the first producers and exporters for a large range of products (coffee, sugar, orange juice, beef, etc.) and is ranked number two in the world in the agriculture trade sector. In 2011, the Brazilian agro-trade sector represented almost 36% of exports and almost 22% of Gross Domestic Product (GDP) and employs 20% of the working population (formal numbers). Brasil also has access to a powerful food-processing industry.

Above all, it has a huge potential of vacant land, which can allow significant increase of production. The ownership of this land is, however, very unequally distributed.

The identified risks within the Brazilian agriculture are essentially linked to a high volatility of input or product prices, or climatic risks, like drought or flood.

History

Agricultural insurance began in 1954 when the federal government created the programme, Rural Activity Guarantee Programme (PROAGRO). It relied on a multi-peril crop insurance system, national and individual, bundled with an agricultural loan. Following this initiative, several states launched their own public crop insurance system: COSEP for the Sao Paulo State, and COCAMIG for the Minas Gerais State. But these programmes were massively subsidised, and quickly discovered to be unprofitable. They all came to an end in 2005, except for PROAGRO, which was maintained till 2008.

Between 1939 and 2007, the Brazilian insurance market was protected by the law and all reinsurances were to be provided by the public reinsurance company "Instituto Nacional de Raseguro do Brasil."

The first private insurance initiative appeared in the years 1997-98 when Porto Seguro, collaborating with Swiss Re, developed an insurance programme for hail for apple and pear harvests in several states in the south of Brasil.

However, only since 2005 has the Brazilian government promoted an agricultural insurance system by subsidizing the premium paid to private agricultural insurance companies at a high level. It entailed an important development of crop, livestock, and forest insurance. The insurance market opened to competition in 2007.

Market structure

In Brasil, the agricultural insurance market is now a market where both public and private insurers have a role to play:

- The public sector of agricultural insurance was reformed in 2004, PROAGRO (addressing commercial agriculture) was deeply transformed and two new programmes were created: PROAGRO MAIS and SEAF (Insurance for Family Agriculture), both addressing family agriculture.
- The private sector is represented by commercial insurers and is developing quickly. In 2003, there were only two private insurers for crop and livestock; now there are eight, and their offers have gained in diversity, as they cover forest, livestock, and crop. Amongst those private insurers, the biggest private insurer is Aliança do Brasil, with an agricultural market share of 51%, followed by Nobre-Seguros, with a market share of 22%.

IRB (Brazilian Reinsurance Institute) acted as national reinsurer in a monopolistic position from 1939 to 2007, when IRB retroceded agricultural reinsurance to global reinsurers on the basis of quota sharing. In January 2007, laws were modified to allow global reinsurers to pen-

trate the domestic market. These players may compete with IRB, which is now registered as a local reinsurer under the name *IRB Brasil-Raseguros SA*, a dual company attached to the Ministry of Finance.

IRB managed a special governmental fund of agricultural reinsurance named FESR (Stability Fund for Rural Insurance). Public and private insurers can access this fund, and any company selling agricultural insurance in Brasil may access this fund, but in reality it is only used by two companies, Aliança do Brasil and AGF Brasil showing that its usage is limited. The government plans to replace FESR with another reinsurance tool named Rural Catastrophe Fund, which is expected to provide a more efficient cover.

In 2008, the main global reinsurers operated in Brasil. Resorting to reinsurance is not a constraint in Brasil for insurance against hail, multi-peril insurance, or livestock insurance.

Products

Concerning public insurance programmes, tools have been developed with the transformation of PROAGRO, and the apparition of two other programmes exclusively dedicated to family agriculture: PROAGRO MAIS and SEAF (Seguro da Agricultura Familiar). These public agricultural insurance programmes are indemnity-based insurances.

PROAGRO is the public insurance programme par excellence: it is a multi-peril insurance, bundled with a loan, which is guaranteed in case of disaster.

TABLE 8

Characteristics of agricultural insurance programmes in Brasil

	PROGRAMME NAME		
	PROAGRO "tradicional"	PROAGRO "maize"	SEAF
Type	Multi-peril insurance bundled with a loan	Multi-peril insurance compulsorily bundled with a loan for PRONAF beneficiaries	Insurance compulsorily bundled with a loan for PRONAF beneficiaries
Beneficiaries	Middle-sized farms	Family agriculture	Family agriculture
Management	Central Bank	Ministry of Agrarian Development	Ministry of Agrarian Development
Distribution	Financial agents	Ministry	Ministry
Protection	US\$89.5 thousand per beneficiary per crop	----	----
Insured amount	US\$1.4 billion	US\$2.7 billion	----
Premium	----	----	2% (fixed rate for every insured crop)
Conditions	Loss > 30% of expected income	----	----
Subsidies	----	----	75%
Reinsurance	No	No	No

⁵² A. Perrin-Janet, case study based on a bibliographic review for FARM (September 2012).

Regarding the private insurance programmes, there are multi-peril insurances based on yield loss, covering soya, corn, wheat, and other cereals, which are specifically allocated to big and diversified farms. Those programmes are offered by six insurance companies. They guarantee 50% to 70% of historical production. The risks covered are storm, excess of rainfall, heat or wind, flood, and drought. For the fruit sector, there are also insurances against hail. Since 2004, insurances cover forest fire.

Southern states also have named-peril insurances against hail, essentially used for orchards, crops, and vineyards.

Livestock insurance has also been offered during numerous years by Porto Seguro and Seguradora Brasileira Rural, but Porto Seguro decided to leave this market in 2008. Livestock insurance covers accident and mortality, but epidemics are noninsurable.

During several years, an index-based insurance programme also existed in the State of Rio Grande del Sul, offered by NobreSeguros in partnership with Agrobrasil, which covered hybrid corn. This programme was subsidised and was not renewed in 2008-2009.

The main distribution channels of agricultural insurance are local brokers, banks (in particular Bank of Brasil, which owns Aliança do Brasil, the biggest crop insurer), producers groups and cooperatives. Cooperatives are very active in Brasil, they provide their members with a wide range of services including loans and production marketing.

The subscription to agricultural insurance is on a voluntary basis. Yet, rural banks may make the policies mandatory to guarantee the seasonal loans they are given. The crop insurance programme of the public sector PROAGRO and SEAF are compulsory for the crop credit Pronaf members.

Market penetration

In Brasil, generally speaking, the agricultural insurance penetration is low, even if it is increasing. And this development remains very heterogeneous.

It is acknowledged that PROAGRO insures more than one million of farmers and that 600,000 small farmers are insured by the SEAF programme. Moreover, 2.27 millions ha are insured by private insurers, which represent 2.6% of the total Brazilian farmland area.

The agricultural insurance market was estimated in 2007-2008 at US\$1.53 billion, corresponding to 4.8% of the agricultural product.

The role of the government

The Brazilian government, who, for a long time, has taxed its farmers on exported products, has only been supporting its agriculture sector for a short time. Currently, Brazilian support of agriculture is concentrated on export and results in substantial investments in research, innovation, and infrastructure development. These investments increased threefold between 2007 and 2010.

The Brazilian government provides direct support for farmers in three areas:

1. Low-interest loan subsidies
2. Insurance premium subsidies, programme management, and fund management
3. Debt rescheduling

Brazilian rural debt is substantial, from refinancing by the Treasury to mere debt reshuffling, sometimes with an interest rate decrease. In 2009, the agricultural debt was estimated to almost US\$64 billion approximately the annual amount of harvests.

Issues

Ambitious in the agricultural field, Brasil is taking initiative to support agricultural insurance. For example, it has a regulatory framework allowing insurance companies to access the market and is developing numerous tools to support agricultural insurance within the framework of public private partnerships. Yet agricultural insurance shows some limitations in Brasil. Current outstanding issues with agriculture insurance in Brasil include:

- Lack of credit and demands for debt rescheduling, which are not a direct consequence of insurance inefficiency

- Banks' reluctance to lend to agricultural clients, fearful that they are not creditworthy
- Infrastructure deficiency (i.e., unreliable data for calculating indices)
- Frauds linked to poor agent training and insurers' restlessness, increasing the premium level
- Knowledge deficiency about agricultural insurance products amongst interest groups and, especially, the farmers
- Complexity of the involved organisations (Ministry of Agriculture, Ministry of Agrarian Development, Ministry of Finance, research institutes, financial organisations, credit, and insurance office)

Conclusion on the value proposition

Around 2001, the Brazilian government intensified its assistance, helping with heavy subsidies, increasing the value of the cover and improving affordability of the products. The reinsurance market opened to international reinsurers and the new competition resulted in

China

Context

China is the world's largest agricultural producer, with the fourth largest arable area. However, only 10% of the country surface is cultivated. Chinese agriculture accounts for about 11% of Chinese GDP and employs 41% of the labour force. The sector is well diversified, with cash crops (peanuts, rapeseed, cotton, sugar, vegetables, and fruit) and food crops (rice, wheat, corn, and soybeans). The farmers, mostly smallholders, are amongst the poorest of the population, with an average annual income of US\$715 per capita in 2008, whilst the income of urban residents was US\$2,370, according to the National Office of Statistics of China.

The main issues faced by Chinese agriculture are drought, flood, hail, and frost. Chinese

an increase in the number of products available and crops insured. This might also have had an impact on the price of reinsurance, which is partly ensured by the government, further bringing down the cost of the product.

The government is highly committed to the development of these products as demonstrated by the numerous investments it is making in the field, not only directly to subsidise the products but also by financing research and infrastructure. There are also programmes designed to target family farms, who are the small farmers. These dedicated programmes add to the potential client-value for small landowners, as they may match their needs better. The products are, however, linked to credit programmes and compulsory: the eligibility criteria may restrict access of low-income farmers and reduce client-value of the products.

Still, insurance education remains low and distribution channels have yet to prove their effectiveness as take-up needs to improve. As fraud remains a problem, the insurers should keep experimenting with index products.

farmers are used to coping with adverse events by diversifying their crops or borrowing money from friends and relatives.

History

After some preliminary trials in the 1930s,⁵³ agricultural insurance took off in 1982, with the introduction by the People's Insurance Company of China (PICC) of both livestock and crop insurance. In 2003, considering the poor take-up and results, subsidised insurance programmes were launched. In the following years, the government emphasised insurance as a tool of critical importance for agricultural development and encouraged the creation of new insurance companies to share the market with the PICC.

⁵³ Z. Yanli, "An Introduction to the Development and Regulation of Agricultural Insurance in China," *The Geneva Papers* 34 (2009): 78-84.

Until recently, the regulatory framework for agricultural insurance was weak and underdeveloped. The China Insurance Regulatory Commission (CIRC), created in 1998, strives to fulfill this gap, ensuring the good development of agricultural insurance.

During the same period, the subsidised national Multi-Peril Crop Policy (MPCI) programme was launched, providing cover for several crops against a wide range of risks, including rainstorms, flooding, waterlogging (oversaturation), strong winds, hail, frost, disease, pests, and rodents. With the challenges of this programme in view (costly to design, losses sometimes misadjusted), the government is encouraging the development of new products and pilots.

Market structure

Given China's vast territory, most initiatives are provincially-based, meaning the development of specific crop and livestock products are relevant to a particular province. However, the PICC and China United operate in several provinces. The market consists of a mix of general insurers, specialist agricultural insurers, mutual and private insurers, and pools.⁵⁴

Thanks to a strong increase in premium subsidy in 2007, the market has expanded rapidly. Premiums rose from around US\$160 million in 2006 to US\$2.8 billion in 2011,⁵⁵ making China the second largest market after the United States. In 2011, the penetration rate was of 33% and 31% respectively for crop and forest insurance, and 59% for pig and cattle insurance, according to the China Statistical Yearbook of CIRC.

In China, group policies, contracts subscribed by a community or a cooperative after discussions and general agreement, play an important role

for two reasons. Firstly, crop insurance is not mandatory. Group policies improve insurance take-up, or at least facilitate debates and information about insurance amongst communities. Secondly, in this framework, group contracts at the village or cooperative level facilitate access to insurance. Specific measures regarding small and marginal farmers remain underdeveloped. Microinsurance pilots launched in 2008 only cover 14 million people, roughly 2% of the rural population.⁵⁶

Products

Insurance programmes are compulsory for subsidised cattle and for sow epidemic disease livestock, whereas crop insurance is voluntary. Products are now available in all provinces and almost all fields available for planting and in the livestock breeding industry.

The majority of China's crop insurance is yield-based, multi-peril crop insurance (MPCI). As mentioned before, it is prone to distortions in the loss adjustment. Since 2011, attracted by the promising Chinese market, AIR Worldwide⁵⁷ has launched a MPCI model for the major crops in China. Adopting a statistical approach, it aims to help insurers and reinsurers estimating potential losses. The model takes into account meteorological indices, soil condition, and crop-specific parameters. It benefits from the AIR Worldwide experience in the United States.

Aside from MPCI, there exists a rich offer of traditional indemnity-based policies:⁵⁸ named-peril insurance, crop greenhouse insurance, and forestry insurance (crop revenue designed but not marketed). The main crops insured in China are maize, rice, soybeans, wheat, and cotton.

During the last years, crop Weather Index Insurance (WII) pilots have been launched with the assistance of WFP, IFAD, and GIZ, none of them being scaled up-to-date. One is based on an index of excess of rain/relative humidity for watermelons. Another one is based on indices of excess of rain and drought for rice. Remote sensing insurance is designed but not marketed yet.

As for livestock, available products cover accident, mortality, and epidemic disease. Poultry and aquaculture also have ad hoc policies. No index-based insurance is marketed in this part of the market.

Role of the State

Since 2007, the Chinese government expresses its strong will to support agriculture by:

- Highly subsidising premiums (80% on average, shared between the central, provincial and local governments)
- Supporting insurance companies (financially, they help the creation of new companies ; technically, governmental agencies give some research and development help, and provincial, and local governments help in product implementation and in risk mitigation)
- Providing reinsurance (provincial governments may play the role of reinsurers of last resort)

It should be noted that the Beijing Municipal Government in 2009 made an agreement with global reinsurers⁵⁹, constituting an original Public Private Partnership (PPP), as never seen before in China. This agreement attests to the governments' interest and involvement in agri-

cultural issues. It aimed to alleviate insurers' risk relative to agricultural catastrophes, thus giving a lift to the market. The agreement states insurers retain a first layer of risk (until losses below 160% of the annual premium) and reinsurers intervene on a second layer (losses between 160% and 300%). The Beijing Municipal Government remains responsible for losses exceeding 300%.

Issues

Some of the issues that affect the Chinese agriculture insurance sector are as follows:

- **Communications.** Clients are not always aware of the functions and benefits of insurance, or trusting of insurance companies
- **Smallholder farmers.** Insurers have no incentives to adapt their offer to small farmers
- **Technical knowledge.** Insurers could benefit from international expertise to improve their offers especially in design, ratemaking, loss adjustment, and underwriting
- **Sustainability.** A very high subsidy may not be sustainable once penetration increases, considering the very large rural population of China

Conclusion on the value proposition

The crop insurance offered in China seems to be broad enough for Chinese farmers with multi-peril risks for various crops as well as livestock and available in all provinces of the country. Furthermore, the subsidy is substantial, making the product affordable for farmers. If the quality of services including access, payment, and claims payment continue to match expectations, penetration may increase over time.

⁵⁴ O. Mahul and C. J. Stutley, "Annex E: International Experiences with Agricultural Insurance," in *Government Support to Agricultural Insurance* (Washington, D.C.: World Bank, 2008).

⁵⁵ J. Drakeford and A. Benfield, "Agricultural Insurance: A Growing Class of Business Globally," (Slide Presentation for the USDA Agricultural Outlook Forum, February 2013), <http://purl.umh.edu/146639>.

⁵⁶ L. Morgan and R. Lord, "What's the Future of Microinsurance in China?" Milliman Corporation Website (2011), <http://www.milliman.com/>.

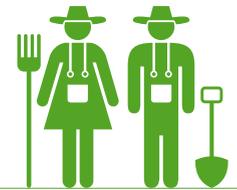
⁵⁷ www.air-worldwide.com.

⁵⁸ O. Mahul and C. J. Stutley, "Agricultural Insurance in Asia and the Pacific Region" (Bangkok: FAO UN, 2011).

⁵⁹ A. Karla, "Microinsurance - Risk Protection for 4 Billion People," *Sigma* 6 (2010).



Conclusions



Lessons learned from established and emerging markets in agriculture insurance

Decade-long experiences in insuring agricultural production in the United States, Canada, and, more recently, in the European Union, have been instructive. The emergence of China, Brazil, and India as big markets for agriculture insurance, as well as large number of pilots and experiments in Africa and other emerging regions, have also provided some interesting observations. The following lessons can be highlighted.

- **It takes time to build well-functioning, actuarially-sound crop insurance systems, and the government has a crucial role to play in creating an environment favorable to agricultural insurance.** A well-specified regulatory regime and legal framework is required to define the insurance companies' field of activities, guarantee their financial integrity, and inspire confidence to all the players involved. Investment in public goods, such as the human and material infrastructure needed to produce and disseminate long time series of reliable data on climatic events, crop yields, etc., can be very useful. So are incentives granted for research on innovative insurance products and for educating farmers to risk management, as it is done in the United States and Canada. All the actors involved – farmers, insurers, reinsurers, governments – have to be mobilised and educated on this topic.
- **Evidence from North America suggests that substantial premium subsidies and public reinsurance are needed to reduce premium cost and attract a large number of farmers, at least to help start the system, but there are issues with this approach.** The strong development of agricultural insurance in India and China is also linked to strong public support. However, long term support through subsidies can be a big drain on national budgets, especially in developing countries. Such subsidies, if not well-considered and implemented, can lead to economic distortions and also hamper risk reducing market based solutions. Hence, such support has to be tempered with efficiency and fiscal sustainability. Experience shows how difficult it is to get rid of subsidies once they have been implemented.
- **The attractiveness and cost of insurance depends on other types of support available to farmers. The efficiency of the services offered creates value for the farmer opting for insurance.** If payment of the indemnity takes too long, as seen in India or Senegal, other coping mechanisms will be preferred by the farmers. The processes as well as the cover must be well thought through to ensure quality of service even when a project scales up to less-densely populated areas. For example, if the producers receive direct payments or benefit from guaranteed prices, like in the United States and the European Union, the governments may have to give high premium subsidies to attract them to crop insurance. Conversely, the existence of smoothing price mechanisms, such as public storage, may reduce price fluctuations and decrease the cost of insurance premiums.
- **Index-based insurance theoretically has many advantages, but it has produced mixed results so far.** Index-based products are potentially less costly and less prone to moral hazard and adverse selection than conventional, indemnity-based insurance imple-



mented in developed countries and some emerging markets (China, Brasil). But they are subject to a strong basis risk, which, in most schemes in developing countries, is far from being adequately addressed. Because of this basis risk, weather index insurance often offers no reliable protection to small farmers. Due to the fact that pilot projects are relatively recent, there is no clear, comprehensive data on the comparative costs of large-scale index-based and indemnity-based insurance systems, taking into account all input and investment expenditures, and premium subsidies. There may actually be room for the coexistence of different types of insurance in

the same country, depending on the production to be insured, the amount of public support, and the targeted population.

- **Technology is a key factor.** Better satellite systems and technical improvements in the modeling of climatic events and crop losses will help reduce the basis risk and the cost of index-based insurance systems in the future. Regardless of the type of insurance, the use of mobile phones can accelerate the indemnification process and diminish costs. Technology can also contribute to improving loss assessments in indemnity-based insurance.

leading to reduced food supply, higher food prices, and increased rural poverty.

- **It is a sound policy to encourage farmers to insure instead of relying on ex-post calamity funds, but not all risks and commodities are insurable.** Insured farmers are encouraged to include the cost of risk in their production decisions and contribute financially to the insurance scheme. They are generally better compensated by insurance indemnities than by public disaster payments. Also, insurance indemnities are triggered by objective factors and are less likely to be captured by political interests than disaster payments, although political interference can never be fully avoided. However, the latter may be the only solution for noninsurable agricultural production, i.e., crops or livestock for which no insurance is available, and when there are no financial instruments, such as futures markets, to manage price risks. Ex-post funds may also be needed to complement insurance indemnities if they are not sufficient to cover deep farm losses. The challenge for governments is to find a balance between restricting calamity funds to encourage the development of insurance (as Spain has done), on one hand, and keeping the possibility of granting ex-post payments under well-defined conditions (as is the case in France), on the other hand. One option, like in the United States, may be to oblige farmers who receive disaster

payments to subscribe to an insurance for the following year, if it is available.

- **Area-based yield insurance appears as an interesting compromise between weather index insurance and indemnity-based crop insurance.** It is potentially less subject to basis risk than the weather index insurance and less expensive to operate than the indemnity-based crop insurance. Also, the farmers may understand area-based yield insurance better than other index-based products, which could lead to higher trust. Area-based yield insurance may, in fact, be used in a complementary way as a hybrid product. However, proper functioning of area-based schemes requires reliable data on yields in each area unit, which may be costly to obtain or may not exist at all.
- **Look for possibilities beyond yield insurance to provide revenue protection.** As long as developing countries do not have well-established insurance markets in agriculture, experience in dealing with yield insurance, and well-functioning futures and options markets, US-type revenue insurance will be out of reach. But other forms of revenue protection may be explored, such as mutual funds based on producers' contributions with government support, or schemes inspired by those implemented for family farms in Brasil.
- **Making insurance mandatory is tempting, but it has drawbacks.** Whilst enlarging the number of farmers in the insurance pool increases the volume of premiums, it also augments the indemnities, and penalises producers who use other risk management methods, especially if the government does not subsidise the premiums or reduce the rate of subsidies to control the cost. In fact, mandatory insurance schemes were common in the 1960s and 1970s; they failed due, in particular, to loose underwriting standards and the lack of incentives to improve their financial soundness. The perspective may be different when one considers linking insurance and credit. Making insurance compulsory for farmers who get subsidised loans, as is the case for example in India and Brasil, is an attractive option so long as the farmers clearly understand the cover they will receive in exchange of their financial contributions.

- **Bundling insurance with inputs is an interesting idea, already put into practice in certain pilot projects.** It may both facilitate the provision of improved seeds, fertilisers, and crop protection products to the farmers, and ease their integration in value chains. However, such arrangements require caution from a legal standpoint, as they may create market distortions and unfair conditions in the access to inputs or credit. Furthermore, unfavourable definitions of eligibility for credit when insurance is bundled with credit or any discontinuity of input distribution may leave some farmers without access to covers and, potentially, such farmers would be the most resource-constrained, and, thus, the most vulnerable.

- **Increase the role of farmers' organisations in the conception, management, and distribution of crop insurance.** A participation process is required to build crop insurance systems, closely involving farmers in order to ensure the client-value of the products. Their increased involvement could also contribute to decreasing distribution costs, better training of farmers, and need for insurance education.

- **Further explore the potential of meso-insurance.** Insuring an entity (aggregator), such as a financial institution, a cooperative, or an input supplier, instead of individual farmers, may make the distribution of insurance easier and reduce the basis risk of index-based products. But there are drawbacks and difficulties too, including (in the case of producer groups) defining the way to redistribute the insurance indemnities amongst farmers. Much research is left to be done to identify how meso-insurance could be properly used.

- **Much remains to be done to encourage research in agricultural insurance, whether by private firms or public entities, and increase educational efforts on risk management at all stages of the insurance industry, from farmers to distributors.** Many research areas are little explored, such as the farmer's demand for insurance – a complex subject that has cultural, social, and economic dimensions. Setting up new, innovative insurance products adapted to specific crops and livestock, and suitable to deal with particular risks, is also a challenge. The need for well-

Emerging Insights

The study observed the following insights and ideas emerging in agriculture insurance. Some mentioned are based on the author's analysis and are open to debate.

- **It is hard to imagine how current pilot insurance projects could be scaled up without the strong and long-lasting financial support of governments.** The experiences from all developed countries and from developing countries that have succeeded in setting up a strong crop insurance system show this success was due largely to public support granted through premium subsidies and reinsurance. Governments seem to be faced with a difficult trade off: keeping underdeveloped agricultural systems or, risking potentially high, and unsustainable, budgetary expenditures. Fixing a time schedule with declining rates in premium subsidies may be an option. Subsidies should be granted as much as possible for medium frequency/medium intensity risk, not for the relatively small risks that can be absorbed by the farmers. And, they should be conditional to the implementation of an actuarially-sound crop insurance system, ensuring that gross premium rates cover, on average, the value of crop losses. However, governments should also weigh the cost of support to agricultural insurance against the cost that producers, and ultimately the consumers and society as a whole, will bear if farmers are not able to insure their crops and livestock, potentially

trained specialists in insurance, from a technical and marketing point of view, will grow as

insurance is more widely adopted by farmers who also need to be educated on insurance.

Insurance: a crucial role in a risk management strategy, but not a panacea

For years, development of the farming sector has been neglected, in many cases by the governments of poor countries. One should rejoice at the emphasis currently being placed on agricultural insurance as a way to help farmers improve their revenue, secure their investments, and help improve food security. Indeed, without managing weather risks, farmers integration in value chains, which gives them access to markets, is compromised. This is especially important for small and medium-sized farmers who have a surplus to sell on the market. This issue will intensify as climate change leads to more frequent extreme weather events, in terms of temperature, rainfall, and storms, and as these events will increase both the need and the cost of risk management.

However, one should be cautious in the enthusiasm certain experts or policy makers have for agricultural insurance, as insurance is not a panacea. It can be an effective risk management tool only when it is combined with other risk management measures (e.g., early warning, provision of risk information, preparedness, and measures to reduce vulnerability). In particular, it is not a substitute for climate change adaptation, which may require changes in farm production systems and all along the agricultural value chains. Insurance should, rather, be considered as one component of a global risk strategy, including risk assessment, risk prevention, and risk management in the strictest sense. This global strategy has many facets, from the resilience of the production system implemented at the farm level, to the nature of policies affecting the agricultural sector. It also deals with questions such as savings made by the farmer to cope with rainy days, and the way risk is managed along the food value chains. It is worth noting that in high income and emerging countries, where agricultural insurance is

well developed, it is part of these countries' agricultural policy.

The policy considerations emerging from the holistic framework recommended by the Organisation for Economic Co-operation and Development (OECD)⁶⁰ for agricultural risk management in developed countries have implications for developing countries too. Firstly, policy design must give attention to the interactions and trade-offs amongst all risks, strategies, and policies, and avoid a narrow focus on single risks or risk management tools, as there is evidence of significant interaction between risks and responses. This should lead policy makers to consider dealing both with yield and price risks, instead of focusing only on yields. Secondly, there is a need for a policy approach with differentiated responses to different types of risk. Catastrophic events, which are beyond the capacity of the farmers or the markets to manage, require government involvement. A medium risk level can be handled through market tools, including insurance and futures markets, and cooperative arrangements amongst farmers (mutual funds). It is up to the government to encourage the development of these markets and arrangements.

The question remains: how should frequent, low intensity risk that affects yields and prices be handled? In developed countries, it is generally thought that these risks are part of the normal business activity and should be borne by the farmers. It is debatable whether the same response can be made for the poorest farmers in the less advanced countries. Therein lies a policy challenge that goes well beyond insurance, and calls for a variety of approaches, from social safety nets to incentives, to shift to non-farm activities.



Appendices



Appendix A

Agriculture insurance and microinsurance

Health and agriculture insurance are known to be the most complex insurance products to bring to the market. Indeed, agriculture insurance providers must be able to absorb the important costs related to the costs of the agricultural risk involved, as well as supply the expertise necessary to implement to product.

The cost of the expertise requested for the loss assessments is considerable, as is the risk of fraud and moral hazard. Agriculture insurance is also subject to important information asymmetries and insurers need to invest in the technical expertise necessary to properly assess the risks.

In addition, modern agricultural production is highly technical and complex and requests a high level of expertise from insurance companies to fully understand the agricultural sector. The remote location of farmers is also a challenge increasing the operational and administrative costs of agricultural insurance in comparison with other types of insurance products. For example, the distribution network needs to have an important presence in rural areas.

The covariant risk inherent in agriculture is another important reason why many insurers shy away from this product. Covariant risk means that the cultivated areas covered by the insurer are often located in areas subject to the same probability of adverse events. Insurance companies hence need to pool the risk across various crops and geographic areas in order to properly hedge their own risk exposure.

As the risk is important and the required expertise to design and administer the products is high, unsubsidised premium levels are often unaffordable to farmers, particularly in developing countries. Traditional loss assessment methods also lead to long waiting periods before the payout is determined and transferred to the beneficiaries.

The main differences between agricultural microinsurance and agricultural insurance reside in the low premiums, which means that microinsurance can only be viable if it is able to attract high volumes.

⁶⁰ OECD, *Managing Risk in Agriculture: Policy Assessment and Design* (OECD Publishing, 2011).

Appendix B

Product types

Agricultural insurance products are usually classified into three main groups: indemnity-based insurance, income insurance, and index insurance. A brief description of indemnity-based insurance and income insurance is provided below, as index insurance was covered in the “current debates” section.

Indemnity-based insurance⁶¹

Indemnity-based insurance is characterised by the payment of a claim based on an actual loss incurred by the insured. In the event of a disaster, an assessment of losses is made on which the compensation is based. These contracts can be on single-risk basis or a multi-peril basis. The main disadvantages of these systems are moral hazard, adverse selection, costly loss assessment process, and often a long waiting period before the compensation is received.

Single-risk insurance

Single-risk insurance is the most common and covers damages resulting from one distinct risk or peril, such as hail, storm, fire, flood, frost, excessive rain, or landslides, which need to be explicitly listed in the insurance policy. A typical contract for single-risk insurance includes the sum insured, which may be based on the production cost or expected income from the harvest. The percentage of loss is determined by an expert and the compensation is calculated by multiplying the percentage of the loss or damage with the sum insured.

The advantage for this type of insurance is the simplicity, affordability of premiums, and clarity of the contract and that the risks are easily measurable.

Multi-risk or multi-peril insurance

A multi-risk indemnity based insurance works like the single-risk insurance, but covers not just one but several perils (including drought) affecting production. The excluded risks are listed in the contract. This type of insurance provides a comprehensive insurance coverage to producers but at a much higher cost than the single-risk insurance.

Multi-risk insurance, which is written mainly in the United States and Canada, accounts for 74% of the total agricultural insurance premiums written worldwide, whilst single risk insurance (hail basically), which is mainly written in European countries, accounts for 16% of the total agricultural insurance premium written worldwide.⁶²

The oldest multi-risk indemnity-based insurance programme is the “U.S. Federal Crop Insurance Program” (FCIP), which was established in 1930 in order to stabilise agricultural production and incomes. It is still the most important and most subsidised programme in the world. Japan also has a long history of such public and subsidised agricultural insurance schemes.⁶³

In the 1970s, this insurance system was introduced in Spain and Portugal, and in the 1980s it spread to many Asian countries (India, Bangladesh, Sri Lanka, Philippines, and China), and in Latin America (Mexico, Costa Rica, Panama, Dominican Republic, Venezuela, Brasil). In several of these countries, the aim of these programmes was more social development (heavily subsidised) than economic development, resulting in very low premium levels.

⁶¹ M. Bielza et al., “Agricultural Insurance Schemes,” 32.

⁶² R. Iturrioz, “Agriculture Insurance,” 4.

⁶³ M. Bielza et al., “Agricultural Insurance Schemes,” 52.

Revenue insurance and others

In most developed countries, and in a limited number of developing countries, agricultural policies provide farmers with safety nets against declines in commodity prices or farm incomes. Some of these safety nets take the form of insurance or comparable systems.

However, revenue insurance and other related mechanisms are a complex matter and differ substantially from country to country, depending on the objectives of policies. There are numerous other mechanisms here that are not cited, whether private, such as futures markets, or funded by the government.

Revenue insurance

Revenue insurance protects farmers against the effects of low yield and low prices. It is a relatively new type of coverage, by which the sum insured is not the size of the harvest, but the revenue. Revenue insurance is very important in the United States, the 73% of the premiums collected coming from these types of insurance.⁶⁴ In addition to insurance indemnities, United States farmers can also receive direct payments, financed entirely by the United States government, when crop prices or crop revenues fall below certain thresholds.

In Canada, farmers receive direct payments when the gross margin of their farm is less than the historical average. These payments cover only a percentage of the loss.

Stabilisation accounts

Stabilisation accounts are a form of self-insurance. They consist of individual accounts where farmers put an amount of money every year, which they can withdraw in a year of big losses.

Stabilisation accounts can be based on yield, revenue, or other indices. These particular accounts are considered because they are not self-insurance accounts created under the farmers’ own initiative, but they are supported and usually regulated by the government. The support can be given by means of direct subsidies complementing the farmers’ contributions to the accounts, like in Canada, or by means of fiscal incentives, like in France.

Mutual funds

Mutual funds are financed by groups of farmers, to indemnify their members affected by a climatic or sanitary disaster, or by low prices. Since 2008, they can be subsidised by the Common Agricultural Policy in the European Union, for compensating losses due to adverse climatic, environmental, or sanitary conditions. The European Union Commission has recently proposed allowing Member States to subsidise mutual funds aimed at paying indemnities against a reduction in the gross margin of the farm due to yield decreases or low prices.

Calamity funds and ad hoc aid

The calamities funds and ad hoc aids are all aids given by the government under the declaration of catastrophes. The ad hoc aids are ex-post aids, which have to be budgeted after a catastrophe has occurred, whilst the funds are provided every year by the Government and they are regulated. The main advantage of the funds over the ad hoc aids is that they avoid big distortions of the government budget. Funds sometimes also receive contributions from the private sector, usually compulsory, in the form of levies on production, or levies on premiums.

⁶⁴ Ibid., 6.

Appendix C

Index-based insurance programmes

Much of the data shown in the following tables comes from a handful of resources. Therefore, these citations are noted with a distinctive symbol:

- © Barnett, B.J., C. B. Barrett, and J. R. Skees. "Poverty Traps and Index-Based Risk Transfer Products." *World Development* 36, No. 10 (2008): 1766-1785.
- † Hazell, P., J. Anderson, N. Balzer, A. Hastrup Clemmensen, U. Hess, and F. Rispoli. "The Potential for Scale and Sustainability in Weather Index Insurance for Agriculture and Rural Livelihood." Rome: WFP/IFAD, 2010.

- ‡ Leblois, A., and Q. Philippe. "Les Assurances Agricoles Basées sur des Indices Météorologiques: Bilan des Connaissances et Agenda de recherché." Paris: CIRED, 2011.

- * Skees, J., A. Murphy, B. Collier, M. J. McCord, and J. Roth. "Scaling Up Index Insurance – What is needed for the big step forward?" Paper prepared for the German Financial Cooperation by Microinsurance Centre, LLC, with GlobalAgrRisk, Inc., 2007.

Additional source:

- ~PlaNNet Guarantee website: www.planetguarantee.com

TABLE 9

Country	Risk	Index	Beneficiaries and date of launch	Initiator and Reinsurance
Algeria ⁶⁵			Yield loss on strategic crops	Agreement signed in January 2013 between CNMA and ONM to design those products. Agreement signed in 2012 planned the construction of several weather stations dedicated to the agricultural field
Argentina ‡	Drought	Rainfall	Small farmholders and dairies (1999) and pilot project in 2005	Help from the World Bank. Reinsurance: Sancor (dairy products)
Bangladesh ⁶⁶	Flood, drought, cyclone, storm surge, and salinity intrusion	Weather index	Small farmholders	Not implemented yet
Benin ⁶⁷	Drought	Satellite imagery, rainfall	Maize and cotton producers (3 products - 2012)	PlaNNet Guarantee, Allianz Afrique, Swiss Re

⁶⁵ Algérie Presse Service, "CNMA-ONM: Accord pour la Mise en Place d'Assurances pour les Cultures Stratégiques," *APS On-line*, January 31, 2013, <http://www.aps.dz/Accord-CNMA-ONM-pour-la-mise-en.html>.

⁶⁶ Asian Development Bank (ADB), "Project 46284-001: Pilot Project on Weather Index-Based Crop Insurance," Project Data Sheet, updated September 2013. <http://www.adb.org/projects/46284-001/details>.

⁶⁷ PlaNNet Guarantee Website, www.planetguarantee.com.

Country	Risk	Index	Beneficiaries and date of launch	Initiator and Reinsurance
Bolivia ⁶⁸	Yieldloss	Area yield index	Farmholders in 4 provinces of North and Central Altiplano	ILO's Microinsurance Innovation Facility government. Insurer: Nacional Vida Seguros de Personas
Brasil†	Drought, flood, and hail on maize	Area yield index	Small, low-income family farms (less than 80 ha) that earn at least 70% of total family income from agriculture (2007)	Dpt of Agriculture and Supply (SAA), State Bank of Rio Grande do Sul (Banrisul), State Data-Processing Company (PROCERGS) and Agro-BrasilSeguros. Insurer: PROAGRO
Burkina Faso ~	Drought		Maize and cotton producers (2 products - 2012) + 1 to 3 projects under consideration (rice, groundnut, cotton, satellite index)	PlaNNet Guarantee, Allianz Afrique, Swiss Re
Canada † (Ontario)	Drought	Rainfall	Breeders / Forage producers – pilot in 2000, insurance in 2003	Federal and Provincial governments, AgriCorp
Caribbean®	Hurricane	Data from NOAA, USGS	Launched in 2007 in 16 countries	Initiated by Caricom
China	Low or rare rainfall‡	Rainfall and daily count of storms	Small producers of watermelon (clients of a microcredit agency) ⁶⁹ . Shanghai. 2007	International Fund for Agricultural Development (IFAD), Government
	Drought and high temperatures†	Drought and heatwave	Rice producers from Changfeng county, Anhui Province (2009)	IFAD-WFP Weather Risk Management Facility (WRMF), Ministry of Agriculture. Insurer: Guoyuan Agricultural Insurance Company
Ethiopia†	Drought	Rainfall and satellite imagery	Small farmholders (2006, 2007 and Harita project in 2010)	Government, PAM, World Bank, Axa Re (PAM's insurer), Nyala Insurance
France	Drought	Satellite imagery	Breeders / Forage producers. Pilot launched in 2013	Private insurer: Pacifica. Public subsidies are under consideration. Product also offered by Groupama ⁷⁰

⁶⁸ ClimateWise, et al., "Adapting to Climate Change in Developing Countries," Global Insurance Industry Statement. www.unepfi.org/fileadmin/documents/insurance_climatechange_statement.pdf.

⁶⁹ B. J. Barnett and O. Mahul, "Weather Index Insurance for Agriculture and Rural Areas in Lower-Income Countries," *American Journal of Agricultural Economics* 89, Issue 5 (2007).

⁷⁰ Assurance Climat, "Coups Durs Pour Groupama Grand Est," *L'Avenir Agricole et Rural*, November 8, 2012, <http://www.avenir52.com/actualites/assurance-climat-coups-durs-pour-groupama-grand-est:RWVQJ8TN.html>.

Country	Risk	Index	Beneficiaries and date of launch	Initiator and Reinsurance
Ghana	Drought, excess of rainfall. (Currently: Maize. Planned: Soya, sorghum, millet, groundnuts, and other crops.)	Rainfall	(2011) Currently: rural banks and one research organisation (Innovations for Poverty Action) which sold the insurance to single farmers. Planned: Commercial banks, rural banks, NGOs, Farmer based organisations, input suppliers, outgrower schemes.	German Federal Ministry for Environment, Nature Conservation, and Nuclear Safety, Ghana Insurers Association
Guatemala	Low rainfall, excess of rainfall, wind, low temperatures		Coffee cooperatives	Project under study by the University of California, Berkeley ⁷¹ , support from USAID
Haiti ⁷²	Hurricanes, earthquakes	Rainfall, wind velocity, seismic activity	Fonkoze's loanees. Programme Kore W launched in 2011	MiCRO (collaboration between Fonkoze and Mercy Corps, Swiss Re, Caribbean Risk Managers Limited, Guy Carpenter and Company LLC, AIC, SFIRi, UK DFID, SDC)
India	Drought /Excess of rainfall	Rainfall / indice satellitaire	Public programmes: NAIS, mNAIS, WBCIS, evolving since 1920	Basix (IMF), AIC, ICICI Lombard, IFFCO Tokio
Indonesia‡	Flood		Slumdweller (2009)	Government, DFID, Tata, GIZ and Munich Re
Jamaica‡	Hurricane		Input providers (pilot in 2009)	Government, DFID, JP Foods
Kenya	Livestock-mortality ⁷³	NDVI	North Kenya: Arid et Semi-Arid Land (ASAL) residents– pilot in 2010	Launching partners: HSNP, FSD, government and reinsurance companies
	Drought, excess of rainfall ⁷⁴	Rainfall	Kilimo Salama crop programme. Small farmholders (2008)	Syngenta Foundation for Sustainable Agriculture
	Weather risks ~	Satellite imagery	Small producers of cotton (2012)	PlaNet Guarantee

⁷¹ E. Sadoulet et al., "Index-Based Weather Insurance for Coffee Cooperatives in Guatemala," (Ongoing project, University of California Berkeley, I4 – Index Insurance Innovation Initiative, 2010).

⁷² Fonkoze's Website, <http://fonkoze.org>.

⁷³ S. Chantarat et al., "Designing Index-Based Livestock Insurance for Managing Asset Risk in Northern Kenya," *Journal of Risk and Insurance* 80 (2010): 205–237.

⁷⁴ Syngenta Foundation Website, www.syngentafoundation.org.

Country	Risk	Index	Beneficiaries and date of launch	Initiator and Reinsurance
Madagascar ‡	Drought and cyclone	Rainfall	Small farmholders (via IMF) (2007)	
Malawi @	Drought	Rainfall (fluid balance)	Groundnut producers (pilot from 2005 to 2010)	Government, DFID, World Bank, Nasfam, Alliance One
Mali ~	Drought		Maize producers (2012) + 1 to 3 products under consideration (rice, groundnut and cotton)	PlaNet Guarantee, Allianz Afrique, Swiss Re
Morocco*	Drought	Rainfall	Small farmholders	Market not interested -> never implemented
Mexico	Drought and excess moisture†	Weather data	Federal and state governments in Mexico purchase the insurance; Benefits are distributed to low-income rural producers of Corn, beans, sorghum and barley (2007)	Agroasemex
	Drought affecting live stock*	NDVI	Breeders from 7 states (2007)	
	Insufficient irrigation*	Reservoir level	Water users groups in the Rio Mayo area	Proposed. Not implemented yet
Mongolia ⁷⁵	Livestock mortality	Mortality index according to area and species	Breeders, 3-year pilot launched in 2006	Government, World Bank
Nicaragua*	Drought and excess of rainfall	Rainfall	Groundnut producers: Project launched in 2006 in 3 departments	World Bank (CRMG)
Peru*	Flood, pouring rain due to El Nino	ENSO anomalies in Pacific Ocean	Rural financial institutions	Proposed. Not implemented yet.
	Drought	Area yield index	Cotton producers	Proposed. Not implemented yet.
Philippines	Typhoons ⁷⁶	Distance from typhoon's path	Small farmholders: Pilot launched in 2009	MicroEnsure and Malayan Insurance Company
	Risks on rice in irrigated areas	Area yield index	Farmer-members of Irrigators Associations and OCCCI, farmer-members of three National Irrigation Systems in Leyte Island (2011)	European Union, BMZ, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Philippine Crop Insurance Corporation (PCIC). Reinsurer: National Reinsurance

⁷⁵ O. Mahul and J. Skees, "Managing Agricultural Risk at the Country Level: The Case of Index-Based Livestock Insurance in Mongolia," Policy Research Working Paper no. 4325 (Washington, D.C.: World Bank, 2007).

⁷⁶ MicroEnsure Website, <http://www.microensure.com/news.asp?id=69>.

Country	Risk	Index	Beneficiaries and date of launch	Initiator and Reinsurance
Rwanda	Drought and flood ⁷⁷	Rainfall	Small farmholders and cooperatives: Pilot launched in 2009	MicroEnsure and Ministry of Agriculture
	Drought, excess of rainfall ⁷⁸	Rainfall	KilimoSalama crop programme. Small farmholders (2012)	Syngenta Foundation for Sustainable Agriculture
Senegal~	Drought		Maize and groundnut producers (2 products - 2012) + 1 product under consideration (rice)	PlaNet Guarantee, Allianz Afrique, Swiss Re, CNAAS
South Africa ‡	Early freeze	Temperature under zero	Cooperatives of apple producers (2007)	Gensec Bank
Spain	Drought		Breeders / Forage producers	
Sri Lanka ~	Weather risks ⁷⁹	Flood and drought		2012: IFC help the insurer SANASA for the product design
Tajikistan ⁸⁰	Weather risks	Weather index	Crops	Feasibility studies underway
Tanzania	Drought and flood ⁸¹	Rainfall	Smallholders	MicroEnsure
	Drought ⁸²	Evapo-transpiration	Cotton producers – pilot project launched in December 2011	MicroEnsure, the Gatsby Foundation, Golden Crescent, Swiss Re, GIFF
Thailand*	Drought	Rainfall	Small maize producers: Project completed in 2007	World Bank (CRMG)

⁷⁷ IFC Advisory Services | Access to Finance, "Weather Index Insurance in Rwanda," Fact Sheet.

⁷⁸ Syngenta Foundation Website, www.syngentafoundation.org.

⁷⁹ Sri Lanka Daily News, "IFC, SANASA Insurance pilot Insurance," April 26, 2002. www.dailynews.lk/2012/04/26/bus03.asp.

⁸⁰ PlaNet Guarantee and FMO "Entrepreneurial Development, Feasibility Study for the Development and Implementation of Index-Based Crop Micro-insurance for Cotton Farmers in Tajikistan," (October 2011), and L. E. Heimfarth and O. Musshoff, "Insurance Schemes for the Agricultural Sector in Tajikistan - What are Adequate Approaches?" [A slide presentation by the Department for Agricultural Economics and Rural Development, Georg-August-Universität Göttingen] (October 2012).

⁸¹ D. E. Osgood et al., "Designing Weather Insurance Contracts for Farmers in Malawi, Tanzania, and Kenya," Final Report to the Commodity Risk Management Group, ARD, World Bank (New York: International Research Institute for Climate and Society, Columbia University, 2007).

⁸² IFC Advisory Services | Access to Finance, "What's New in the Global Index Insurance Facility," GIFF Newsletter 1 (April 2012).

Country	Risk	Index	Beneficiaries and date of launch	Initiator and Reinsurance
Ukraine ⁸³	Yield loss	Yield and area yield index	Pilot project in 2001. Since 2001, insurance available for cereals, oilseed and crops for nonfood uses	Product distributed by 15 insurers (out of the 37 companies involved in crop insurance)
	Drought and high temperatures	3 products: Rainfall, temperature and Selyaninov Hydrothermal Ratio (SHR)	Winter wheat producers in the Kherson oblast (2 farmers insured in 2005 -> project stopped)	IFC, Agribusiness Development project and World Bank CRMG. Insurer: Insurance Company Credo-Classico
USA†	Drought	2 products : Rainfall and NDVI + yield ⁸⁴	Breeders / Forage producers. 2 pilots launched in 2007	US Department of Agriculture, Risk Management Agency (USDA-RMA)
Vietnam ⁸⁵	Flood (business interruption losses due to flood)	River levels	State agricultural bank (VBARD) 2008	GlobalAgRisk; Product approved by the Vietnam Department of Insurance but never bought by VBARD
	Risks on rice	Area yield index	Provincial level-bought by VBARD to insure part of its lending portfolio (2011)	Agricultural Bank Insurance Company (ABIC)
	Drought	Rainfall	Covers consequential costs and losses for coffee producers in DakLak Province (2011)	GlobalAgRisk
Zimbabwe	Drought ⁸⁶	NDVI	Small farmholders	Under consideration, not implemented yet.

⁸³ R. Shynkarenko, "Introduction of Weather Index Insurance in Ukraine – Obstacles and Opportunities," Seminar Paper 9244 at 101st Seminar, European Association of Agricultural Economists, Berlin Germany, July 5-6, 2007, <http://purl.umn.edu/9244>.

⁸⁴ J. Atwood, et al., "The Big Picture - Satellite Remote Sensing Applications in Rangeland Assessment and Crop Insurance," Conference Paper Presented at USDA Outlook Forum, February 24, 2005, <http://purl.umn.edu/32807>.

⁸⁵ GlobAgRisk Website for Vietnam Project, <http://globalagrisk.com/globalagrisk-projects/vietnam/>.

⁸⁶ E. M. Makaudze and M. J. Miranda, "Catastrophic Drought Insurance Based on the Remotely Sensed Normalized Difference Vegetation Index for Smallholder Farmers in Zimbabwe," Paper Presented at 2010 AAAE Third Conference/AEASA 48th Conference, Cape Town, South Africa, September 19-23, 2010, <http://purl.umn.edu/96183>.

Appendix D

Coordination initiatives

Funders, development agencies, and regional associations are putting agriculture insurance on their agendas.

Insurance was recently discussed by the agriculture ministers at the G20 in June 2011 in the context of food price volatility and agriculture. As a result of this meeting, the Platform for Agricultural Risk Management (PARM) was initiated. Consultative meetings of major donors and stakeholders were held to agree on the conceptual framework. The objective of PARM is to promote the integration of agricultural risk management into the agricultural policies of developing countries by facilitating coordination amongst practitioners in this field. The platform was initiated by the French Development Agency (AFD) and is currently endorsed by IFAD, FAO, WFP, World Bank, African Development Bank, OECD, NEPAD, and some bilateral cooperation agencies. PARM will be hosted by IFAD. The New Partnership for African Development (NEPAD) hopes to achieve the integration of risk analysis in every agriculture investment proposal leading to increased awareness of risks and capacity to assess and diagnose risk in agriculture policies and agriculture investments.⁸⁷

The Fédération des Sociétés d'Assurances de Droit National Africaines (FANAF – regrouping 164 insurance companies from 29 African states) met in June 2012 to discuss the state of agriculture insurance in its member states. The concluding report advocates for a continued support from donors in the development of agriculture insurance mechanisms and the sharing of experiences amongst the member states.⁸⁸

At the February, 2013 G20 Development Working Group meeting in Moscow, the Russian presidency put PARM on the agenda leading to statements of support from France, Germany, Italy, and NEPAD.

Awareness is growing regarding the role of agriculture insurance. National governments are realising the role they need to play in order to see the development of such mechanisms with creative ideas such as an African or regional re-insurance pools for agricultural climate risks and other ideas.

⁸⁷ Personal Communication with M. Hemp, IFAD.

⁸⁸ Federation des Societies d'Assurances de Droit National Africaines (FANAF) Website, www.fanaf.org.

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The Microinsurance Network is a member-based network of organisations and individuals active in microinsurance. The mission of the Network is to promote the development and proliferation of good-value insurance products for low-income persons by providing a platform for information sharing and stakeholder coordination.

The Agriculture Working Group of the Microinsurance Network seeks to promote the wider use of agricultural insurance, particularly crop and livestock insurance, as a modern financial risk management instrument in developing countries.

For more information on the Microinsurance Network visit www.microinsurancenetWORK.org

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