

Improving climate risk transfer and management for Climate-Smart Agriculture

A review of existing examples of successful index-based insurance for scaling up



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Review

The review consists of a collection of case studies providing the basis for further exploring the function of index-based risk management tools towards the promotion of Climate-Smart Agriculture, through the adoption of tailored solutions by farming communities increasingly exposed to climate change related risks.



GLOBAL ALLIANCE FOR
CLIMATE-SMART AGRICULTURE

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Food and Agriculture
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RESEARCH PROGRAM ON
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LIST OF ACRONYMS

1.	ACRE	Agriculture and Climate Risk Enterprise
2.	AFD	Agricultural and Forestry Development
3.	AGRA	Alliance for a Green Revolution in Africa
4.	AGRODIA	Association de Grossistes et Détaillants d’Intrants du Burkina Faso
5.	AIC	Agricultural Insurance Company of India
6.	AIP	Approved Insurance Providers
7.	AMAB	Assurance Mutuelle Agricole du Benin
8.	APH	Actual Production History
9.	ARBY	Area-based yield
10.	ARH	Actual Revenue History
11.	ARP	Area Revenue Protection
12.	ARS	Assurance Récolte Sahel
13.	AYP	Area Yield Protection
14.	CAT	Catastrophic Coverage
15.	CCAFS	Climate Change and Food Security
16.	CGIAR	Consultative Group for International Agricultural Research
17.	CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
18.	CSA	Climate-Smart Agriculture
19.	CSV	Climate-Smart Village
20.	ECOWAS	Economic Community of West African States
21.	EU	European Union
22.	ET	Evapotranspiration
23.	FAO	Food and Agricultural Organization of the United Nations
24.	FCIC	Federal Crop Insurance Corporation
25.	FMARD	Nigeria’s Federal Ministry of Agriculture and Rural Development
26.	GACSA	Global Alliance on Climate-Smart Agriculture
27.	GHG	Green House Gases
28.	GIIF	Global Index Insurance Facility
29.	GIZ	German Corporation for International Cooperation
30.	GRIP	Group Risk Income Protection
31.	HARITA	Horn of Africa Risk Transfer for Adaptation
32.	IBRD	International Bank for Reconstruction and Development
33.	IFC	International Finance Corporation
34.	IFDC	International Fertilizer Development Center
35.	IFW	Insurance for Work
36.	ILO	International Labour Organization
37.	IPCC	Intergovernmental Panel on Climate Change

38.	IRDA	Insurance Regulatory and Development Authority of India
39.	IRI	International Research Institute for Climate and Society
40.	MFIs	Microfinance institutions
41.	NAIC	Nigerian Agricultural Insurance Corporation
42.	NARF	National Agricultural Resilience Framework
43.	NDVI	Normalized Difference Vegetation Index
44.	NGOs	Non-governmental organizations
45.	NIA	Nigerian Insurers' Association
46.	NIMET	Nigerian Meteorological Agency
47.	PG	PlaNet Guarantee
48.	PSNP	Productive Safenet Program
49.	REST	Relief Society of Tigray
50.	RMA	Risk Management Agency
51.	RNCPS	Reseau National des Cooperatives des Producteurs de Semences d'Arachide du Senegal
52.	RPG	Replanting Guarantee
53.	SSA	Sub-Saharan Africa
54.	SCO	Supplemental Coverage Option
55.	SNIID	Social Network for Index Insurance Design
56.	SRA	Standard Reinsurance Agreement
57.	UNCTAD	United Nations Conference on Trade and Development
58.	UNEP	United Nations Environment Programme
59.	USAID	United States Agency for International Development
60.	USDA	United States Department of Agriculture
61.	WBCIS	Weather Based Insurance Index
62.	WFP	World Food Programme
63.	WFRP	Whole-Farm Revenue Protection
64.	YP	Yield Protection

Introduction

Overview of index based insurance tools application and rationale of the publication¹

"In a world of plenty, no one, not a single person, should go hungry. But almost one billion still do not have enough to eat. I want to see an end to hunger everywhere within my lifetime."

These were the words of Ban Ki-moon, United Nations Secretary General, at the Rio20+ Conference in Rio de Janeiro, Brazil in 2012, where heads of states, principals of major global development agencies, and leaders from business and civil society met to envision viable pathways for sustaining the environmental well-being of the planet as population grows toward a projected nine billion people by 2050.

The causes of hunger and global food insecurity are numerous. Contributing factors include low agricultural productivity of farmland in much of the developing world; weak or under-developed agricultural markets; inadequate extension services; unsustainable farming practices; lack of access to capital and displacements of populations from their homelands due to persistent violence, conflict or insurgency. These situations constitute severe challenges, many of which have been linked to climate change. Since 1980, climate change is estimated to have reduced global yields of maize and wheat by 3.8 and 5.5% respectively (Lobell *et al.*, 2011). Increased climate variability in the coming decades will increase the frequency and severity of floods and droughts, radically disrupting markets, increasing production risks, reducing coping capacities and elevating threats to food access, especially for vulnerable and resource-poor communities (Bates *et al.*, 2010; Thornton and Gerber, 2010; FAO and EU, 2014).

¹ Contribution prepared by Professor Jimmy Adegoke, University of Missouri-Kansas City (UMKC) and Bianca Dendena (FAO).

Climate-smart agriculture (CSA) has recently gained prominence as a responsive approach to these challenges. CSA is defined by three objectives: sustainably increasing agricultural productivity to support increased incomes, food security and development; promoting adaptive capacity at multiple levels; and enabling greenhouse gas (GHG) emission reductions and increasing carbon sinks (FAO, 2013). Therefore, the concept of CSA combines climate change and food security through the integration of adaptation and mitigation measures. As such, it aims to reduce vulnerability by improving the adaptive capacity of agricultural systems to climate stress, thus securing the provision of food, while reducing GHG emissions from agricultural practices and land uses that contribute to climate change (Scherr *et al.*, 2012; Campbell *et al.*, 2014; Harvey *et al.*, 2014). The case has been made that CSA's overarching aim is to orient and "ground" the correct technical, policy and investment conditions required for agriculture to respond to climate change and future food demands (Ren, 2015). A key reason for the emergence of the CSA model was the recognition that agriculture, and related food security issues, require a holistic approach that can be achieved through synergistic efforts that encompass climate change mitigation and adaptation objectives within an integrated framework.

As mentioned, a key component of CSA is building adaptive capacity to enable various actors along the agricultural production value chain to respond effectively to longer-term climate change and improve their ability to manage the risks associated with increased climate variability. Actions to build adaptive capacity are diverse. These include building ecosystem services that enhance resilience in agricultural systems; access to crop varieties that are more tolerant to heat, drought, flood and salinity; diversification of farm enterprises; and climate information services and information related to planting dates, pest control, etc. (Campbell *et al.*, 2014).

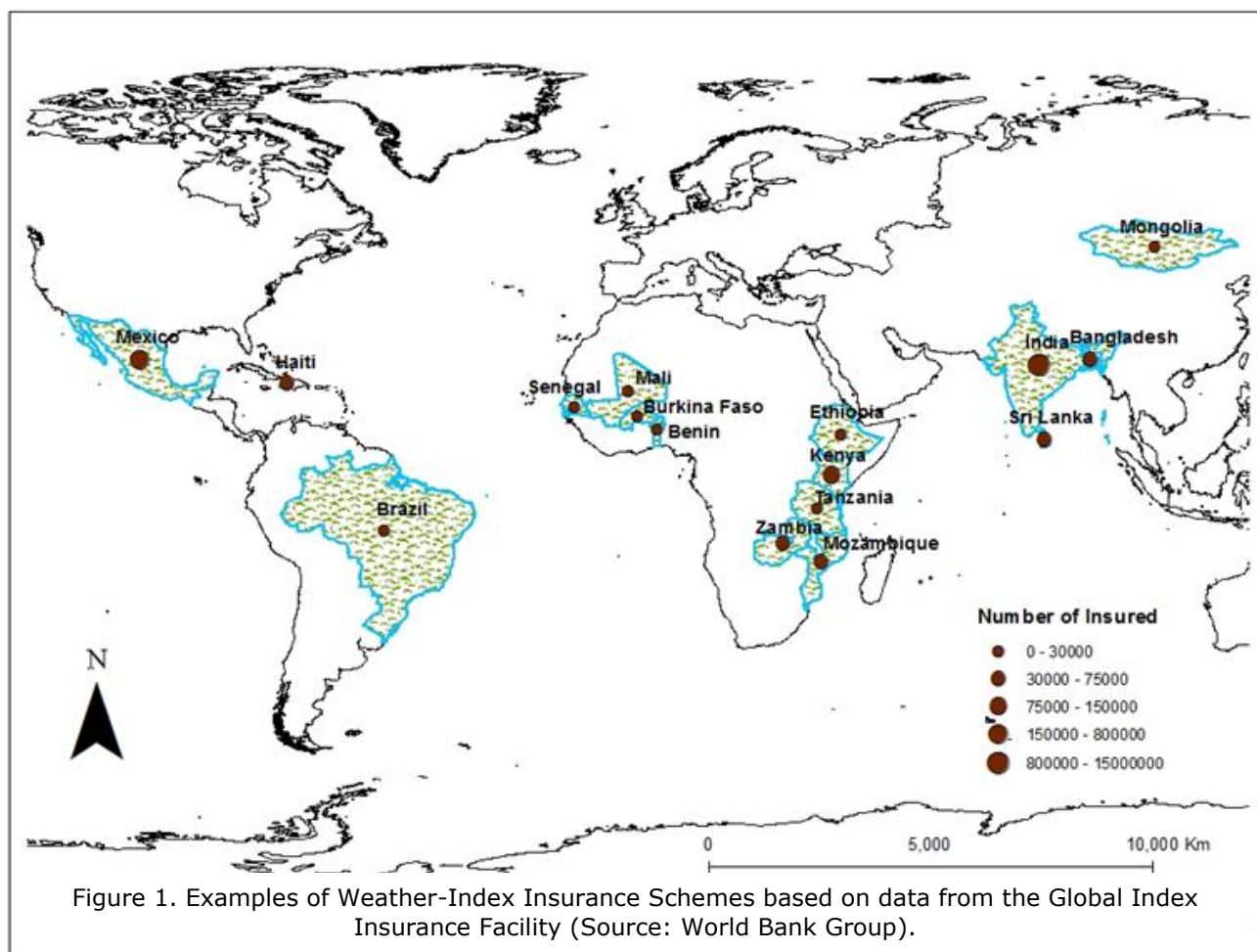
Other actions may include enhancing social safety nets and adopting risk management or risk transfer instruments such as index-based insurance, which is increasingly viewed as an important tool for allowing smallholder farmers to better manage climate risk by enhancing their resilience.

Index insurance differs from traditional indemnity insurance, where payouts are explicitly based on measured loss for a specific client. Instead, in index insurance, farmers can purchase coverage based on an index that is correlated with those losses, such as the amount of rain during a certain time span (weather-based indices) or average yield losses over a larger region (area yield indices). Payouts are then triggered when this index falls above or below a pre-specified threshold. This means that index insurance is not designed to protect farmers against every peril, but is instead designed for situations where there is a larger scale, or regional risk (in the case of area yield insurance), or a well-defined climate risk (in the case of weather-based index insurance) that significantly influences a farmer's livelihood (Greatrex *et al.*, 2015).

Compared to its traditional indemnity counterpart, index-based insurance has several advantages, especially for smallholder farmers in developing countries. In indemnity insurance, the contract payout is dependent on the crop outcome of a specific farm for which insurance was previously purchased. The farmer can only claim a payout if the crop fails, and this might serve as an incentive for the farmer to allow crops to fail. This is the so-called "moral hazard". On a related note, adverse selection may occur when the demand for insurance is positively correlated with the risk of loss, thus higher risk clients will tend to buy more insurance. Both of these phenomena lead to increased

premiums in order for the insurance company to account for the increased risk of a payout. Index insurance largely overcomes these problems. In this case, payout is determined by an objective index, such as the amount of rain measured at a local weather station, or the health or vigor of vegetation as determined through a satellite-derived index. There is no need to verify losses through individual farm visits, which offers major cost saving from reduced administration costs.

In addition, index insurance is more resistant to moral hazard and adverse selection, which again leads to lower premiums. In this case, a payout does not depend on the state of farmers' fields, and so the farmers who benefit most are those who can keep their crops alive in an adverse year (Greatrex *et al.*, 2015). Moreover, index insurance is usually designed for a specific, clearly defined hazard and it does not typically cover all the risks that a farmer might be exposed to. The insurer is therefore covering less risk and is better able to quantify the probabilities of payout. These savings generally translate to less expensive premiums for the insured. It is precisely for these reasons that index-based insurance is being promoted as a valuable adaptive instrument and climate risk transfer mechanism for smallholder farmers through increased access to the insurance market.



As well as contributing to effectively building adaptive capacities to face climate change, index-based insurance can play a role in fostering the reduction of GHG emissions and increasing carbon sinks by contributing to orient the intensification of agroecosystems. In this sense, some studies (e.g. Campbell *et al.*, 2014) suggest that when intensification is well planned and properly incentivized, it is not only an essential means of adapting to climate change, but also results in lower emissions per unit of output. The relevance of mitigation is acknowledged in the CSA approach, where the reduction of GHG is indeed the third leg of the tripod on which CSA stands. This is not unexpected as agriculture is a significant sector in terms of GHG emissions, and is therefore under pressure to mitigate climate change through GHG emission reductions. The 2014 Fifth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC) estimated that agriculture, forestry and other land use are responsible for around a quarter of current anthropogenic GHG emissions (Smith *et al.*,

2014). If pre- and post-process emissions are included, global food systems contribute between 19% and 29% of global GHG emissions (Vermeulen *et al.*, 2012). The potential for GHG emission reductions from agriculture by 2030, considering both reductions in GHG emissions and increases in soil carbon sequestration, are estimated to be between 4,500 and 6,000 Mt CO₂e/year (Branca *et al.*, 2013; Smith *et al.*, 2008).

Developing countries are particularly vulnerable to climate change impacts because of weak institutional support mechanisms and the high dependence on rainfed agriculture among their millions of smallholder farmers. In this framework, it is generally acknowledged that Africa will be the continent hardest hit by climate change, and with the weakest coping capacity, while resources to manage disaster risk and adaptation to climate change are limited and segmented. The recent guidebook on climate change adaptation in Africa produced by UNEP (2012) identified insurance and other *ex ante* risk financing mechanisms as a critical

part of a comprehensive disaster risk management strategy, having the potential to play an important role in disaster risk reduction and climate change adaptation in Africa. In addition, financial products need to be tied to efforts and incentives for investment in risk reduction.

There are some, though still few, very good examples of the use of micro-insurance for helping climate change vulnerable communities available in different parts of Africa, as well as in other geographic regions. In Africa specifically, where over the last 30 years data from the International Disaster Database show that an estimated 1,000 natural disasters occurred affecting 328 million people, the index-based program initially known as HARITA (now known as the Rural Resilience Initiative R4²) is helping farmers to get access to loans. Such loans are used to purchase farm inputs with the support of a national organization that provides agricultural extension services, including assistance in securing better market access for farmers. In addition, the World Bank, in collaboration with MicroEnsure as an insurance intermediary, introduced one of Africa's first Weather Index Crop Insurance programs during the 2005-2006 growing season as a pilot in Malawi³. This product provided protection against crop failure caused by drought or excess rain, and enabled farmers to access credit used to purchase quality seeds and fertilizers in order to maximize output. By linking farms to local weather stations and introducing an automatic payout process, farmers were not required to file a claim or go through an expensive loss verification process in

² For further details on the program, see the section referred to as *The R4 Rural Resilience Initiative*.

³ The partners involved in this project since 2005 include the Insurance Association of Malawi (IAM), Malawi Rural Finance Corporation (MRFC), Opportunity International Bank of Malawi (OIBM), the National Association of Small Farmers of Malawi (NASFAM), and in more recent years the Malawi Union of Savings and Credit Cooperatives (MUSSCO), Malawi Savings Bank (MSB), the contract farming companies Alliance One, Limbe Leaf and Cheetah, the National Association of Small Farmers of Malawi (NASFAM), and the Malawi Meteorological Services Department (MMSD).

the event of crop failure. Following the success of this pilot scheme, Weather Index Crop Insurance was extended to cover farmers across in Tanzania, Rwanda and Asia (India and the Philippines). The Global Index Insurance Facility (GIIF)⁴, an innovative program of the World Bank Group's Finance and Markets Global Practice, is an effective example of initiatives spreading index insurance as a tool for ensuring resilience and self-reliance for small-scale food producers worldwide. GIIF is multi-donor trust fund supporting the development and growth of local markets for weather and disaster-related index-based insurance in developing countries, primarily sub-Saharan Africa, Latin America and the Caribbean, and Asia Pacific. GIIF's objective is to expand the use of index insurance as a risk management tool in agriculture, food security and disaster risk reduction. To date, GIIF's implementing partners have covered more than 600,000 farmers, pastoralists and micro-entrepreneurs with \$119 million in sums insured and reached over one million people with information about and access to index insurance. Another related project is the Index Insurance Innovation Initiative (I4)⁵, jointly implemented by the Feed the Future Innovation Lab for Assets and Market Access at UC Davis, the United States Agency for International Development (USAID), the Food and Agriculture Organization of the United Nations (FAO), the Micro-Insurance Innovation Facility of the International Labour Organization (ILO) and Oxfam America.

Such a research initiative is focused on designing and testing specific solutions to issues characterizing earlier index insurance tools and facilitating the uptake of improved tools by at-risk communities. Currently, there are a wide range of innovative solutions being tested related to different aspects of index-based insurance products.

⁴ For a complete overview of GIIF projects by region, please refer to [GIIF website](#).

⁵ For a complete overview of I4 program, please refer to [I4 website](#).

In Guatemala, for instance, the research focus is on understanding how index-based insurance products can improve risk management and risk coping for coffee cooperatives and their members, particularly looking at the reasons why index-based group insurance may be superior to index-based individual insurance in terms of uptake.

In northern Kenya, pastoralist and agro-pastoralist households vulnerable to drought are involved in a project aimed to evaluate synergies between social development and social protection plans, with the latter consisting of an insurance program with payments based on remote sensing indicators of forage scarcity and livestock mortality.

An ongoing experiment in Peru seeks to test an area-based yield (ARBY) insurance scheme for small and medium-sized producers in selected valleys of the Peruvian coast by working in close collaboration with government officials, financial market providers, and the private insurance sector. By assessing the uptake and impact of this pilot project, conclusions will be made to inform future activity of the local Ministry of Agriculture.

The OSU/ACET project in Ghana is testing a model of integrated climate risk management strategies, focused on the coupling of index insurance with production loans that require any indemnity payment to first be applied to outstanding loans. According to the research hypothesis, this would reduce the impact of agricultural loan defaults on lenders during adverse natural events, thereby allowing lenders to reduce the interest rates they charge on agricultural production loans, thus expanding access to credit among smallholders.

In Tanzania, the focus of the research initiative is on reducing the basis risk associated with weather index insurance products by developing a satellite-based index that could increase the precision of using environmental and weather factors to estimate actual yields. The satellite-based indicators currently being tested are the Normalized Difference Vegetation Index

(NDVI) and measures of evapotranspiration (ET) on which a low cost index system more strongly correlating with crop yields could be built.

Through collaboration with Nyala Insurance in Ethiopia, the I4 initiative is trying to provide insurance through credit contracts, thus overcoming the approach of addressing only a credit constraint or insurance failures. The testing of insured credit targets local cooperatives that borrow in order to make in-kind loans of fertilizer. In years in which an index insurance mechanism indicates a payout, loans will be repaid by the insurance to the cooperatives, with the ultimate goal of improving agricultural productivity and incomes among Ethiopian smallholders.

In Ethiopia and Bangladesh, there is another ongoing research project aimed at developing simple, flexible and inclusive index insurance products to be placed in the framework of network-based savings, gifts and loans credit to insure some of the basis risk inherent to these products.

The research questions underlying the ongoing initiatives mentioned in the overview above, which is far from being exhaustive, provide the basis for further exploring the function of index-based risk transfer instruments in light of the urgent challenges and issues posed by climate change. A major point in this sense is the understanding of the opportunities for using index-based insurance to promote sustainable intensification within agricultural systems in ways that can help achieve all three CSA objectives.

This review will explore this central question and examine the extent to which weather index insurance complements the three CSA objectives. Some relevant case studies are referred to by highlighting key success factors and challenges that appear to contribute to the outcomes of the implementation of the index-based agricultural insurance programs reviewed. The report also draws out lessons that should be considered as a basis for further building out these initiatives and/or scaling them up to other contexts and countries.

Case Study: India⁶

Background

Since 1920, there have been several scattered pilot projects on crop insurance in India. However, the first comprehensive nation-wide crop insurance scheme was launched only in 1985. It was based on the area-yield approach and covered cereals, legumes and oilseeds, and was linked to agricultural credit borrowers. The indemnity and premiums were to a large extent paid by the government. A National Agricultural Insurance Scheme was launched in 1999 to address the operational problems of the previous scheme. Today, nearly 30 million farmers are insured in India (Dept. of Agriculture, 2014).

Weather-index-based insurance began in 2003 when the ICICI-Lombard General Insurance Company offered rainfall insurance to groundnut and castor farmers in Andhra Pradesh. A national-level Weather-Based Crop Insurance Scheme (WBCIS) was launched in 2007. Under this scheme, claim payments to farmers are an explicit function of specific triggers related to thresholds of rainfall, temperature or humidity as recorded at a local reference weather station. The scheme also works on an area approach. The introduction of WBCIS gave stakeholders an option of rainfall/temperature index in addition to yield index of previous schemes. Almost 14 million farmers have their crops insured by weather index-based schemes, which is largest in the world (Dept. of Agriculture, 2014).

Objectives and approach

Climatic variability has been a major source for widespread agrarian distress in India. The key objective of WBCIS is to provide farmers an objective, transparent scheme that offers them a safety net in the event of climatic extremes. Reducing agrarian

distress through a faster and more transparent claim settlements process and removing moral hazard associated with crop cutting experiments are among the key objectives of WBCIS. The triggers are designed for specific crops and regions based on crop-weather relationships. Payments are made once the weather variable crosses the pre-established trigger at the pre-agreed local reference weather station.

Contribution to CSA

Smallholder farmers have limited capital and often lack the resources to access to institutional credit. In the event of crop damage due to climatic stresses, weather-based crop insurance can assure farmers of some income, to mitigate their losses and build resilience. Payouts from the insurance scheme can prevent farmers from undertaking extreme coping measures such as migration, emergency disposal of assets and so on. It can instil faith in farmers to continue farming and investing in inputs even in the face of climatic stresses. In addition, insurance in India is linked to farm loans and therefore it increases access to credit for resource poor farmers. This income presumably goes towards improved technologies but there is no direct evidence that insurance triggers investment in climate-smart agriculture practices and technologies. At present, crop insurance programmes have no link with the adoption of any climate-smart agriculture practices and technologies.

Characteristics and Design Methodology of Weather Index Insurance

India has been experimenting with a number of crop insurance schemes for at least four decades. Area-yield index insurance schemes were introduced on a large-scale in 1985. To reduce the anomalies and moral hazard in such schemes, a weather-based pilot was introduced in 2003 as rainfall insurance. Based on this experience, a national level weather-based crop insurance scheme

⁶ Contribution prepared by Dr Pramod Aggarwal, Regional Program Leader of the CGIAR Research Program on Climate Change, Agriculture and Food Security.

(WBCIS) was started in 2007 where the claim payment is a direct function of weather parameters such as rainfall, dry spell, high temperature, frost, or humidity. Several alternative products have been tried in India, like season rainfall index, weighted rainfall index, multiple phase weather index, consecutive dry day index, excess/untimely rainfall index, low temperature and frost indices, high temperature indices and indices for pest and diseases. Today's WBCIS products are typically a combination of these based on crop and region. The most common rainfall indices have crop sensitivity in different phenological phases.

Insurance is provided for crops grown in the monsoon season as well as in the post-monsoon season. Most cereals, pulses, oilseeds and several annual horticultural crops are covered under this scheme. The scheme operates on the principle of "Area Approach" in selected notified Reference Unit Areas linked to a notified reference weather station. The risk coverage is generally from sowing to crop maturity but could vary with individual crops and Reference Unit Area.

Adverse weather incidents, if any, during the crop season entitle the insured farmer a payout, subject to the weather triggers defined in the 'Payout Structure' and the terms and conditions of the scheme. All farmers (including sharecroppers and tenant cultivators) in the notified area are treated on par with regard to insurance. The scheme is mandatory for cultivators availing institutional credit for agriculture, and voluntary for everyone else.

Various states have tried to implement both area-yield index as well as WBCIS simultaneously. Both schemes enjoy substantial government subsidy: only the insured cultivator pays only a part of the total premium, and the balance is borne by the government. Unlike area-yield index schemes, WBCIS allows participation of private sector insurance companies. For a given district, governments generally choose one specific insurance company based on open competition between companies.

The amount of insurance protection (the sum insured) is broadly based on the cost of inputs expected to be incurred by the insured in raising the crop. The sum insured is notified per unit area at the beginning of every crop season in consultation with experts. It is different for various crops and could also vary by region. The total sum insured is further divided to various growth phases and critical weather indices depending upon their importance. These are determined by agronomists and others based on their judgement and experience. For the rainfed crops during the monsoon season such as rice, millets, soybean, cotton, pigeon pea and peanut, most insurance schemes have a crop growth stage specific scheme. In winter crops such as wheat, chickpea and mustard the growth stage specific or calendar month specific indices of high temperature as well as frost days are generally used in insurance schemes. In crops such as potato, insurance schemes are also available for pests and diseases such as late blight, which use proxies of temperature, rainfall and humidity as triggers.

Despite such details, there is still considerable basis risk in all crops leading to farmers' dissatisfaction (Biswas and Tortajada, 2015). As a consequence there is a fair chance of an insured farmer getting compensation when he or she may actually not have suffered a loss. Also, the contrary case of not being compensated when they have suffered heavy losses may occur. An additional reason for these is the spatial distribution of risk, which is not well captured due to the limited density of weather stations. Lately a variety of statistical tools and crop growth models have been used by the industry to better characterise key weather indices, the critical crop growth phases, and their relative importance in yield loss estimation. More recently, a farmer satisfaction index was developed to develop appropriate rainfall/dry spell triggers based on an innovative methodology using historical crop weather and yield data, statistical models, few crop growth models and optimisation techniques.

The premium rates are calculated based on expected losses calculated using historical weather data of the last 30 to 100 years depending upon availability. Thus, the premium rate could vary with each region and with each crop. For most food crops premium rates to be paid by the insured are capped at 1.5-2.0 % and the balance is paid by the government.

Distribution and Organization Mechanism

All farmers in the notified areas can avail the WBCIS scheme. In addition, farmers availing crop loans from any financial institution including cooperative / commercial / regional and rural banks are automatically covered under the insurance scheme. All other farmers who wish to avail insurance coverage can enrol by registering for the scheme at the nearest bank branch before the start of the crop specific risk period, if they have a bank account, and pay the requisite premium. These financial institutions are responsible for distributing any payouts from the insurer to the insured.

The Agricultural Insurance Company of India (AIC) has been the traditional administrator of the government crop insurance programs. Lately, private insurance companies are also allowed to participate in the scheme. Today, there are several insurance companies offering

WBCIS. In each district, only one company is assigned to run the scheme.

Other relevant actors involved

Besides farmers, insurers and the government (Dept. of Agriculture and Insurance Regulatory and Development Authority of India, IRDA) as regulatory bodies, other institutions like banks, research institutes like state agriculture universities and CGIAR centres are among the major actors involved in this sector. Research institutes, farmers and experts play an important role in designing WBCIS term sheets. The India Meteorology Department, and lately several private companies, provide the reference weather data as well as the historical data. State government officials, banks and sometimes insurance companies conduct awareness campaigns for farmers.

Program Impact and Outcomes

The weather index insurance in India is the world's largest weather-based crop insurance scheme. Over the last decade, it has established its position in the crop insurance market through transforming itself from small scattered pilots to a large-scale program covering more than 14 million farmers.

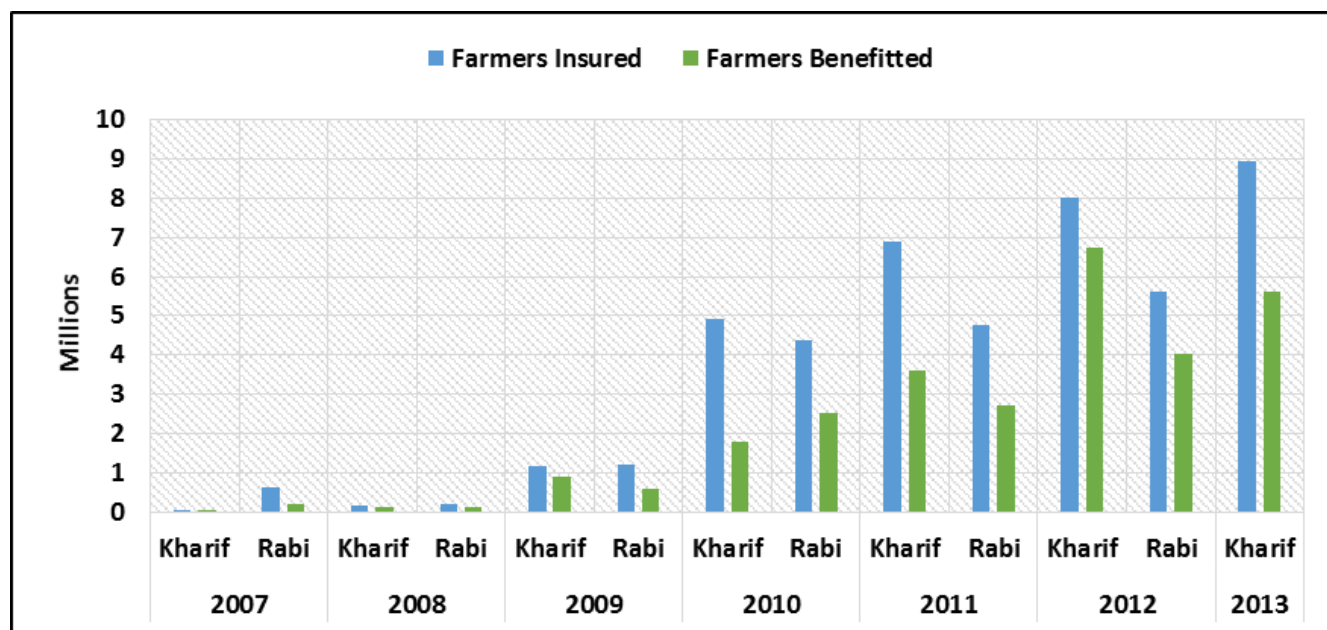


Figure 2. Number of farmers insured and benefited by WBCIS in India from Kharif-2007 to Kharif-2013 (Source: Anon, 2014).

This was partially achieved by making and subsidising the premiums to the tune of 50 to 70 %. Currently, WBCIS is being implemented in 18 states, with the highest coverage in Rajasthan. Figure 2 shows the exponential pattern of the growth of WBCIS in India.

Over a period of six and half years, WBCIS has insured, on an average, 4.3 million farmers per season leading to 5.9 million hectares of land coverage per season. The financial indicators like sum insured, gross premium and claims are presented in Figure 3.

The amount in claims was less than the premium amount in all seasons except for Rabi-2012. For the entire period, the claim ratio was 0.7 and loss cost was 7%. Both (claim ratio and loss cost) are significantly lower than other insurance schemes being operated in India. This certainly indicates better financial viability. A question, though, arises on the high basis risks, which is leading to no or less payment despite significant crop losses. This certainly indicates better financial viability. A question, though, arises on the high basis risks, which is leading to no or less payment despite significant crop losses.

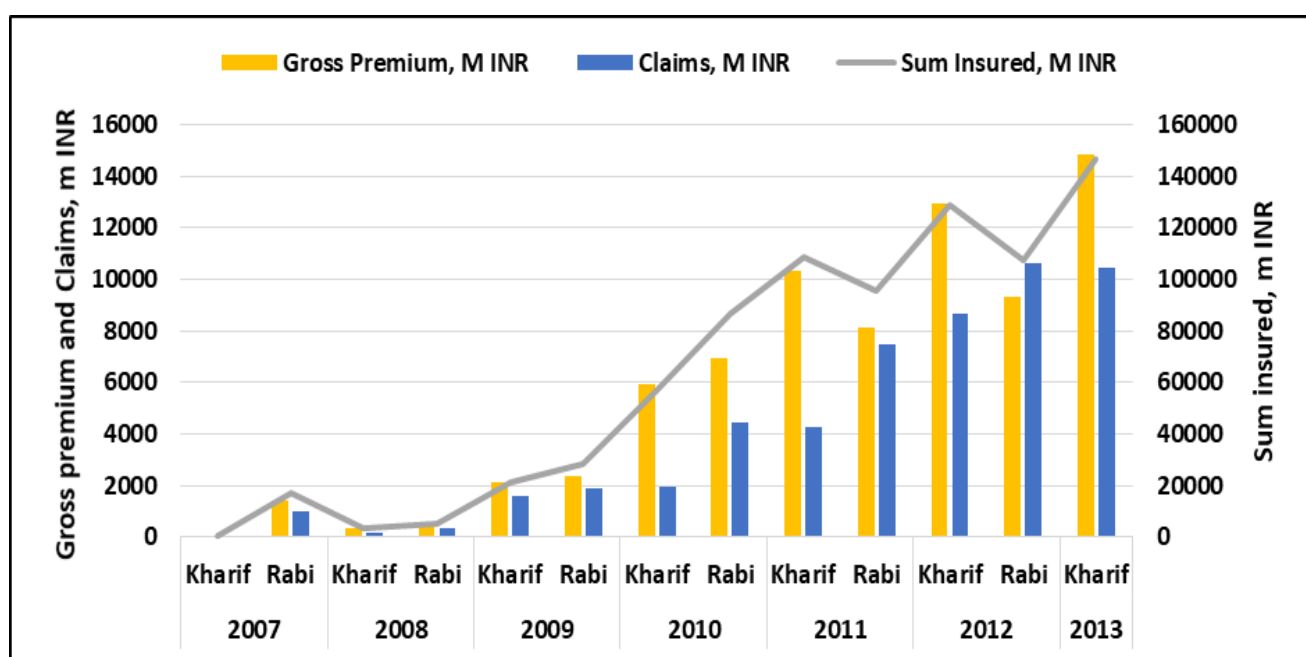


Figure 3. Sum insured, gross premium and claims made under WBCIS in India from Kharif-2007 to Kharif-2013 (Source: Dept. of Agriculture, 2014).

Case study: West Africa^{7,8}

Background

Assurance Récolte Sahel (ARS): A climate insurance project rolled out and coordinated by PlaNet Guarantee (PG) in West Africa

The ARS project started in 2011 in Mali and Burkina Faso and has since then been rolled out in 4 countries. In 2012, the initiative started in Senegal and in 2013 in Benin. All projects are still ongoing. After the conduction of a feasibility study in 2013, a dry run pilot is currently being implemented in Ivory Coast for maize. Between 2011 and 2014, 52,228 farmers subscribed to the weather index insurance initiative.

ARS target population consists of farmers who are vulnerable to climate variations. They often live close to the poverty line, and their revenue mainly depends on agriculture. Therefore, a bad harvest due to adverse weather can put at risk their livelihood, and push the farmers and their families into a poverty cycle. Consequently, banks and microfinance institutions (MFIs) consider them as risk-prone clients. By subscribing to crop index insurance, vulnerable farmers can secure their access to credit.

Constraints in regions where PG operates include the general lack of awareness and understanding of insurance functioning, a weak level of agricultural financing by financial institutions and the remoteness of rural populations.

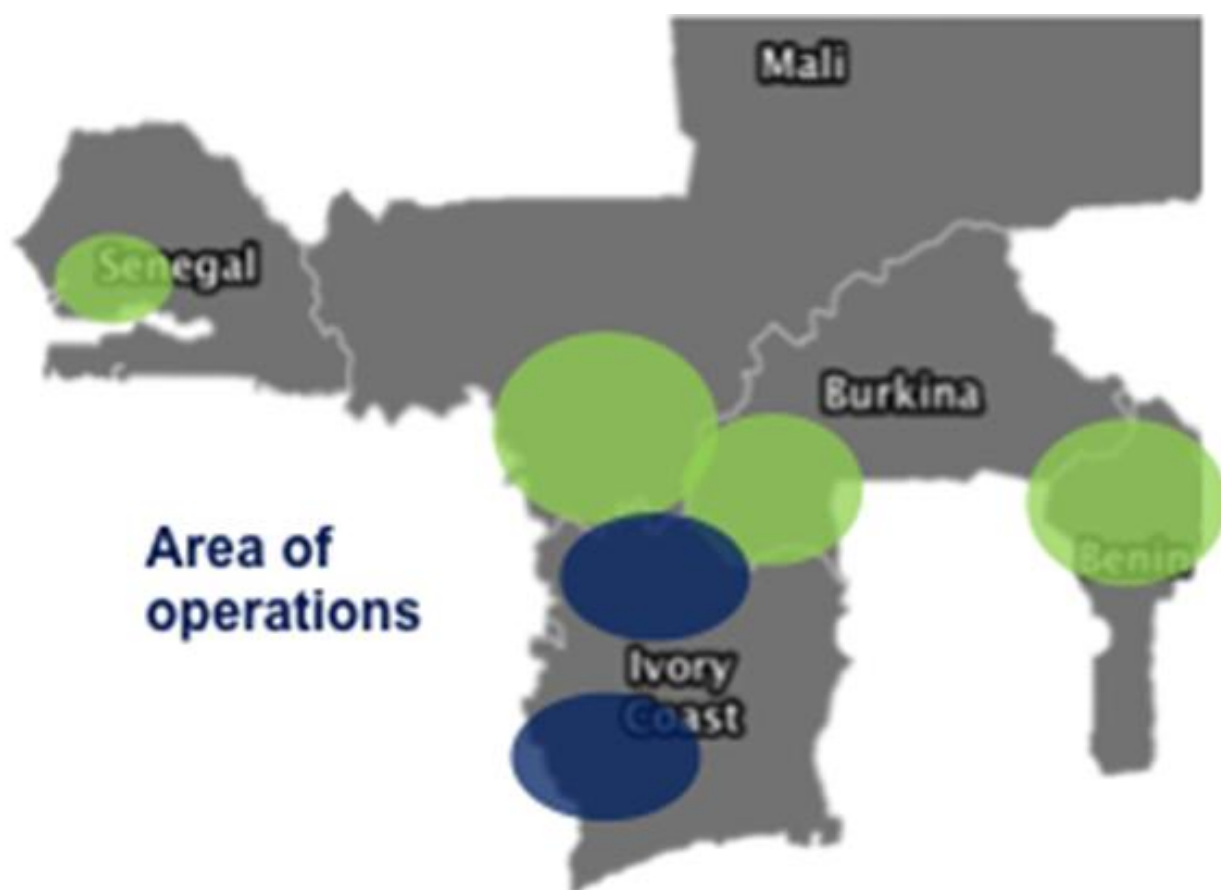


Figure 4. ARS Areas of Operation in West Africa.

⁷ The main source for this document is a presentation provided by Planet Guarantee (PG) as well as contributions from PG team members.

⁸ Contribution prepared by Mark Rüegg, CEO and Founder of Celsius Pro.

Objectives and Approach

The overall objective of the programme is to enable access of farmers to financial tools in order to reduce the fluctuation in agricultural income and facilitate the financing mechanism for agriculture. By protecting the portfolio of the banks and MFIs, insurance secures the access to credit and supports the development of the agricultural sector. By improving access to credit and by securing the financial sector, the project aims to contribute to the overall growth of the agricultural sector.

Contribution to CSA

PG's crop index insurance contributes to climate-smart agriculture as it builds resilience of farmers to climate change by protecting their revenues from climate variations. In addition, by improving their access to credit, it gives them an opportunity to increase their productivity via the purchase of high-quality agricultural inputs.

A study was conducted in Burkina Faso on the relationship between maize index insurance and the agricultural performance of the farmers (Koloma, 2015). By comparing subscribers to ARS crop insurance and non-subscribers, the results of the study showed that the first group was more likely to invest in agricultural inputs compared to the latter. In both villages where the study was conducted, the number of fertilizer bags used per hectare appears to be twice as high for the insured population. Insured farmers also increase the planted surface. This also means the insured group is more prone to taking risks compared to the non-insured group. Moreover, this study also shows an increase in access to credit for PlaNet Guarantee's clients. The research shows that the sample of the insured population of the two villages studied in Burkina Faso was able to mobilize a larger credit amount (1.4 times more) compared to the non-insured sample.

Characteristics and Design Methodology of Weather Index Insurance

PlaNet Guarantee and its partners have developed four indices using various methodologies:

- Relative evapotranspiration
- Rainfall estimate
- Area yield
- Weather stations

The relative evapotranspiration index is used for maize, sesame, and multi-cereals insurance products; the rainfall index is used for maize, groundnut, millet and rain fed rice insurance products and the yield index is used for cotton insurance product. The climate products cover drought/rainfall deficit. All climate-based products are designed for multiple risk periods including coverage for sowing failure and a dedicated coverage for each of the three phases of crop development. Triggers, exits and the duration of each phase are determined according to the historical climatic data crosschecked with best crop practices. The yield-based product comprises two triggers, the first one applying to the insured production area and a second one applying to the neighbouring area. The first step in the methodology to develop crop indices is to conduct an on-the-field survey to understand crop practices and demand of beneficiaries, their socio-economic conditions, ability and willingness to pay for insurance. Focus group with potential clients are organized, during which they are able to share about the risks they are facing, and their level of concern.

Index experts in close collaboration with international research organizations (CIRAD, EARS, IRI) developed indices on the basis of historical data.

Once designed, product presentation workshops were organized with all stakeholders. Crop index insurance solutions were typically launched in the form of a pilot programme, which enabled modifications of the product's features if needed. This participative methodology ensures relevance and suitability of the product to fit the farmers' demand.

Every year the products are improved with the help of field visits, focus groups and weather data analysis conducted by the index expert in order to compare the results of the index with the farmers' feedback and the rainfall data.

Distribution and Organization Mechanism

Distribution is currently done before the rain season via farmer cooperatives, MFIs, inputs dealers and NGOs. Going forward however, the distribution *strategy outlined below is planned*:

Micro-Insurance Approach: A few strategic elements are crucial for a better distribution in the coming seasons:

- Develop the bundled distribution and portfolios coverage models;
- Extend the mobile subscription system;
- Modify the underwriting cycle by organizing post-harvest distribution;
- Distribute index-based products that are not connected with a specific cultivated crop in Burkina Faso and Mali;;
- Develop a model for premium payment tailored to the farmers' financial constraints.

Aggregator Approach: The aggregator strategy targets larger clients, in the hope of collecting greater premium amounts. This option is the most relevant option to financially break-even whilst maintaining the social mission of the organization. PlaNet Guarantee can provide added value to the aggregators and has accordingly developed a commercial pitch for each type of aggregator as illustrated in the graph below.

Commercial Pitch for Aggregators

In terms of marketing, weather index insurance was barely known in the West African countries and demand had to be created. The project started with awareness creation by Planet Guarantee. Awareness campaigns and trainings were conducted with farmers, distributors, local insurers, regulators and governments. Marketing activities were conducted on four levels: a) Train the trainers, b) Train key contacts among farmers, c) Direct awareness raising and d) Mass promotion. A broad set of marketing instruments was applied, ranging from marketing shows to focus groups in villages.

Banks and MFIs can lend to more customers as the risks are now covered; reduce the credit recovery costs; reduce the default risks on the whole value chain.

Input producers can stabilize their revenues as the farmers can order the following year; acquire & retain customers if they decide to fund the farmers all or part of the premium.

Agri-businesses can secure revenue or cost in the year of draught; retain local suppliers if they share the insurance; develop a larger local supplier base if they share the pay off of the insurance.

Figure 5. Synopsis of the advantages provided by weather based index insurance products.

Indicator	Country	2011	2012	2013	2014	TOTAL
Number of farmers	Mali	167	132	13 282	15 980	29 561
	Burkina Faso	227	1 307	2 331	9 610	13 475
	Senegal	N/A	60	2 325	5 660	8 045
	Benin	N/A	N/A	48	1 099	1 147
Total number of farmers		394	1 499	17 986	32 349	52 228

Figure 6. Results for the ARS scheme.

Other relevant actors involved

The schemes work with a number of partners in the individual countries. The main distribution partners are the following:

- Benin: FECECAM (MFI)
- Senegal: CCPA and RNCPS (rural cooperatives of Groundnut producers). FEPROMAS (Rural cooperative of maize producers). Several networks of Millets and rain-fed rice producers.
- Burkina-Faso: Union Nationale des Producteurs de Cotton / Sofitex / Ecobank, Ecobank Burkina Faso, Réseau des Caisses Populaires du Burkina (RCPB Leading MFI with almost 80% of market), AGRODIA (network of inputs suppliers) and several MFIs.
- Mali: SORO YIRIWASO (MFI), COPROCUMA, Siguiniesigui, COPAM, (rural cooperatives of maize and sesame farmers) and PROSEMA (agribusiness dedicated to sesame promotion and transformation).
- The main insurers and reinsurers are:
- Insurers: Allianz Mali, Allianz Burkina-Faso, CNAAS Senegal, AMAB Benin.
- Reinsurers: Swiss RE, Hannover Re, Sen Re, Africa RE, CICA RE.
- The main international organizations and technical partners:
- AFD, GIIF, USAID Feed the Future, AGRA, World Bank Group.
- CIRAD, IRI, I4, Oxfam, WFP, Positive Planet, IFDC.

Program Impact and Outcomes

The ARS initiative on agricultural index insurance is the first of its kind in francophone West Africa and is an opportunity to build an innovative and

unique regional platform for the design and delivery of inclusive social insurance solutions.

PlaNet Guarantee has been developing agricultural insurance in West Africa since 2009, starting from scratch with no existing index based insurance product in the market. The last few years have been very promising and have resulted in a strong set of accomplishments. First, PlaNet Guarantee has secured the regulatory framework, trained several crop insurance officers, increased the awareness of farmers on insurance, developed several products, opened 5 offices including a hub of crop insurance expertise in Dakar and involved important distribution channels including microfinance institutions, agribusinesses and farmer organizations. Moreover, PlaNet Guarantee has secured a network of insurers and reinsurers, international donors and technical partners.

Payouts were disbursed in 2012 in Mali and Burkina Faso, while in 2013 and 2014 there were payouts in all involved countries. Once the index triggers, PlaNet Guarantee manages the process and the delegation from the insurer to distribution channel to execute the payout. PG calculates the financial flows between the insurer and the distribution channel and is responsible for all information transfer between both partners.

Since the beginning of the initiative, there were no complaints registered from insured farmers or any significant basis risk situation noted regarding the ARS products.

Case study: The R4 Rural Resilience Initiative (R4)⁹

Background

The R4 Rural Resilience Initiative (R4), established in 2011, is a strategic partnership between the UN World Food Programme (WFP) and Oxfam America. Its aim is to improve the resilience and food security of vulnerable rural households in the face of increasing climate risks. In particular, the R4 initiative is deliberately targeted at poor smallholder farmers who were previously considered to be uninsurable due to a combination of poverty, lack of education, data limitations and remoteness.

R4 refers to the four integrated risk management strategies implemented by the program. The first is Risk Reduction. This is the access to improved climate risk management, for example natural resource rehabilitation or new agricultural extension techniques. It is designed so that a drought year might have less of an impact on farmers. Second, Risk Reserves involves access to individual or group savings, so that farmers can build a financial base for investing in their livelihoods. Savings can also provide a buffer for short-term needs, increasing a household's ability to cope with shocks. Group savings can be lent to individual participants with particular needs, providing a self-insurance mechanism for the community, or targeted at particular groups such as savings for women in Oxfam's Savings For Change program. Index-based insurance falls under the third strategy, Risk Transfer, and aims to transfer the component of risk (e.g., a major regional drought) that cannot be reduced in any other way. Finally, Prudent Risk Taking involves access to micro-credit. MFIs are often reluctant to offer credit to farmers because of the perceived high risk of default in bad seasons. The other R4 strategies allow farmers to have a stronger

asset base and an ability to pay back a loan in a drought year, thus improving access to credit to allow investment in productive assets such as seeds, fertilizers and new technologies.

The R4 initiative was initially called the Horn of Africa Risk Transfer for Adaptation (HARITA) project, developed in Ethiopia 2009 as a partnership between Oxfam America, the Relief Society of Tigray (REST), Ethiopian farmers, and several other national and global partners. HARITA transitioned into the R4 Initiative in 2011, and expanded its partnerships to include the World Food Programme, with the aim of adapting lessons learnt in Ethiopia to other countries. The program has scaled solidly, from 200 Ethiopian farmers in the original 2009 HARITA pilot in Tigray, to over 43,000 farmers (about 200,000 people) in Ethiopia, Senegal, Malawi, Zambia and Kenya. Between 2015 and 2016, about US\$ 450,000 in pay-outs were distributed through the initiative in Ethiopia, Senegal and Malawi. The insurance component is notable for reaching a relatively large 29% of the population on average, and up to 38% in some villages (Madajewicz *et al.*, 2013). It is also notable for the fact that a large proportion of the scaling happened in 2011 after a relatively wet year with very few payouts.

Objectives and Approach

Its approach has combined strong and inclusive participatory processes, with strong institutional partnerships and scientific support. This has enabled it to reach highly vulnerable smallholder populations with index insurance, as one integral component of a diversified risk management strategy.

Characteristics and Design Methodology of Weather Index Insurance

Social Network for Index Insurance Design (SNIID) is a participatory approach to design a product that integrates local farmers' and experts' knowledge and expertise. A "design team" composed of community leaders and representatives, was established in each village and is

⁹ Contribution prepared by Dr James Hansen, Senior Research Scientist at the International Research Institute for Climate and Society (IRI) and Daniela Cuellar, Resilience and Social Protection Programme Officer at World Food Programme (WFP).

regularly consulted. Aspects of the SNIID process include discussions about exactly what needs insuring and when, plus experimental economic risk simulations ('games') with the farmers to understand their preferences for key parts of the insurance contract, such as coverage and frequency of payouts. Alongside these information-gathering sessions, the R4 Initiative organizes financial education trainings and educational activities. This allows time to work with farmers on topics such as basis risk communication and community-based basis-risk strategies. In all of those activities, care was taken to understand gender dynamics and to ensure inclusion of appropriate gender strategies in risk reduction activities.

Experimental research games were also played to ensure that the product properly reflected the farmers' wishes (Norton *et al.*, 2014). During this research, game participants exhibited clear preferences for insurance contracts with higher frequency payouts and for insurance over other risk management options, including high interest savings. The preference for higher frequency payouts was mirrored in commercial sales of the product, with commercial purchasers paying substantially higher premiums than the minimal, low frequency option available. This combined evidence challenges claims that the very poor universally choose minimal index insurance coverage and supports concerns that demand may outpace supply of responsible insurance products.

Because ground-based weather stations are extremely sparse in the R4 project area, several data-sources were used in index design and validation. The R4 index is based on ARC2 satellite rainfall estimates, which were validated and back-stopped by a combination of other satellite rainfall and vegetation estimates, water-balance satisfaction indices, rainfall simulators and statistical tools that interpolate data from stations nearby (Stanimirova *et al.*, 2013).

To overcome the liquidity constraint, poor farmers have the option of paying premiums either in cash or through insurance-for-work (IFW) programs. In Ethiopia, the IFW scheme is built into the

Government of Ethiopia's Productive Safety Net Program (PSNP). In other countries, it is built into WFP Food For Assets initiatives. In 2014, an option of paying for insurance through a combination of cash and labor was introduced to give farmers the opportunity to graduate from the IFW programs. In addition to providing a means of insuring the poorest households without resorting to direct premium subsidy, the approach is also designed to complement other R4-strategies. For example, the IFW programs employ farmers in community drought risk reduction activities identified through local participatory planning processes. Education about these activities was rated as one of the most important aspects of R4 in a recent impact review (Madajewicz *et al.*, 2013).

Distribution and Organization Mechanism

The project has a well-defined plan for scaling in each new country. The first year is known as a 'dry run' in which farmers and local experts are consulted, an initial index design is completed, economic research games are played, and intensive capacity development is completed at a farmer and an institutional level. This is followed by the second year. Here, there is a rollout of the program for several thousand farmers, plus further refinement and scaling in future years. The dry-run strategy has allowed the project to test insurance products in a controlled environment and learn farmer preferences between product options, prior to offering them through commercial outlets.

Other relevant actors involved

The R4 initiative attributes its relative success in part to the strength of its institutional partnerships. The project has directly engaged organizations at all stages of the insurance process, including farmer groups, governments, banks, MFIs, local insurers, research institutions and international reinsurers. This has helped to build trust and develop an institutional landscape that enabled insurance to sustainably scale.

Program Impact and Outcomes

On average, across all districts, insured farmers increased the amount of savings by an average of 123% compared to uninsured. The insured farmers tripled their savings from an average amount of 465 birr in 2009. The insured farmers also increased the number of oxen they own by 25% since 2009. Some benefits varied among the three districts evaluated. In one district, insured farmers increased their levels of grain reserves more than uninsured farmers. In a second district, insured farmers increased the number of oxen owned relative to the uninsured. The number of oxen declined slightly among the uninsured. In a third district, insured farmers increased the number of loans and amounts borrowed relative to the uninsured. The evidence showed that the program benefitted vulnerable groups and particularly women farmers. For example, relative to participating male-headed households, female-headed households increased their investments at a higher rate, took out more loans, decreased the amount of land that they sharecropped, increased their investments in hired labor, and increased their total planted land in response to insurance (Madajewicz *et al.*, 2013).

Case Study: Agriculture and Climate Risk Enterprise (ACRE) Africa¹⁰

Background

About 97 % of staple production in Sub-Saharan Africa (SSA) is rainfed (FAO, 2011). This means millions of SSAs inhabitants who depend on agriculture for employment and food supply are inherently exposed to the vagaries of weather. There is plenty of evidence showing that empowering farming households to better deal with weather shocks have far reaching implications not only in improving their welfare in the short term but also for long term economic growth (Hill, 2010).

This has led to heightened interest in agricultural insurance as a means to reduce vulnerability to weather shocks in the face of increasing climate change.

Consequently, agricultural insurance pilots have flourished in SSA each following its own unique approaches (Tadesse, 2015). Kilimo Salama – which means “safe farming” in Swahili - is one of the most successful agricultural insurance pilots.

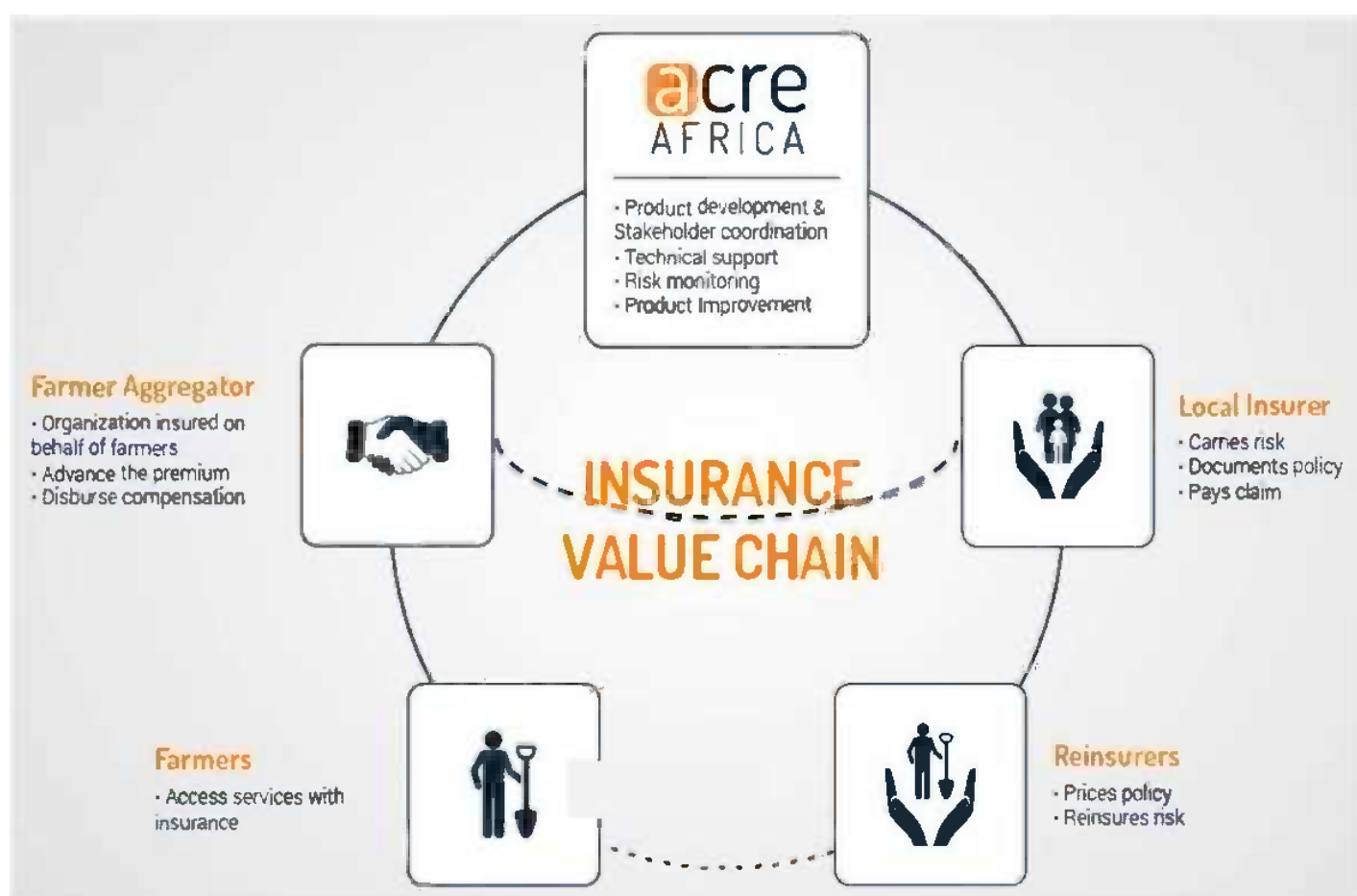


Figure 7. ACRE Africa Business model (Source: ACRE Africa <https://acreafrica.com/services>).

¹⁰ Contribution prepared by Rahel Diro, Research Staff Associate at International Research Institute for Climate and Society (IRI).

Kilimo Salama was launched by the Syngenta Foundation for Sustainable Agriculture, UAP Insurance and Safaricom in 2009 in Kenya. With investments from the Syngenta Foundation, the Global Index Insurance Facility (GIIF) and other funders, the initiative later evolved to establish Agriculture and Climate Risk Enterprise Ltd. (ACRE). ACRE Africa, which is a brand name of ACRE Ltd., operates as an insurance intermediary that provides insurance services to agricultural communities by working with local insurers and players in the agriculture value chain. It is involved in risk analysis, product development and monitoring (ACRE Africa, 2016). It develops insurance products that are customized to the specific needs of farmers. The biggest breakthrough in ACRE Africa's model is its ability to capitalize on existing relationships. It partners with farmer aggregators to provide insurance cover bundled with other services.

Objectives and approach

ACRE Africa is a company that aims to unlock agricultural productivity by offering localized solutions to mitigate climate risks. It brands itself as a company that is focused on covering production risks that affect wider portfolio of farmers. It offers a menu of protection covering risks such as drought, storm, floods for crops and disease and accidental death for livestock.

One of the biggest barriers to developing insurance products for smallholder farmers is the huge distribution costs albeit the small value of individual transactions. ACRE Africa was able to overcome this challenge through its innovative approach of working with farm aggregators (input providers, lending institutions, cooperatives and out-growers) and mobile network operators. Bundling the insurance with other services such as inputs or loans makes it attractive to farmers while mobile transactions ensure instantaneous premium collection and claim settlement.

Contribution to CSA

Onset and cessation of rainfall during the agricultural season have become

increasingly uncertain in many parts of Africa. Such interannual variability is expected to increase with climate change (Feng, 2013). This has practical implications in agricultural production. A long dry spell after planting prevents the seeds from germinating. This would mean farmers would have to buy new seeds and replant if they are to seize rainfall opportunities later in the season, which in itself is uncertain. Such loss is especially a big setback for smallholder farmers who often have little to spend on inputs. ACRE Africa is mitigating this exact challenge by offering a replanting guarantee cover. This has significant contributions to climate smart agriculture by ensuring quick loss recovery and long term productivity of farmers.

There is strong evidence suggesting that insurance plays an important role making credit more accessible and affordable to borrowers that are "rationed out" from credit markets due to their exposure to risk (Boucher *et al.*, 2008). ACRE Africa provides its clients with access to agricultural inputs by bundling insurance and input loans. In addition, it offers insurance to out grower agribusinesses to protect against the exposure of contract farmers to weather shocks. Studies show that contract farming is an integral part of agricultural development as it affords predictable income to farmers and promotes access to markets (UNCTAD, 2009).

Livestock is another important income generating resource for a smallholder farmer. Not only it serves as a source of protein for the household, it's also an immediate source of cash be it through sell of livestock products, like milk or the animal itself. Cognizant of its importance to livelihood, ACRE Africa provides dairy insurance cover to manage loss due to accidental death of livestock that's beyond the control of the owner. The product comes with animal care package requiring proper vaccinations and animal husbandry practices. These type of tailored agricultural insurance products are essential to build household assets and improve their resilience to climatic shocks.

Characteristics and Design Methodology of Weather Index Insurance

The 'Replanting Guarantee' (RPG) is ACRE Africa's signature agricultural insurance product. This innovative approach provides farmers with access to a RPG cover by placing a scratch-off voucher found in the bag of the seed that they purchase. Interested farmers then register their location and planting date through SMS by using the code in the card. This initiates the insurance contract for their specific location. Upon registry, a text message will be sent to the farmer notifying her/him of the policy number and value of the sum insured (IFC, 2011). The premium is partly absorbed by the seed company. From the seed company's perspective, bundling the insurance with a bag of seed is not only a product differentiation strategy but also a means to build customer loyalty (Ribeiro, 2017).

In the event of germination failure caused by a drought, registered farmers will receive a payout as a mobile money transfer or a replacement seed. This allows farmers to immediately replant and take advantage of the rainfall later in the season. Payout is calculated by comparing actual rainfall over a 21-day period during the planting with a pre-agreed upon "trigger" level. The "trigger" - which is considered to be the minimal rainfall level needed for normal planting and germination - is set based on historical rainfall for the specified location based on data from Meteorological Departments, ACRE Africa's automatic weather stations or using satellite rainfall estimates. The payout amount will depend on how much the actual rainfall deviated from the trigger level (Greatrex *et al.*, 2015).

As each contract targets a specific weather related loss, weather index insurance by design is exposed to some degree of basis risk. For instance, a drought index insurance contract will not cover a loss that is caused by a pest infestation or disease. In fact, this is exactly what happened in 2013 in Kenya where the maize crop failed because of disease. In response to this challenge, ACRE Africa started offering a

hybrid index and multi-peril crop insurance cover (Ribeiro, 2017). The way the hybrid product works is by complementing the weather index trigger with a loss adjustment after a field assessment. Although this type of hybrid product provides immediate solution for a comprehensive cover, it offsets the benefits of weather index insurance through additional field visit costs. The long term strategy may be to invest in technological innovations that would address basis risk concerns without inflating costs.

Distribution and Organisation Mechanism

ACRE Africa employs different distribution channels for its products. The RPG product first used input dealers to sell the RPG cover bundled with a bag of seed. The input dealers would get a commission of the profits. On top of that, ACRE Africa partnered with Safaricom, the largest mobile network operator in Kenya, to register farmers and locate their farms. The program also made use of Safaricom's M-PESA, a popular mobile payment system, for executing premium collections and payout settlement. This combination of partners made it possible to launch and sustain a successful product.

Loan providers are other distributors with a vested interest in insurance. Working with credit service providers, ACRE Africa provides insurance for covering agricultural input loan of farmers. This arrangement provides farmers with much needed credit for purchasing agricultural inputs by increasing their creditworthiness while minimizing defaults for the loan company. By 2016, 76% of ACRE's farmers received insurance linked loans (IFC, 2016). Dairy cooperatives are also important partners for distributing dairy livestock insurance for farmers dealing with high yielding cows.

Other relevant actors involved

Active involvement of financial institution is critical for a successful insurance program. ACRE Africa partners with local financial institutions in the countries it operates as

well as with global reinsurance companies. It works with over 10 financial institutions. UAP Insurance in Kenya is the main insurance partner, as well as CIC Insurance Group, APA, and UAP in Tanzania and SORAS in Rwanda among others. Swiss Re and Africa Re are among the re-insurance company it partners with. Government is another important actor in the insurance business. Regulatory agencies play a central role in ensuring agricultural insurance products meet the financial regulatory framework of the country.

Program Impact and Outcomes

ACRE Africa is by far the largest and fastest growing microinsurance schemes in Africa. Started 2009 as a pilot, it has reached 1.2 million clients by 2016 distributed across Kenya, Tanzania and Rwanda (IFC, 2016). Its goal is to reach 10 countries covering 3 million farmers by 2018. To date, the sum insured has reached \$56 Million across the three countries, while average premiums stand at \$100 (ACRE Africa, 2016). It has had real success in bringing about meaningful change in farmers lives. An impact evaluation indicates that insured farmer invested 19% more in their farms, and earned 16% more than uninsured farmers in 2016 (IFC, 2016; ACRE Africa, 2016).

ACRE Africa's success with its signature RPG product is partly attributed to the 50% premium subsidy offered to farmers (Tadesse, 2015). The subsidized offer is to a 'free sample' that is designed to eventually lure clients into buying full season coverage, which will ensure the operational sustainability. Despite the attractive offer, however, there was low registration for insurance (IFC, 2016; Ribeiro, 2017). Studies have shown clients are more likely to buy insurance when they trust the provider (Cohen and Sebstad, 2006; Dercon *et al.*, 2008). Clients are also less likely to buy insurance if they don't understand the product they are being offered (Gaurav *et al.*, 2011; Dercon *et al.*, 2014). The low take-up rate could imply trust and product awareness may be lacking.

While working directly with farm aggregators enables easy provision of insurance by slashing distribution costs, it is possible that farmers are unaware of the coverage details. In the absence of financial education and training – particularly in the context of SSA where literacy levels are low - ACRE Africa's strength of working with aggregators could become its weakest link. As such, financial education and training should become part of its strategy as it scales to reach many more farmers. Furthermore, while insuring the loan portfolio of a lending institution protects against mass defaults caused after weather shock, it may undermine farmer level "entrepreneurial" risk-taking if the payouts do not directly or indirectly trickle down to farmers.

Case Study: United States¹¹

Background

The U.S. federal crop insurance program began in 1938 when Congress authorized the Federal Crop Insurance Corporation (FCIC). The current program, which is administered by the U.S. Department of Agriculture's Risk Management Agency (RMA), provides producers with risk management tools to address crop yield and/or revenue loss for about 130 crops. Insurance policies are sold and completely serviced through 18 approved private insurance companies. In 2014, federal crop insurance policies covered 294 million acres with most crop insurance policies being either yield-based or revenue-based. Typically, revenue-based policies account for between 75% and 80% of all policies. Government costs for crop insurance peaked at \$14.1 billion in 2012 when large areas of the central and southern parts of the U.S. suffered devastating drought. The government subsidy was about \$8.7 billion in 2014 (Shields, 2015).

The first area-yield insurance, the GRP, was started in 1993 in the U.S. The GRP was initially offered for seven crops in over 1,900 counties within the U.S. and by 1999 the GRP was replaced by a new area-based revenue insurance product called Group Risk Income Protection (GRIP). The GRIP uses county yields and within-year national price movements to insure against declines in expected county revenue. Among the portfolio of FCIP policies, the acres insured under GRP and GRIP products grew rapidly from only 2% of total acres insured in 1999 to 16% of insured acres by 2007 (Skees *et al.*, 2007) but has since suffered a precipitous decline (USDA/RMA, 2015). These area-yield products represent the most substantial U.S. experience with index-based insurance.

As concerning the target population, this consists of U.S. commodity crop farmers. In 2014, federal crop insurance policies

covered 294 million acres (~ 83% of the total crop acres) under 1.2 million policies with \$110 billion in loss coverage (total liability). Major crops are covered in most counties where they are grown. Four crops—corn, cotton, soybeans, and wheat—typically account for more than 70% of total acres enrolled in crop insurance. In 2014, the federal crop insurance covered the following proportion of acreage of each crop: 87% of the corn; 96% of the cotton; 88% of the soybeans; and 84% of the wheat.

Objectives and approach

U.S. crop insurance provides producers with risk management tools to address crop yield and/or revenue losses for about 130 crops. For most U.S. farmers, federal crop insurance is the most important component of the farm safety net. The federal crop insurance program makes available subsidized policies to help farmers manage risk associated with natural disasters, including drought, excessive precipitation, flooding and price fluctuations. The average annual federal cost is approximately \$8 billion. The farm safety net also includes the farm commodity support programs, which provide price and income support for a narrow list of covered commodities such as corn, soybeans, wheat, rice, and peanuts. Agricultural disaster programs are available for producers owning livestock or fruit trees.

Contribution to CSA

Most agricultural revenue is subject to weather variations, and shifts in agricultural supply and demand, which often result in volatile market prices. Crop insurance support is focused on producing areas with less rainfall and more variable crop-weather conditions. In this way, it insures farmer revenue against production impact due to unfavourable weather conditions. For example, in 2011, relatively high indemnities were paid in the Great Plains, where drought reduced crop yields in the south and central areas of the U.S.

¹¹ Contribution prepared by Dr Rebecca Shaw, Chief Scientist at the World Wild Foundation for Nature (WWF).

while excessive precipitation affected plantings and production in the north.

The U.S. crop insurance program provides financial support to farmers in the U.S in the event of yield and/or revenue loss due to drought, excessive moisture, hail, wind, frost, insects, and disease. Through these payments, farmers are covered for their losses, and therefore, adapt to extreme weather events. This program does not address increasing the adaptive capacity of farmers, nor does it work to build resilience in the system or decrease greenhouse gas emissions. The program does not incentivize farmers to adopt risk-mitigating measures and it encourages production methods that will become increasingly expensive to administer unless changes are made. The crop insurance program promotes farm management practices that increase greenhouse gas emissions, degrade soils, pollute waterways and use excessive water. Resilience-building practices such no-till, cover cropping, and crop rotation are avoided because of their impact on short-term yield, and therefore, on insurance payments. Environmental conservation groups in the U.S often make the case for premium subsidies. They argue that these might actually encourage production in environmentally fragile land.

Characteristics and Design Methodology of Weather Index Insurance

In purchasing a crop insurance policy, a producer growing an insurable crop selects a level of coverage and pays a portion of the premium, which increases as the level of coverage rises. The federal government pays the rest of the premium (62%, on average, in 2014) (Shields, 2015). Insurance policies are sold and serviced through 17 approved private insurance companies. The insurance companies' losses are reinsured by U.S. Department of Agriculture (USDA) and their administrative and operating costs are reimbursed by the federal government under the Standard Reinsurance Agreement (SRA).

Most crop insurance policies are either yield-based or revenue-based. For yield-

based policies, a producer can receive an indemnity if there is a yield loss relative to the farmer's historical yield. Revenue-based policies protect against crop revenue loss resulting from declines in yield, price, or both. Other insurance products protect against losses in whole farm revenue or gross margins for livestock enterprises.

Federal Crop Insurance coverage and policies include:

1. **Catastrophic Coverage (CAT)** pays 55% of the established price of the commodity on crop losses in excess of 50%, which is the deductible or out-of-pocket loss absorbed by farmer. The federal government pays the premium on CAT. CAT coverage is not available on all types of policies.
2. **Buy-up Coverage** offers higher coverage (a lower deductible) and is purchased instead of CAT. Policies include:
 - a. *Yield-based policies:*
 - i. **Actual Production History (APH)** and Yield Protection (YP) policies insure producers against yield losses due to natural causes such as drought, excessive moisture, hail, wind, frost, insects, and disease. The farmer selects the amount of average yield he or she wishes to insure and the percentage of the projected price to insure. If the harvest is less than the yield insured, the farmer is paid an indemnity based on the difference.
 - ii. **Area Yield Protection (AYP)** policies insure producers against yield losses due to natural causes such as drought, excessive moisture, hail, wind, frost, insects, and disease. The farmer selects the amount of average yield he or she wishes to insure and the percentage of the projected price to insure. If the harvest is less than the yield insured, the farmer is paid an indemnity based on the difference.
 - iii. **Dollar Plan** provides protection against declining value due to

damage that causes a shortfall in yield. Amount of insurance is based on the cost of growing a crop in a specific area. A loss occurs when the annual crop value is less than the amount of insurance. The insured may select a percentage of the maximum dollar amount equal to catastrophic coverage level.

b. *Revenue-based policies:*

i. **Area Revenue Protection (ARP)** insures producers against yield losses due to natural causes such as drought, heavy precipitation, flooding, hail, wind, frost, insects, and disease, and revenue losses caused by a change in the harvest price from the projected price. The projected price and the harvest price are 100% of the price determined by futures contracts. The amount of insurance protection is based on the greater of the projected price or the harvest price. If the harvested plus any appraised production multiplied by the harvest price is less than the amount of insurance protection, the producer is paid an indemnity based on the difference.

ii. **Actual Revenue History (ARH)** insures an average of historical grower revenues. Like other revenue coverage plans, ARH protects growers against losses from low yields, low prices, low quality, or any combination of these events.

iii. **Whole-Farm Revenue Protection (WFRP)** insures revenue of the entire farm rather than an individual crop by guaranteeing a portion of whole-farm historic average revenue (both crops and livestock). To calculate the guarantee, the plan uses five consecutive years of a producer's revenue and current-year expected farm revenue. Livestock Policies insure against declining market prices or gross margins for swine, cattle, lambs, and milk.

3. Supplemental Coverage Option

(SCO) may be purchased with CAT or Buy-up to cover part of the deductible of underlying policy. Eligible crops in 2015 are corn, cotton, sorghum, rice, soybeans, barley, and wheat (Shields, 2015).

A reference yield calculation method used in the US Federal crop insurance program. Current law requires that U.S. RMA, which administers FCIC, strive for actuarial soundness for the entire federal crop insurance program. As a result, RMA sets premium rates to only cover expected losses and a reasonable reserve. The agency is required to conduct periodic reviews of its rate-setting methodology, which sets premium rates according to the average historical rate of loss.

Distribution and Organization Mechanism

USDA's RMA manages the federal crop insurance program and its mission is to promote, support, and regulate sound risk management solutions to preserve and strengthen the economic stability of America's agricultural producers. As part of this mission, RMA operates and manages the FCIC. RMA was created in 1996; the FCIC was founded in 1938. The Standard Reinsurance Agreement (SRA) is a risk sharing agreement between the Federal Government and Approved Insurance Providers (AIP). Under the SRA, the Federal Government, through the FCIC, will underwrite all crop insurance policies sold and serviced by AIPs. All farmers regardless of state and region are eligible for crop insurance coverage. Under this agreement, RMA sets the underwriting rules and premium rates. The AIPs and the FCIC will then share in the premium revenue as well as the loss exposure. Technically under this agreement the AIPs are liable for all the policies they write but are protected from catastrophic loss by the FCIC.

The FCIC does the following:

- sets standards and premium rates
- approves new products

- subsidizes farmer premiums (62% on average)
- pays 100% of delivery costs through Administrative and Operation (A and O) reimbursement to private insurance companies
- shares gains/losses with private insurance companies
- reinsures private insurance company losses

There are 17 AIPs that are designated by USDA to provide insurance coverage through the SRA for the year 2016. The private companies

- sell crop insurance policies through 12,500 agents
- collect and forward premiums to FCIC
- determine individual crop losses through 5,000 adjusters
- pay claims with funds from FCIC
- share gains/losses with federal government

Under the SRA, private insurance companies may transfer some liability associated with riskier policies to the government and retain profits from less risky policies. This transfer of risk is accomplished through a set of reinsurance funds maintained by FCIC. Within 30 days of the sales closing date for each crop, companies allocate each policy they sell to one of two funds that are maintained for each company by state: “assigned risk pool” or “commercial pool” which have different amount of liability exchange and premium ratio shared between the FCIC and the AIPs.

The assigned risk fund is used for policies believed to be high-risk because it provides the most loss protection to insurance companies through stop-loss coverage that reinsures against state-level disasters. While the profit potential is greater compared with the Assigned Risk Fund, so is the loss potential. The federal government assumes a large portion of liability associated with high-risk policies. The Commercial Fund is for policies that the companies expect to have the greatest opportunity for profit and only a small amount of losses. Under this current

structure, there is an increase in moral hazard as there is in any other type of reinsurance program.

U.S. commodity crop farmers are the clients. In 2014, federal crop insurance policies covered 294 million acres (~ 83% of the total crop acres) under 1.2 million policies with \$110 billion in loss coverage (total liability).

Program Impact and Outcomes

Recently, new area yield products were introduced by the RMA and Area Yield Protection (AYP) replaced GRP while Area Yield Protection (ARP) replaced GRIP. Since then the two products have been offered under what is known as Area Risk Protection Insurance (ARPI), which provides four plan choices: AYP, ARP, Area Revenue Protection with Harvest price Exclusion, and Catastrophic Coverage, which is only available under AYP. The uptake of the AYP and ARP area yield products by producers is still far below the peak uptake levels reached in the late 2000s. For example, in 2015 the premium totals for AYP and ARP was only \$170 million (USDA/RMA, 2015) compared to combined premium totals of \$650 million for GRP and GRIP in 2007 (USDA/RMA, 2007).

While the advent of weather markets in the late 1990s is often cited as the impetus for a growing interest in index insurance for agriculture, it is worth noting that weather insurance products have been used in the U.S. for a number of years (Skees *et al.*, 2007). Their success seems to be most noteworthy among specialty crops where other forms of agricultural insurance may be limited (e.g., high value citrus crops vulnerable to freeze). Beyond that, the use of index-based weather insurance in the U.S. is limited and may have been hindered by early mistakes in implementing these programs (Skees *et al.*, 2007). For example, it has been reported that in 1988, a major insurance provider introduced drought insurance for farmers growing Midwestern crops (e.g., corn and soybeans). This effort failed in the first year due to poor underwriting decisions.

Farmers understood that a major drought was emerging and reasoned that the probability of a payout was greater than implied in the contract. The insurance provider did not have adequate resources to pay the massive losses that resulted from the 1988 drought leading to court cases. Rainfall insurance has not been in the same fashion to Midwestern crop farmers since that time. This event was a major setback to what could have emerged in the U.S. markets¹².

¹² This discussion on weather index insurance for agriculture in the U.S. is based wholly on the report titled *Scaling Up Index Insurance: What is needed for the next big step forward?* By Jerry Skees et al. 2007.

Case Study: Nigeria¹³

Background

Climate change poses significant risks to agricultural development and, by extension, food security, poverty reduction and political stability. This is especially the case in Nigeria where agriculture contributes over 40% of the GDP, over 70% of the workforce is engaged in agriculture-related activities and millions live in rural areas where they are dependent on agriculture for their livelihoods. In 2012, torrential rains across Nigeria caused farmers to lose crops to floods. In 2013, maize farmers in the north were hit by drought that halved their expected yields. These climate-related shocks can undermine development gains by destroying rural infrastructure and eroding farmers' productive assets. Even in climatically-favourable years, climate risk contributes to farmers' reluctance to invest in their farms. Farmers also have limited access to credit and remain trapped in a low income-low productivity cycle.

Experiences from index insurance initiatives in India, Kenya, Rwanda, Ethiopia and Senegal suggest that bundling insurance with production inputs and finance can make insurance more attractive to farmers. Well-designed index insurance can achieve specific risk objectives such as protecting farmers' livelihoods in the face of major climate shocks by enhancing farmer uptake of drought tolerant crop varieties and other agricultural technologies (Carter *et al.* 2016; Karlan *et al.* 2014). In insurance program this has been achieved either through the direct bundling of farm inputs with insurance, or through including

insurance within a larger risk management portfolio. Examples of the former include ACRE Africa (GSMA, 2015) and insurance linked with credit in Zambia (Mookerjee, 2016). The R4 Rural Resilience Initiative is a good example of the latter approach whereby farmers can pay for the insurance through labor on climate-smart agricultural projects (Food for Assets), alongside access to credit and savings (Madajewicz *et al.*, 2013).

Objectives and approach

In 2014, Nigeria's Federal Ministry of Agriculture and Rural Development (FMARD) proposed a major expansion of agricultural insurance in the context of other reforms to the agricultural sector, and as part of the implementation of its National Agricultural Resilience Framework (NARF). The commitment to expand insurance to Nigeria's roughly 15 million smallholder farmers is one of the pillars of NARF. FMARD is seeking to enhance farmers' access to accurate weather information and increase the participation of the private sector in the provision of weather insurance products to millions of Nigeria's smallholder farmers. FMARD has aligned with partner Ministries, Departments and Agencies (MDAs) focused on agriculture and the environment for closer National policy synergies.

Contribution to CSA

One of the objectives of NARF is to ensure that Nigeria's agricultural sector is able to cope with the shocks and stresses linked to climate change. In its bid to promote agricultural resilience, Nigeria joined the Global Alliance for Climate-Smart Agriculture (GACSA), to contribute to the goal of ensuring that 500 million smallholder farmers worldwide can adopt Climate-Smart Agriculture (CSA) technologies and practices through agricultural insurance as well as other options. Nigeria is also part of the West Africa Alliance for Climate-Smart Agriculture launched by the Economic Community of West African States (ECOWAS).

¹³ Contribution by Dr Jon Hellin, Senior Scientist at the International Maize and Wheat Improvement Center (CIMMYT); Dr James Hansen, Senior Research Scientist at the International Research Institute for Climate and Society (IRI); Dr Helen Greatrex, Associate Research Scientist at the International Research Institute for Climate and Society, Columbia University; Dr Robert Zougmore, Africa Program Leader of the CGIAR research programme on Climate Change, Agriculture and Food Security (CCAFS).

Characteristics and design methodology of Weather Index Insurance

Bringing together relevant actors from the public and private sectors

Since September 2014, FMARD and the CGIAR Research Program on Climate Change, Agriculture and Food Security research program (CCAFS) have been working together to design a roadmap for evidence-based insurance development for Nigeria's farmers. CCAFS organized an initial knowledge-sharing workshop in London in January 2015. This was followed by a planning meeting in Zurich in May 2015, hosted by the re-insurer Swiss Re. Participants in the workshops included FMARD, the heads of the Nigerian and Indian Agricultural Insurance Corporations, CCAFS, Swiss Re, German Corporation for International Cooperation (GIZ), Nigerian Meteorological Agency (NIMET), Nigerian Agricultural Insurance Corporation (NAIC) and Nigerian Insurers' Association (NIA).

There are many different approaches to designing and implementing index insurance not least whether it is a weather-based index or one based on area yield. Nigeria can learn from past and existing index insurance schemes worldwide that CCAFS has analysed and documented. The effectiveness of communication with farmers is a key factor that influences trust and farmer uptake of all technologies and practices, including insurance. This is especially the case when it comes to index insurance. Nigeria's ambitious plans to rapidly scale up agricultural insurance will require efficient, scalable mechanisms to engage farming communities, and build their capacity to understand and hence effectively demand appropriate insurance products. Farmers need to trust that the people they are paying to take on their risk will be around to provide payouts, and need to understand and trust the structure of the contract. Partnering with organizations that already interact with farming communities, and that have already built trust, has proven to be effective in several successful agricultural

index insurance initiatives (Greatrex *et al.*, 2015).

FMARD and CCAFS are also drawing on the expertise of Pula Advisors, a consultancy company whose staff were intricately involved in the design and implementation of one of the most successful index insurance initiatives to date: the Agriculture and Climate Risk Enterprise (ACRE) (formerly known as Kilimo Salama) that has reached 200,000 farmers in Kenya and Rwanda. Pula Advisors and CCAFS are doing pilot-testing in Nigeria of both weather-based and area yield index insurance. With more than 5.56 million ha of land planted to maize in 2013 (or about 16% of all of Africa's maize area combined) the pilot-testing is taking place in maize-growing areas.

Roadmap document for index insurance

The outcome of work between FMARD, CCAFS and other key actors is a roadmap document detailing a phased expansion of insurance coverage for Nigeria's agricultural sector including its smallholder farming population. Agricultural insurance has been a feature in Nigeria for over two decades and the roadmap document aims to consolidate existing knowledge and information on the risk profiles of value chains, while creating a mechanism for expanding insurance products and services to all smallholder farmers to increase their resilience to shocks and stresses which may undermine productivity and eco-efficiency. FMARD is expected to launch officially the Roadmap document in 2017.

A key area that FMARD and CCAFS are working on is data availability. Index-based insurance is particularly dependent on the availability of reliable, high-quality meteorological, hydrological, agronomic and economic data. Because the relationship between crop yields and weather observations weakens, and therefore basis risk increases, with increasing distance, early index insurance pilots only offered index insurance to farmers within a given distance from a

long-term weather station. Sparse and generally declining weather observation networks have been identified as a major challenge to scaling up weather index insurance in Nigeria.

The Nigerian Meteorological Agency (NIMET) maintains a network of roughly 60 climate plus synoptic observing stations. Although the country has many more agromet and rainfall stations (roughly 500), most of these are currently under the control of state governments rather than NIMET. Providing FMARD with access to all available, quality-controlled historical and monitored meteorological data is a priority for developing weather index insurance. Given their multiple uses, these data will make the greatest contribution to society if the government treats them as public goods, and supports their collection and free availability. Although the index insurance market might provide incentive for private sector investment in data collection, particularly automatic weather stations, socially optimum investment and use of data requires public investment.

Challenges and lessons learnt

Agricultural insurance was introduced to Nigeria in 1987 through the Nigerian Agricultural Insurance Scheme (NAIS). The Nigerian Agricultural Insurance Corporation (NAIC) was established in 1993 as a public-sector corporation to administer NAIS and its associated subsidies, foster agricultural credit, and generally promote increased agricultural production to reduce the need for ad-hoc agricultural disaster assistance from the government. Up to 2013, NAIC held a regulatory monopoly on providing agriculture insurance. This regulation was lifted in 2013, and since then six other insurance companies have applied for, and received a license to provide agriculture insurance. The focus of these companies has, however, been on medium- and large-scale farmers, and their capacity and exposure in the area of index insurance is limited.

A strategy for expanding insurance for Nigeria's smallholder farmers must address

challenges that include: limited and asymmetric information; crowding out by post-disaster relief efforts; limited access to reinsurance markets; lack of insurance culture; and inadequate regulatory environments. The development of effective market-based agricultural insurance, requires government support in five key areas: data systems; awareness and capacity building; facilitating international risk pooling; "smart" subsidies; and an enabling policy environment that facilitates the establishment of multi-stakeholder partnerships. There are three immediate challenges:

First, it is important to form a task force of public sector champions who will spearhead insurance efforts in order to create a regulatory environment that makes it attractive for insurance companies to enter the market. For agricultural insurance to be viable, insurance companies need reinsurance arrangements to protect them from major spatially-correlated climate shocks, such as drought. However, early agriculture insurance markets like Nigeria struggle to reach premium volumes that attract international reinsurers, limiting the growth of the market. Regulation in Nigeria also regulates the involvement of the international reinsurers. The insurance law act of 2003, section XII point 72.4 stipulates that only under exceptional circumstances may any reinsurance or insurance be placed outside of Nigeria with international insurers and or reinsurers, and that such an exception needs to be approved by the National Insurance Commission. Since much of the technical and financial capacity in agriculture insurance is generally with reinsurers rather than domestic primary insurers, this regulation is likely to limit the willingness of international reinsurers to participate in any product in terms of technical capacity as once the product has been established there is a risk that they may be pushed out of the market by this regulation.

Second, there is a need to develop public-private partnerships that incentivize and support companies to develop innovative

products and services for agriculture. The private sector will require support at the early stages of development, as initial set up costs for innovative new products and distribution channels are often high. The Nigerian Government should therefore consider a fund for those companies willing to implement innovative products, as this will de-risk insurance companies from entering the sector and committing their human and insurance capital. Such a fund could support technical assistance for product development, pilot testing, feasibility studies, development of financial education, or testing of innovative marketing and distribution channels. Such funds have been done in other countries – although generally by development agencies such as the private sector arm of the World Bank, IFC – and have resulted in innovative schemes that subsequently scaled up. Lessons from the beneficiary companies should be shared, so that the sector as a whole can benefit from these experiences, returning a public benefit of these initiatives developed by the private sector.

Third, a phased process for developing agricultural insurance should start with wider pilot implementation of both weather

index and area-yield index insurance, designed in a manner that progressively builds the capacity of all relevant stakeholders, and strengthens the knowledge and evidence base for scaling up. Pilot implementation provides an opportunity to test and adapt several innovations that have proven useful in other parts of the world, including:

- Innovative ways to build farmers' understanding of the complexities of index insurance, e.g., through interactive radio programing;
- Involvement of farmers and other key stakeholders in the design of insurance products and services;
- Development and use of merged satellite-station rainfall and temperature data sets as an alternative to sparse ground-based observations;
- Identification of suitable climate-smart agricultural technologies (e.g. drought tolerant crop varieties that are being bred for different agro-ecological zones in Nigeria) that lend themselves to bundling with crop insurance initiatives.

Conclusions

Lessons learned, key challenges and potential for scaling up¹⁴

Increasing climate risks, large networks of weather stations and financial institutions, compulsory insurance for farmers taking on institutional credit, large premium subsidies and relatively shorter time periods for claim settlements have made weather-based index insurance schemes potentially attractive to farmers exposed to the uncertainty of climate-related impacts. It is important to note, however, that these schemes still have a large basis risk due to:

- i) significant spatial and temporal variability in precipitation;
- ii) limited density of weather stations to capture it, thus affecting data availability and quality;
- iii) non-coverage of all weather-related perils;
- iv) modification of risk exposure by different planting times and use of adapted varieties;
- v) differences in soil types and management practices (WFP and IFAD, 2011; FAO, 2008).

Insurance schemes are typically developed and evaluated against past weather data (Clarke *et al.*, 2012). Basis risk, or the differences between a payout and a farmer's actual loss, is sometimes quoted as a key constraint for index insurance. The R4 project has dedicated much time to minimizing basis risk events through examining multiple data sources, and has invested significant resources in discussing what a community might do in a basis risk event. As such, the R4 initiative aims for a situation where farmers will no longer see the event as a failure, but rather as a year where they need to take option B (e.g., use a community savings fund or their savings at the MFI).

In an era of rapidly changing weather scenarios, there are possibilities of new weather patterns which may not exist in past data leading to dissatisfaction among farmers. Product designs need to improve so that claims payouts correspond to shortfalls in yield in most cases (Clarke *et al.*, 2012). New methodologies and computer-based crop growth simulation models have shown success and this needs to be used to trigger ad hoc design mechanisms.

A comprehensive 2012 study done to review WBCIS (Clarke *et al.*, 2012), showed that the key factors of farmers' dissatisfaction with weather-based insurance were mostly related to:

- vi) Location of reference weather station
- vii) Mechanisms for grievance redressal
- viii) Convenience of enrolment in insurance scheme
- ix) Resolution of queries
- x) Responsiveness of intermediary agencies, such as banks

It is obvious that the widespread spatial and temporal variation in rainfall should be taken into account, together with strengthening the aspects of delivery of crop insurance schemes, and building awareness in order to scale up weather-based index insurance schemes. While there is a growing effort to increase the density of weather stations, greater analyses of satellite estimates of weather needs to be explored vigorously. Similarly, there is a need to explore alternate delivery channels to sell insurance policies, build capacity, address queries in real-time and also to ensure timely payments. The huge power of digital technologies such as crowd sourcing, cloud computing and digital banking for increasing insurance literacy and penetration needs to be assessed and tapped.

As per the first two case studies reported in the present publication, crop insurance in India is linked to farm loans, thus

¹⁴ Contribution prepared by Professor Jimmy Adegoke, University of Missouri-Kansas City (UMKC) and Bianca Dendena (FAO).

increasing access to credit for resource-poor farmers. This income presumably goes towards improved technologies, but there is still lack of clear evidence that insurance triggers investment in climate-smart agriculture practices and technologies. A study conducted in Burkina Faso, however, on the relationship between maize index insurance and the agricultural performance of the farmers involved in the Assurance Récolte Sahel (ARS) crop insurance scheme (Koloma, 2015), does provide some encouraging signs in this sense. By comparing subscribers to the ARS scheme and non-subscribers, in fact, the first group was found to be more likely to invest in agricultural inputs compared to the latter. This also applied to the purchase of fertilizer, the planted surface and the access to credit.

One of the key lessons of this initiative is that due to their use of insurance, farmers are encouraged to invest more, and thus are more prone to taking risks. The ARS initiative also showed that building local insurance capacity is necessary in order to succeed in implementation. Furthermore, it should be considered that government subsidies represents a critical advantage in order to help develop the market, as the cost of the products remain one the main hurdles for market's expansion. Current insurance schemes do not distinguish between technology adopters and non-adopters, however, and provide no incentives for climate-smart agriculture. For example, farmers conserving water and using this resource sustainably scientifically will have lower risk, and therefore their premium should be lower. This is especially important and should be thoroughly taken into account when developing index-based insurance schemes: as the cost of the products still remains an important barrier, in fact, ad hoc solutions to reduce it could be coupled with the adoption of climate-smart practices with the aim of disseminating the CSA approach.

Crop index insurance solutions build PG's clients' resilience to climate change, as they receive payouts in the event of adverse weather. They are less economically vulnerable to climate variations, and are

less likely to be trapped in a poverty cycle (Hellmuth *et al.*, 2009). In line with the other country cases reviewed, crop index insurance solutions reported for the ARS scheme enable farmers to increase their productivity, generating additional revenue, and potentially savings for education and health expenses for their families. As a consequence, farmers' confidence in the future can be improved so that they are enabled to change their perspective from a day-to-day vision of life, to a long-term perspective (De Bock *et al.*, 2010).

Specifically from an operational point of view, longer and more flexible reinsurance contracts would help in reducing the annual price variability, and a larger distribution strategy needs to be implemented in order to reach this scale. One useful lesson in this regard is in the case of Senegal, where the public-private partnership with CNAAS contributed to the successful scaling-up of the scheme. Additionally, distribution via aggregators allows a broader reach for the products, and should be considered for an optimized distribution strategy.

The case study referred to as the R4 initiative highlights another important point with respect to the dissemination of index-based insurance schemes, that addressing the issue of data poverty is vital for scaling up. In the R4 project, the index is based on the output of the ARC2 satellite rainfall estimates, supported by information from vegetation remote sensing, farmer interviews, on-site validation and tools such as weather generators and crop simulation models.

Farmer-driven design is one method of bridging this gap and has been credited as key to scaling in many cases studies. All of the projects that engaged in meaningful discussions with farmers reported large benefits to index design and uptake. For example, recent work has shown that playing experimental games in the R4/HARITA project significantly increased demand for the product (Norton *et al.*, 2014). The R4 project considers the use of the games so important that they use the first year in a country as a "dry run", where the insurance can be tested and discussed with farmers before it is formally

purchased. A specific focus on education building has also played a key role in building trust and demand. In the R4 project, this was achieved through working in close collaboration with farmers through community discussions.

In R4, a holistic approach is at the core of the program: insurance is purposefully only one component of a larger risk management system, which includes risk reduction through better agronomic practices, prudent risk taking through access to credit, and improved risk reserves through access to savings. As part of this project, Norton *et al.* (2012, 2014) found that farmers showed increased demand if insurance was linked to other risk management strategies. This strategy is at the core of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) program called Climate-Smart Villages (CSV) for comprehensive risk management in agricultural landscapes. This includes mobilising farming communities and local governments and raising their capacity to adopt climate-smart agriculture practices and technologies related to conservation agriculture, efficient management of water and nutrients, use of solar energy, agroforestry and use of improved seeds. Climate information services such as seasonal and short-term weather forecasts are made available to farmers for contingency planning and action. In this framework, index insurance is an option provided among others. Climate-smart agriculture practices and technologies reduce risk exposure of farmers in most seasons, but in extreme climatic risk seasons, insurance acts as a safety net and protects farmers' income. At present, the insurance in CSVs is not priced differentially. A verifiable and implementable scheme that links insurance premiums to climate-smart agriculture technology adoption in the longer term will ensure more resilient agricultural systems and livelihoods.

The reported experience referred to as ACRE Africa is indicative of the increasing relevance of agricultural insurance as a means to reduce vulnerability to weather shocks in the face of increasing climate

change in SSA. It is, in fact, by far the largest and fastest growing microinsurance scheme in Africa, stemming from the Kilimo Salama initiative. In the present paper, specific mention is made to the Replanting Guarantee program (RPG), which is referred to as the ACRE Africa's signature agricultural insurance product. The implementation of such a program highlighted one of the biggest issues to developing insurance products for smallholders, and so the value added of ACRE Africa's model in providing insurance services. The relevant distribution costs against the reduced value of transactions for each farmer are overcome through partnerships with local mobile network operators (see Safaricom's M-PESA). This points to the need for building and further developing existing relationships established in local contexts, which is also embedded in ACRE Africa's approach strongly based on working with farm aggregators (input providers, lending institutions, cooperatives and out-growers). The importance of cooperating with actors on the ground is also acknowledged and valued through the active involvement of local financial institutions and governments, working side-by-side with global reinsurance companies and regulatory agencies. Interestingly, the experience of the RPG product shows that notwithstanding the attractive offer an insurance product may be associated with, it is the trust in the insurance provider which makes the real difference in the taking up of the product, as well as the thorough understanding of its conditions. Therefore, building on trust and strengthening financial education and training are to be considered as paramount elements backing the scaling up of insurance programs.

The U.S. case study reports on a consolidated crop insurance program providing producers with risk management tools to address crop yield and/or revenue losses for about 130 crops. As such, for most farmers countrywide, this federal crop insurance program is the most important component of their farm safety net. The program is intended to cover farmers for

their losses affecting yield and/or revenue, but does not address increasing the adaptive capacity of farmers, nor does it work to build resilience in the system or foster climate change mitigation. On the contrary, resilience-building practices such as no-till, cover cropping, and crop rotation are avoided because of their impact on short-term yield, and therefore, on insurance payments. With specific reference to weather-based insurance products, their usage in the U.S. is reported to be established to some extent just for crops where other forms of agricultural insurance may not be suitable, thus, being rather limited. Poor underwriting decisions in the past are singled out as the major setback in this case, and reemphasize the need to fine-tune the insurance products with respect to local conditions, provided the availability of data.

The final case study reported on in the present document, in Nigeria, provides a different perspective as compared to the others as it traces the roadmap currently being developed by the Nigeria's Federal Ministry of Agriculture and Rural Development (FMARD) and CCAFS, with the aim of defining a phased expansion of insurance coverage for Nigeria's agricultural sector. Hence, it captures a work-in-progress experience where some key points have already emerged as significantly affecting the uptake and scale up of index insurance programs. First, data availability is acknowledged as particularly sensible, with public investment in data collection highlighted as socially optimal, notwithstanding the importance of the private sector to provide support in this sense. The commitment of the government is also required in other key areas, namely awareness and capacity building, facilitating international risk pooling, "smart" subsidies, and an enabling policy environment that facilitates the establishment of multi-stakeholder partnerships.

In light of the evidence provided by the case studies presented in this document, and given the challenges of climate change and the uncertain future that it portends for agriculture, improved financial services for producers everywhere are desperately

needed. Innovations like weather-index insurance for agricultural and natural disaster risks have to be part of the solution as key elements of integrated risk management strategies. Effectively implementing and expanding index insurance programs will require strong collaboration among governments, donors and private sector partners. Past and recent experiences show that index insurance must also be placed within a larger developmental context, motivated by the goal to enhance the resilience of agricultural producers by strengthening their capacity to produce more food, more sustainably and with reduced risk.

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REVIEW ON INDEX-BASED INSURANCE FOR CLIMATE-SMART AGRICULTURE

Reviews are documents providing evidence for critically analyzing key issues affecting the adoption of the Climate-Smart Agriculture approach with the aim of building on existing initiatives and/or scaling them up.

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