

Scaling up index insurance for smallholder farmers:

Recent evidence and insights



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Front cover photo

Shamsa Kosar, a beneficiary of Takaful insurance in Wajir, northern Kenya. Photo credit: ILRI/Riccardo Gangale.

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Abbreviations and acronyms

ACRE	Agriculture and Climate Risk Enterprise (formerly Kilimo Salama)
AIC	Agriculture Insurance Company of India
ARC2	African Rainfall Climatology Version 2
ASAL	Arid and Semi-Arid Land
BIP	Base Insurance Product
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CCIS	Comprehensive Crop Insurance Scheme
DRP	Disaster Response Product
HARITA	Horn of Africa Risk Transfer for Adaptation
GCC	Government Catastrophic Coverage
GIIF	Global Index Insurance Fund
IBLI	Index-Based Livestock Insurance (Kenya)
IBLIP	Index-Based Livestock Insurance Project (Mongolia)
ICT	Information Communication Technology
IFC	International Finance Corporation
IFW	Insurance-for-work
ILRI	International Livestock Research Institute
IRI	International Research Institute for Climate and Society
LIIP	Livestock Insurance Indemnity Pool
MFI	Microfinance Institution
mNAIS	modified National Agricultural Insurance Scheme
NAIS	National Agricultural Insurance Scheme
NCIP	National Crop Insurance Programme
NDMA	National Drought Management Authority
NDVI	Normalized Difference Vegetation Index
NGO	Non-Governmental Organization
PSNP	Productive Safety Net Programme
R4	Risk reduction, taking, transfer and reserve as part of the R4 Rural Resilience Initiative
REST	Relief Society of Tigray
SAO	Seasonal Agricultural Operations
SNIID	Social Network for Index Insurance Design
SORAS	Société Rwandaise d'Assurance
UAP	Union des Assurances de Paris
WBCIS	Weather-Based Crop Insurance Scheme
WFP	World Food Programme

Executive summary

This report explores evidence and insights from five case studies that have made significant recent progress in addressing the challenge of insuring poor smallholder farmers and pastoralists in the developing world. In India, national index insurance programmes have reached over 30 million farmers through a mandatory link with agricultural credit and strong government support. In East Africa (Kenya, Rwanda and Tanzania), the Agriculture and Climate Risk Enterprise (ACRE) has recently scaled to reach nearly 200,000 farmers, bundling index insurance with agricultural credit and farm inputs. ACRE has built on strong partnerships with regional initiatives such as M-PESA mobile banking. In Ethiopia and Senegal, the R4 Rural Resilience Initiative has scaled unsubsidized index insurance to over 20,000 poor smallholder farmers who were previously considered uninsurable, using insurance as an integral part of a comprehensive risk management portfolio. With strong public and private sector support, the Mongolia Index-Based Livestock Insurance Project (IBLIP) insures more than 15,000 nomadic herders and links commercial insurance with a government disaster safety net. Finally, the Index-Based Livestock Insurance (IBLI) project in Kenya and Ethiopia demonstrates innovative approaches to insuring poor nomadic pastoralists in challenging circumstances.

A few common features appear to have contributed to recent progress within these case studies:

- explicitly targeting obstacles to improving farmer income;
- integration of insurance with other development interventions;
- giving farmers a voice in the design of products;
- investing in local capacity; and
- investing in science-based index development.

Evidence from these case studies can inform the ongoing debate about the viability of scaling up index-based insurance for vulnerable smallholder farmers in the developing world. The rapid progress observed in recent years suggests that index insurance has the potential to benefit smallholder farmers at a meaningful scale, and suggests the need to reassess arguments that lack of demand and practical implementation challenges prevent index-based insurance from being a useful tool to reduce rural poverty.

1. Introduction

In recent years, index insurance has been presented as an important tool that can allow smallholder farmers to better manage climate risk, enabling investment and growth in the agricultural sector. 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 wind speed, the amount of rain during a certain window of time (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.

Index insurance has the potential to build the resilience of smallholder farmers, not only by providing a payout in bad years to help farmers survive and protect their assets; but also by helping to unlock opportunities that increase productivity in the non-payout years, which might allow them to escape from poverty traps or from the threat of them. For example, insurance might allow farmers to access credit, which they can then use to invest in new agricultural technologies or inputs. This could allow the farmers to use their increased profits to pay for the insurance premium, knowing that the insurance would allow them to repay their loan in the event of a climate shock.

There are several reasons why index insurance might be selected over its traditional indemnity counterpart, especially for smallholder farmers in developing countries. In indemnity insurance, the contract payout is dependent on the crop outcome on the client's farm. If the crops fail then the farmer can claim a payout, which naturally leads to a powerful incentive to allow crops to fail, called moral hazard. Adverse selection is an equally difficult issue to solve, where clients' demand for insurance is positively correlated with their risk of loss (higher risk clients 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. Premiums are also raised if there are logistical difficulties in sending a qualified assessor to the insured farms. This might be possible for a few large farms, but quickly becomes expensive and impractical when applied to a developing country with many small farms and poor transport infrastructure. As a result, agricultural indemnity insurance is

often prohibitively expensive for smallholder farmers, infeasible for insurance companies, and is almost non-existent in low-income countries. Although agricultural insurance is a very substantial business sector in regions such as the USA, Europe and Australia with a premium income in 2008 of over USD20 billion (Mahul and Stutley 2010), multi-peril indemnity crop insurance has only been possible for the majority of farmers with extensive government subsidy (Glauber 2004). Hail and named peril agricultural insurance have developed unsubsidized markets in these regions however.

Index insurance largely overcomes these problems. As a payout is determined by an objective index, such as the amount of water falling into a rain gauge or the state of vegetation recorded by a satellite, the need to verify losses through individual farm visits is eliminated, leading to significantly 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 the farmers' fields and so the farmers who benefit most are those who can keep their crops alive in an adverse year. Finally, index insurance is not designed to cover every risk or a farmer's entire livelihood, but instead protecting them from a clearly defined hazard. This again leads to more affordable premiums because the insurance company is able to quantify more accurately the probabilities of payout and is covering less risk. These factors have led many to suggest that index insurance might allow smallholder farmers access to the insurance market and that it could become a key tool in the fight against poverty.

However, there are still many limitations of index insurance. The very disconnect between on-farm losses and payouts which prevents moral hazard, is also one of the greatest challenges for index insurance. A weather index by its very definition is not directly insuring a farmer's loss, and multiple farmers, who will typically have somewhat different losses, must often be covered by the same index formula and data source. Farmers may receive a payout even when their crops survive, or they may experience losses when a payout is not triggered. This phenomenon is called "basis risk" and has been cited frequently as a key barrier in index insurance uptake (Miranda and Farrin 2012; Clarke et al. 2012; Cole 2012; Binswanger-Mkhize 2012; Carter et al. 2014). A basis risk event might occur for many reasons: the index formula may not exactly reflect real world farmer losses; index measurements from weather stations, satellites, and other sources may not be precise enough to reflect a farmer's losses; or conditions on a particular farm may be caused by something that wasn't covered by the insurance. For example,

pest-related losses would not be covered by drought insurance.

Thus for an index insurance project to be successful, an index must be robustly designed so that it protects a farmer against the targeted risk and correlates well with losses. This often needs significant input from agricultural and scientific experts to answer questions such as “how can we measure drought?” or “how far from a rain-gauge does a farm have to be before the index isn’t appropriate?” The very nature of index insurance means that basis risk can never be removed in its entirety, thus good communication is also needed with clients so that they understand the covered risk and can plan for the possibility of a basis risk event. Building these links between insurance companies, reinsurers, scientists and the clients is not a trivial task. In addition, the index must be easily measurable, easily accessible, tamper proof and with a clearly quantified uncertainty in order to be priced. Finally and importantly, there are often limitations in distribution networks due to poor infrastructure, limited supply chains, lack of liquidity and poor communication, especially when working with smallholder farmers in developing countries. Farmers must be able to access, afford and understand their contracts before they will buy them.

It is important to stress that because of the diversity of risks and constraints faced by farmers in different situations, index insurance (or indeed any risk management product) can never have universal application. Weather-based index insurance in particular is only appropriate if there is an obvious, easily measureable and quantifiable climate risk (e.g., a deficit in rainfall at the start of the season). Further, there needs to be a demonstrable benefit in buying insurance, which is one reason why insurance is often bundled with credit or inputs which can demonstrate productivity gains.

There have been many pilot index insurance programmes over the last 20 years. However, until recently, some have doubted that index insurance could overcome these challenges and scale to the numbers of farmers needed to meaningfully address poverty (Banerjee and Duflo 2011; Binswanger-Mkhize 2012). In addition, despite many studies and reviews of index insurance (e.g., Binswanger-Mkhize 2012; Mirinda and Farrin 2012; Cole et al. 2012; Helmuth et al. 2009; Carter et al. 2014), current information in the academic literature on index insurance programmes and particularly evidence of their impacts is quite limited, due in part to their commercial nature.

The aim of this report is two-fold. First, it updates previous assessments of index-based agricultural insurance in the developing world, providing concrete evidence from a few initiatives that are starting to overcome the challenges, and demonstrate substantial demand and tangible development impacts among farmers previously considered difficult to insure. Second, it draws out lessons from these case studies about factors that appear to contribute to the degree of success of these case studies. In the first part of the report, we discuss five case studies that insure smallholder farmers or pastoralists in the developing world. The second part of the report is a discussion of the evidence from these case studies about the potential for index-based insurance to benefit smallholder farmers in the developing world, and the strategies that they have employed in order to scale.

2. Case studies

Table 1 gives a snapshot of the five case studies selected, and their current scope in terms of targeted commodities, coverage, number of insured people and key features. Four of these were selected because of their scale (at least 10,000 contracts sold in 2013). The fifth case study, IBLI, was selected because of quantified developmental impacts and innovations that may prove useful for other projects. All

include relatively poor smallholder farmers or pastoralists. Each of the case studies shows elements of success in their implementation, uptake and development benefits.

Table 1. Summary of index insurance case studies

Case study	Country	Commodities	Start date	Number of insured	Key features
NAIS <i>National Agricultural Insurance Scheme</i> mNAIS <i>modified National Agricultural Insurance Scheme</i> WBCIS <i>Weather-Based Crop Insurance Scheme</i>	India	Cereals, millets, pulses, oilseeds, annual commercial horticulture	1999	16.79 million under NAIS, 3 million under mNAIS, 13.62 million under WBCIS (2013)	State-subsidized insurance programmes, bringing insurance to millions of farmers through a link with agricultural credit.
ACRE <i>Agriculture and Climate Risk Enterprise (formerly Kilimo Salama)</i>	Kenya, Rwanda, Tanzania	Maize, beans, wheat, sorghum, coffee, potatoes	2009	Over 187,466 (60% in Kenya, 40% in Rwanda (2013))	Strong links to aggregators and mobile technology. Wide range of products, mostly linked to credit or inputs.
R4 <i>Rural Resilience Initiative (formerly HARITA)</i>	Ethiopia, Senegal	Teff, beans, maize, wheat, barley, sorghum, millet	2009	24,133 in 82 villages in Ethiopia, 1989 in Senegal (2014)	A farmer-led, integrated risk management project, with labour for insurance and satellite rainfall indexes.
IBLIP <i>Index-Based Livestock Insurance Project</i>	Mongolia	Livestock (camels, cattle, sheep, goats and horses)	2006	Approximately 15,000 herders (2014)	A public-private partnership with innovative risk layering, within a diversified risk management portfolio.
IBLI <i>Index-Based Livestock Insurance</i>	Kenya	Livestock (camels, cattle, sheep, goats)	2010	Approximately 3000 contracts sold during the project lifetime	Creative education methodologies and an innovative mortality index-based on NDVI.

Case study 1: India's national index-based insurance schemes

Agriculture is an extremely important part of India's economy, accounting for over 50% of employment. India also has approximately 138 million farm holdings, of which 85% are smallholder farmers (<2 ha) exposed to high climatic risk (Ministry of Agriculture 2014; Joseph 2013). It is therefore unsurprising that both weather-based and area yield index insurance have a long heritage in India, with the concept first reported in 1920 (Chakravarti 1920). India now administers the world's largest weather index insurance market, reaching tens of millions of farmers each year.

Given the history and scale of Indian crop insurance, there have been many studies and reviews on the topic (e.g., AFC 2011; Clarke et al. 2012; Prabhakar et al. 2012; Rao 2011; Singh 2010; World Bank 2011a). Without attempting to capture this rich body of work, we present a short overview of the Indian index insurance market, plus some insights into why and how it has scaled. To do this, we focus on India's major nation-wide index insurance programmes: the National Agricultural Insurance Scheme (NAIS), which has now partly been replaced by the modified National Agricultural Insurance Scheme (mNAIS), and the Weather-Based Crop Insurance Scheme (WBCIS). These programmes are state sponsored and the choice to offer NAIS, its replacement mNAIS, or the WBCIS is a decision taken by the regional state authorities rather than individual smallholder farmers. The programmes are also supported through premium subsidy. Premium subsidies vary by insurance programme and by state, but in general the farmer pays between 25% and 40% of the premium and the government provides a subsidy for the remaining 60% to 75% (Aon Benfield 2013).

National Agriculture Insurance Scheme (NAIS)

The Government of India launched NAIS in 1999, as the successor of the Comprehensive Crop Insurance Scheme (CCIS) that had been running since 1985. In states or union territories that choose to participate in NAIS, insurance for food crops, oilseeds and selected commercial crops is compulsory for all farmers that take Seasonal Agricultural Operations (SAO) credit from financial institutions and is voluntary for non-

borrowing farmers without SAO credit. The index is primarily an area yield product at sub-district scale, thus payouts are triggered if regional yield measurements fall below a pre-specified threshold. The state-sponsored Agriculture Insurance Company of India (AIC) covers the claim up to the premium, then the local and national governments contribute equally to cover the remainder. For commercial crops, the premium rates are actuarial, and the government does not subsidize claims.

Modified NAIS (mNAIS)

Difficulties in the administration and financing of NAIS led to systemic delays in the settlement of claims (up to 9-12 months or more) and poor risk classification, resulting in adverse selection and inequity between farmers in nearby insurance units (World Bank 2011a). In September 2010, the Government of India approved a plan to move from the NAIS into a modified NAIS (mNAIS) programme under an actuarial regime in 50 districts. NAIS was to be completely withdrawn as of 2014 but the new national government allowed regional governments to continue NAIS in 2014-15. The regional governments therefore had a choice of NAIS, mNAIS or WBCIS for the 2014-15 growing seasons.

Modifications from NAIS to mNAIS included: changing the governments financial liability into up-front subsidy on premiums, reducing the insurance unit size to village level to lower basis risk, elimination of calamity years in calculating threshold yield, coverage for prevented sowing & post-harvest risks, plus additional coverage for failed planting based on weather indices (World Bank 2011a; Zevenbergen 2014).

Weather-based Crop Insurance Scheme (WBCIS)

The Weather-based Crop Insurance Scheme (WBCIS) was formally introduced in 2003 as a pilot, underwritten by ICICI-Lombard General Insurance Company and insuring groundnut and castor farmers in BASIX's water user associations in Andhra Pradesh. Other private sector pilots followed and by 2007 the Government adopted it as an official alternative to NAIS. Around 40 crops are insured under the category for various climatic risks such as deficit rainfall, dry-spells, excess rainfall, low temperature, high temperature, high humidity, and high wind. As shown in Figure 1, the project now covers over 13 million farmers.

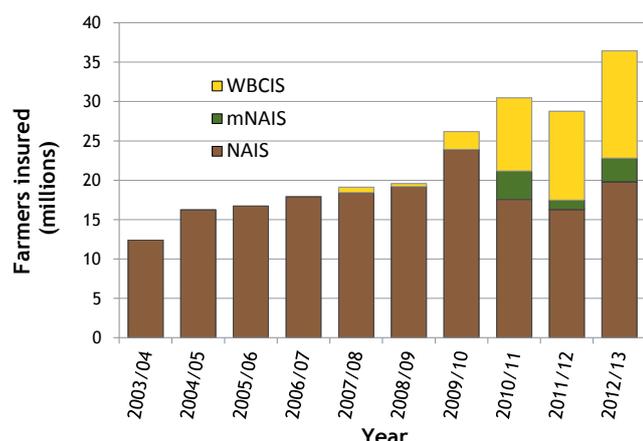


Figure 1. The number of farmers covered by India's WBCIS, NAIS and mNAIS crop insurance programmes. Data from: Aon Benfield (2013) and Joseph (2013).

The primary product of WBCIS is based on weather data linked to one of the network's 5000 reference weather stations. The limited availability and quality of ground-based weather data has been cited as a key bottleneck for further scale up (Parthasarathy 2014). One advantage for end-users of this product is that insurance payouts are provided within a reasonable time (mostly within 45 days) from the end of the season covered by the contract, whereas area yield estimates take substantially longer to calculate (Aon Benfield 2013). WBCIS allows risk-based premium rates, supported by up-front subsidies in premium. Private sector insurance companies are allowed to compete with the Agriculture Insurance Company of India (AIC), the public insurer, to offer the subsidized products (Clarke et al. 2012).

Goals, accomplishments, and impact

The stated objectives of Indian index insurance (Ministry of Finance 2014) are to: (a) "provide a measure of financial support to farmers in the event of crop failure from drought, cyclone and incidence of pest & diseases;" (b) "restore the credit eligibility of a farmer for the next season after a crop failure;" (c) "encourage the farmers to adopt progressive farming practices, high value inputs and higher technology in agriculture;" and (d) "help stabilize farm incomes, particularly in disaster years." The second and third objectives involve the relationship between insurance and farmers' ability to access credit. Much of the scaling in these schemes can be attributed to requiring insurance as a prerequisite for agricultural credit, and high premium subsidy of up to 75% (Singh 2010). This allowed insurance to reach approximately 24% of farm households nationwide. This corresponds with a 2006 survey which found a 27% insurance take-up rate among a sample

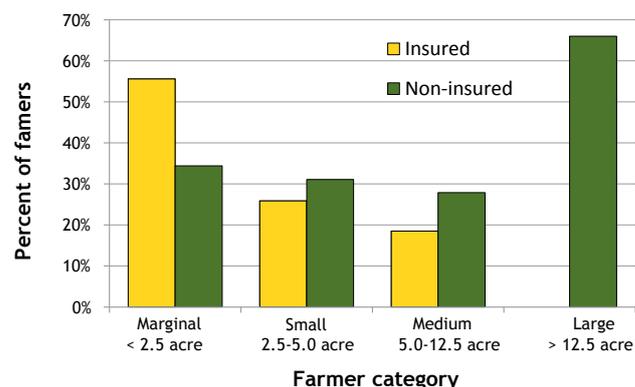


Figure 2. Distribution of insured and non-insured farmers, by wealth category, from a survey of 88 farmers in Nashik district, Maharashtra. Data from Zevenbergen, 2014.

of farmers in Andhra Pradesh and a 23% rate by another sample in Gujarat, India (Cole et al. 2013). There is now a growing body of information on the types of farmer that have bought this insurance, although the size of India and the wide variation in wealth and infrastructure mean that the impact will almost certainly vary from region to region. A 2007 study (Giné et al. 2008), sampling approximately 750 households, showed that those who purchased index insurance as part of a crop credit package were generally poor to middle-income smallholder farmers. This was backed up by a smaller study of a sample of farmers in Maharashtra (Zevenbergen 2014). Finally, a randomized control experiment in Andhra Pradesh, India, showed that weather index insurance, associated with WBCIS, prompted a shift toward more profitable, higher risk farm production systems (Cole et al. 2013).

The Zevenbergen (2014) impact study was conducted in the relatively wealthy region of Nashik, Maharashtra, where a survey of approximately 90 farmers showed that it is not necessarily the largest or most educated farmers that use crop insurance. The majority of insured farmers fell in the marginal farmer category (Figure 2). There was limited evidence to show that insured farmers were also more likely to have tractors and to apply more advanced farming techniques, potentially due to the crop credit bundled with the insurance. In addition, Rao (2013) conducted a study of over 600 farmers spread across eight districts of Karnataka, Tamil Nadu and Madhya Pradesh, which revealed that farmers growing crops under irrigation were more likely to seek insurance compared to farmers growing crops under rainfed conditions. This was attributed to the higher working capital and higher returns from irrigated farms. Zevenbergen (2014) also showed that NAIS farmers in Nashik are keen for more input into the

insurance design process. The study referenced a pilot DHAN Foundation mutual yield-based insurance programme in Tamil Nadu with high levels of satisfaction attributed to farmer-driven design. For example, the product was designed in conjunction with farmers and there was a democratic process in which farmers were chosen to represent their community within a formal feedback and assessment process.

The mandatory nature of insurance for borrowing farmers makes it difficult to evaluate their motivation for buying NAIS and WBCIS insurance, or its impact on their livelihoods. For example, there is limited evidence to evaluate whether farmers are now more likely to avail crop credit because of the protection offered by the insurance. One method of addressing this is to look at the small proportion of farmers who voluntarily purchased insurance without also purchasing crop credit. Significant regional variation can be seen. For example, Swain (2014) reported that in 2009-2010, the percentage of non-borrowing farmers varied from 0-15% across different states, and that non-borrowing farmers in the state of Odisha were more likely to choose WBCIS over NAIS. Other sources have suggested that this number is between 10-30% (AIC 2014). Kakumanu (2011) reported that awareness of the programme might also be a factor, with an awareness-raising effort by AIC significantly increasing demand for WBCIS by non-borrowing farmers.

There are of course caveats to interpreting demand by non-borrowing farmers, especially if one attempts to compare them to a completely voluntary insurance programme. Farmers who purchase insurance in isolation from credit are likely to have different motivations or socio-economic status compared to those who purchase insurance bundled with credit. It is thus reasonable to speculate that the demand by non-borrowing farmers is not a complete reflection of demand for Indian index insurance in general. For example, there is some evidence to support the hypothesis that some farmers who purchased insurance bundled with credit would have otherwise been interested in voluntary, non-bundled insurance. This is shown in Zevenburgen (2014), which reported that farmers in Nashik district, Maharashtra wanted more access to voluntary insurance. In addition, it is reasonable to suggest that insurance offered without the bundle with credit is playing a different role in farmers' risk management strategies, for example, it is more likely to protect assets or be used for safety-nets or consumption smoothing, whilst bundled insurance is more likely to be used to build productive assets. It is possible that these differing roles of the product might have a different impact on demand.

The wide variety of programmes and contracts offered in India means that the issue of basis risk is often discussed as an important issue for Indian index insurance programmes. In the case of weather index-based WBCIS, many different index designs have been proposed (Clarke et al. 2012), but a lack of validation data has made it difficult to rigorously assess the level of basis risk or evaluate the alternatives. In the case of yield measurement used within NAIS and mNAIS, basis risk is due to the difference between aggregate area yield and yield on individual farmer's plots. To address this, mNAIS scaled down the unit area of insurance from the sub-district level of NAIS, to individual villages or clusters of 4-5 villages, although no formal validation of the impact on basis risk has yet been reported.

WBCIS also provides an interesting example of public-private sector interactions and partnerships. Weather-based index insurance in India was developed originally by the private sector, then adopted by the State and subsidized in 2007. From 2009-2010, private sector firms were allowed to compete with the public insurer AIC to offer subsidized WBCIS products at a state level (Clarke et al. 2012). The future is likely to offer more changes to this public-private relationship as the Government is transitioning to a National Crop Insurance Programme (NCIP) where mNAIS, WBCIS and a pilot palm coconut insurance programme will be merged, the Government will change the method of providing subsidies to an actuarial approach and private sector firms will be allowed to compete for contracts (AIC 2014; Bhavan 2013, Parthasarathy 2014).

In conclusion, India provides evidence that it is possible to create logistical frameworks to insure many millions of individual farmers and that it is possible to scale up a programme where insurance is bundled with agricultural credit and subsidy. Many different index designs have also been used in the country, which allow insight into index design and basis risk. One of the strengths of the index insurance programmes in India is their flexibility in responding to new technology and evidence, where mNAIS is an excellent example of this progression.

Case study 2: ACRE – East Africa

The Agriculture and Climate Risk Enterprise (ACRE) is the largest index insurance programme in the developing world in which the farmers pay a market premium, and the largest agricultural insurance programme in sub-Saharan Africa. It is also the first agricultural insurance programme worldwide to reach smallholders using mobile technologies (IFC 2013). ACRE was originally a project run by the Syngenta Foundation for Sustainable Agriculture called Kilimo Salama (Kiswahili for Safe Agriculture). It transitioned to its current form as a for-profit social enterprise in June 2014. ACRE has shown rapid scale-up in East Africa (Figure 3), and is projected to reach 3 million farmers across 10 countries by 2018 (ACRE 2014b). In 2013, the sum insured reached USD12.3 million, the recorded insurance payout was USD370,405 and the average cost of insurance was 5-25% of harvest value (IFC 2014). Donor money is currently used for feasibility studies, satellite ground proofing with automatic weather stations, and salaries during the early stages of growth in each target country (ACRE 2014b). From 2014 onwards, some donor money will also be directed into premium subsidies.

There are three pillars to ACRE's approach (ACRE 2014b). First is a wide range of products based on several data sources, including automatic weather stations and remote sensing technologies. The second is ACRE's role as an intermediary between insurance companies, reinsurers and distribution channels/aggregators. Such aggregators include microfinance institutions, agribusiness and agricultural input suppliers. The third pillar is its link to the mobile money market, particularly the M-PESA scheme in East Africa. This allows quick enrollment and payment of claims without having to physically visit farmers, thus enabling the programme to quickly reach the many millions of farmers enrolled in M-PESA.

As of 2013, ACRE offered a range of insurance products (ACRE 2014a). First, insurance was linked to agricultural credit from Microfinance Institutions (MFIs). This credit was designed for farmers who wished to grow maize using improved inputs, thus the credit had to cover seed or mineral fertilizer and needed to be at least USD100. In 2013, 182,092 farmers purchased this package, which also included agronomic training from MFI field agents. Second, ACRE offered contract seed grower insurance for large-scale producers (> 20 acres) at an average value of US\$650 per acre. In this case the seed company paid the premiums at the start of the season, which was then repaid by the farmers at harvest when delivering their seeds to the company. In 2013, 650 producers covered 11,814 acres with this package. Third, dairy livestock insurance was offered in partnership with a dairy cooperative (for farmers who already own cattle) or lending institution (for farmers who want to purchase them). These partners pay the premium

up-front, then either deduct it from the payments to farmers for milk deliveries, or combine it with the loan payments. The cover is also linked to animal care packages and vaccines. In 2013, 58 dairy farmers bought this product, insuring 97 cows worth an average of US\$400 each. Finally, in 2013 and 2014, insurance was incorporated into a replanting guarantee by a seed company, linking ACRE, UAP Insurance and Safaricom. The insurance premium was incorporated into the price of a bag of seed. Each bag contained a scratch card with a code that could be texted to ACRE during the planting period to start coverage against drought. Each farm was then monitored using satellite imagery for 21 days. If the index was triggered the farmers were automatically paid via M-PESA for a new bag of seed so that they could replant. In 2013, 2,279 farmers signed up to the service, and in the 2014 February-April planting season, over 9,000 bags of seed were sold and over 700 farmers compensated (Safaricom 2014).

There is growing evidence that ACRE is demonstrating positive development impact, including statistics that insured farmers had 16% more earnings and invested 19% more compared to their uninsured neighbours (IFC 2014). In 2012, 177,782 farmers received USD8.4 million in financing in part due to ACRE's index insurance products (some of the farmers may have been able to access this credit without the insurance). As with any bundled product, for example the Indian case-study, it is difficult to assess the motivation of farmers for purchasing insurance. In some cases, the insurance might have unlocked credit. But in other cases, farmers who already had access to credit also purchased insurance. An earlier unbundled product offered by Kilimo Salama via agri-businesses also showed strong scale-up from 200 farmers to over 7000, suggesting that the demand for insurance is not driven purely by the demand for credit, seed or other products (Goslinga 2012).

One of the strengths of ACRE is that indexes used for its products are based on several data sources, allowing experimentation with new technologies without degrading trust and its baseline of users. Data sources include 130 solar powered automated weather stations, satellite rainfall measurements, and government area yield statistics. Indexes have been developed for maize, beans, wheat, sorghum, millet, soybeans, sunflowers, coffee, and potatoes (Nganga 2013). In Rwanda, more than 37,000 low-income smallholder farmers were able to purchase a satellite-based index insurance product (Fiondella 2013).

ACRE has cited its wide range of partners as a major reason behind their rapid scaling and demand. Partners include banks and MFIs, mobile network operators (Safaricom), seed companies, government agencies (Ministries of Agriculture and National Meteorological Services), research institutions including IRI, insurance and reinsurance companies (UAP in Kenya, Société Rwandaise d'Assurance (SORAS) in Rwanda, Swiss

Re, Africa Re) and global donors (Global Index Insurance Fund, GIIF). ACRE has leveraged the expertise of this partner network to implement new and innovative solutions to challenges farmers face. It is supported by an “in house knowledge hub” of 30 local and international specialists to work on all aspects of the programme, from index design to distribution and farmer education. Farmer education and capacity development has been a key component of this work. In 2011, 40% of the project’s budget reportedly went towards trainers who work with farmers, a telephone helpline, and radio programmes about insurance (Rosenburg 2011).

ACRE is perhaps most well known for its distribution channels. Mobile banking is a key part of the East Africa economy, with over 19.3 million users of the M-PESA mobile banking system (Safaricom 2014). The partnership between ACRE and M-PESA has allowed both premiums and payouts to be paid instantly using mobile banking, plus the M-PESA system supports easy registration and tracking of individual clients.

This link has enabled ACRE to reach many thousands of remote farmers while maintaining low transaction and delivery costs. Although there has been little formal investigation into the type of farmer purchasing ACRE products or their motivation, the link with M-PESA gives some indication. For example, in contrast to the IBLI case study, it is aimed at farmers who have access to a mobile phone or live within the mobile coverage area which is 91% of Kenya (Safaricom 2014).

In summary, this is an example of a project reporting rapid scaling based on a strong partnership between different partners and innovative approaches to address the differing needs of different farmers. It has particularly built on links with lending institutions and input providers, and with the M-PESA mobile banking community to allow easier payment and distribution. Finally, this programme gives one of the strongest demonstrations that innovative technology solutions can lead to scale in smallholder agricultural insurance.

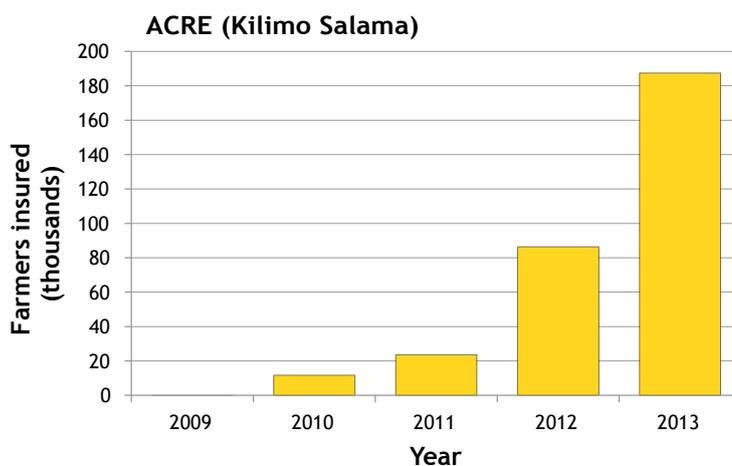


Figure 3. The number of farmers covered by the ACRE programme in East Africa. Data obtained from ACRE 2014. From 2009-2012, the programme operated in Kenya. In 2013, contracts were sold in Kenya, Tanzania and Rwanda.

Case study 3: R4 Rural Resilience Initiative – Ethiopia and Senegal

The R4 Rural Resilience Initiative (R4) 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. R4 refers to the four integrated risk management strategies implemented by the programme. The first is *Risk Reduction*: access to improved climate risk management, for example natural resource rehabilitation or new agricultural extension techniques. This 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 programme. 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. Microfinance Institutions 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 programme has scaled solidly, from 200 Ethiopian farmers in the original 2009 HARITA pilot in Tigray, to over 24,000 in Ethiopia (in 81 villages) and 2,000 in Senegal in 2014 (Figure 4). 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.

Future plans for scaling include expanding to Zambia and Malawi in 2015, plus further expanding the number of farmers enrolled in Ethiopia and Senegal. 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 in the second year by the rollout of the programme 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.

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. To overcome the liquidity constraint, poor farmers have the option of paying premiums either in cash or through insurance-for-work (IFW) programmes. In Ethiopia, the IFW scheme is built into the Government of Ethiopia's Productive Safety Net Programme (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 labour was introduced to give farmers the opportunity to graduate from the IFW programmes. 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 programmes 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).

Several other development impacts were also reported (Madajewicz et al. 2013). 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 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 programme 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 labour, and increased their total planted land in response to insurance.

One challenge facing the R4 Initiative is data availability. 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). As with any weather-based index, reducing and appropriately communicating basis risk is also a challenge, especially as there are several non-drought perils faced by farmers in the region (such as insects or heat stress). Risk assessment and context analysis has been key to facing this issue, which has taken time and meaningful investment by project partners. There has also been significant research with scientific partners into regions with recurrent basis risk, leading to current efforts to design hybrid index insurance products using a combination of satellite rainfall estimates and vegetation indices.

Central to this has been the development of a farmer-led index design process run using the Social Network for Index Insurance Design (SNIID). 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 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.

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.

In summary, the R4 Initiative has demonstrated strong scale-up while targeting farmers previously considered uninsurable. 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.

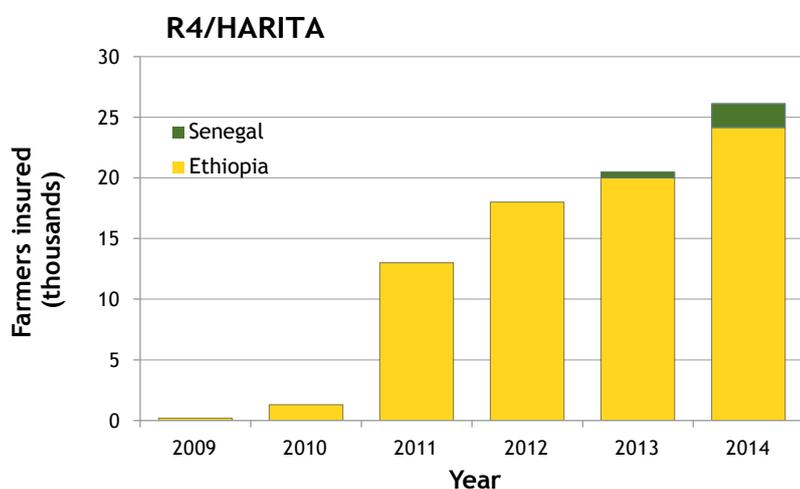


Figure 4. The number of farmers covered by the R4 Initiative in Ethiopia and Senegal. Data obtained from R4 Quarterly reports (R4 Rural Resilience Initiative 2014).

Case study 4: Mongolia Index-Based Livestock Insurance Project (IBLIP)

The Mongolian Index-Based Livestock Insurance Project (IBLIP) developed by the Government of Mongolia in 2005 with the support of the World Bank, is an index-based mortality livestock insurance product now available in every Mongolian province. The aim of IBLIP is to protect Mongolian herder households from significant livestock loss by providing financial security, while also encouraging them to adopt practices that build their resilience to extreme weather events. This case study offers insights into how insurance can be used for multiple purposes that include self-insurance, market-based insurance, and a social safety net. Similar to ACRE, this case study also shows how a donor supported index insurance programme can successfully transition into a commercial entity.

A number of challenges have affected Mongolian pastoralists in recent decades, including the transition from communist to free market economy. Because of the privatization of herds, several mild winters, and increasing urban unemployment the number of livestock roughly doubled between 1970 and 1999 (Figure 6; Shagdar 2002). The collapse of the communist state also started a complex evolving dynamic between politics, culture, resource access, risk management and institutional

change, resulting in rapidly increasing inequality among pastoralists (Murphy 2014). Withdrawal of state sponsored insurance and pastoral support services transferred risk from the Government to individual pastoralists.

The most important climate-related shock impacting Mongolian pastoralists is the dzud, where extreme winter weather conditions result in high livestock mortality. This hazard occurs approximately once every 5-8 years. It is important to note however that dzud events impact different wealth categories of herders quite differently. In 2013, 14.5% of herder households were categorized as wealthy, owning more than 500 animals (Yadamsuren 2014). Murphy (2014) and Luxbacher and Goodland (2011) suggest that these households are able to mitigate the dzud livestock mortality rate through collective migration rights and better access to protective assets. The majority of herders have mid-sized herds, with 32.7% owning 200-500 animals and 24.6% owning between 100-200 (Yadamsuren 2014). These herders often lack the financial resources and financial capital to migrate, leaving them much more vulnerable to weather risk. Murphy (2014) found that these farmers were particularly susceptible to dzud events in the Uguumer region. Unsurprisingly, the poorest 28.2% of herders with fewer than 100 animals are also highly susceptible to dzud. Murphy (2014) reported that this risk might be ameliorated in some cases if the herders also worked as hired labour for the wealthy farmers, as this allows them to access risk management strategies for their own livestock such as migration. However, a survey of 1094 herders across 3

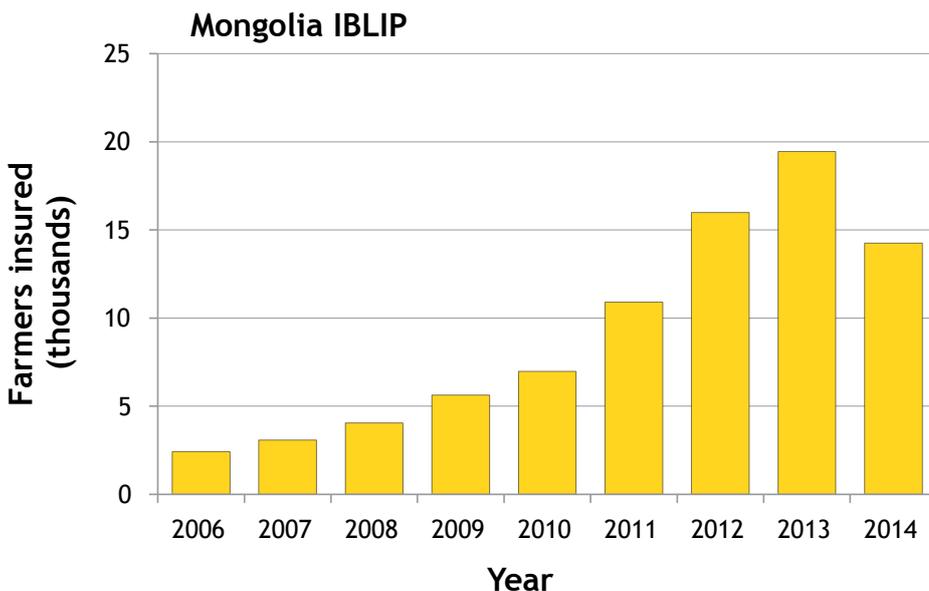


Figure 5. The number of farmers covered by the Mongolian Index-Based Livestock Insurance Project (IBLIP). Numbers obtained from Yadamsuren (2014).

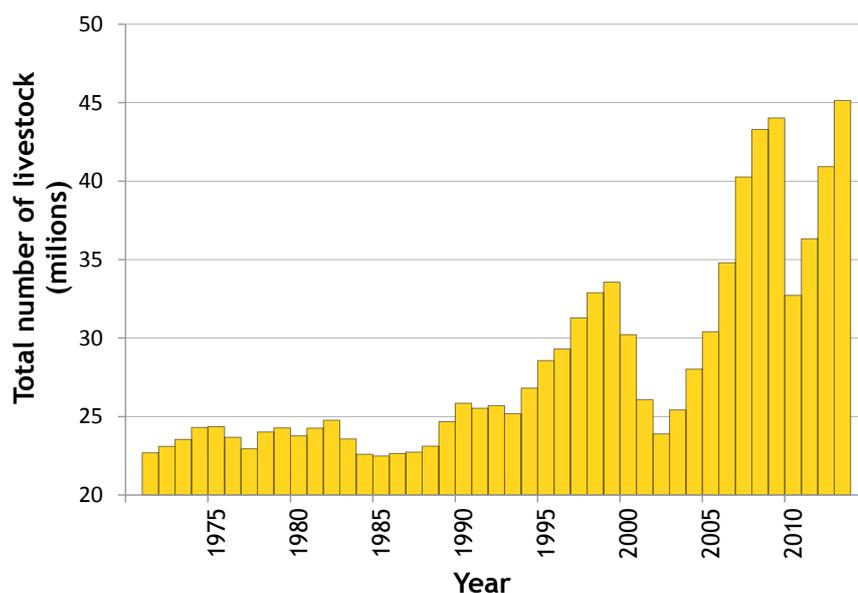


Figure 6. Total number of livestock in Mongolia. Data from the Mongolian National Statistics Agency. The impact of dzud winter events of 2002 and 2010 can clearly be seen.

provinces in western Mongolia reported that it was the poorest herders who suffered the heaviest losses from the 2010 dzud event (Bertram-Hümmer and Krähnert 2015). The possibility of a dzud winter appears to be a barrier to investing in improved practices such as upgrading animal quality (Miranda and Farrin 2012, World Bank 2009a).

IBLIP was developed in response to a perfect storm, between 1999 and 2002, of increased livestock numbers, increased vulnerability, and a 3 consecutive dzud winters. This led to the loss of over 11 million animals, representing a financial loss of over USD500 million (Yadamsuren, personal comm, 2015). It also led to an increase in the poverty rate from approximately 30% in 2000 to over 40% in 2004 (CDKN 2013) and imposed strains on the Government of Mongolia's budget for disaster relief (World Bank 2009b). The losses from these extreme weather events were so severe that the small agricultural indemnity insurance industry went bankrupt trying to pay out the farmers and herders, and the private insurance system collapsed, destroying the risk management systems that were in place. This event clearly showed the difficult nature of the problem for indemnity livestock insurance in Mongolia: losses were highly correlated, the frequency and severity of risk was uncertain and there was high risk of moral hazard. Finally, the nomadic nature of many of the farmers meant that there were high administrative costs and it was difficult to monitor individual behaviour.

The index used in IBLIP is the livestock mortality rate at the local region (or soum) level. The coverage period is from January to May, when more than 80 percent of the livestock losses occur. The sales season is from April to June in the

previous year. Each June, the National Statistical Office conducts a mid-year survey, which is compared with the previous end-of-the-year census, conducted in December, to determine the livestock mortality rate of adult animals. The livestock mortality rate was considered suitable for use as an index for IBLIP because farmers are incentivized to report accurate numbers through local belief systems and peer review, because data is available for over 40 years for all animals at a soum level, and because historical validation studies show that the index captured historical loss years (GlobalAgRisk 2012 Mahul and Skees 2007). As the IBLIP index is closely linked to loss, there have been very few basis risk events.

IBLIP is unique in its formal layering approach. When livestock mortality is <6%, farmers are encouraged to self insure, but are supported by World Bank risk management tools in the Sustainable Livelihood Project (Luxbacher and Goodland 2011). When livestock mortality is 6-30%, farmers receive payouts from the Base Insurance Product (BIP), now called Livestock Risk Insurance (LRI), supported by the Livestock Insurance Indemnity Pool (LIIP). The LRI is sold to farmers at fully loaded, actuarially correct premium rates (Miranda and Farrell 2012). Herders select the percentage of the value of their herd that they would like to insure – typically about 30% (Rutten 2012). Reserves within the LIIP come from premiums and an insurer participation fee, and are used to make payments to herders. Finally, livestock losses that exceed 30% are covered by the Government of Mongolia's Government Catastrophic Coverage (GCC) formally called the Disaster Response Product (DRP). The Mongolian Government also covers costs such as the livestock census, the management

of the risk management tools, and a subsidized reinsurance treaty (Mahul et al. 2009). The GCC is financed through the reinsurance treaty, with international donor funds coming through the World Bank. Herders could access stand-alone GCC coverage up to 2008/2009, but it is now only available bundled with LRI (Rutten 2012, Luxbacher and Goodland 2011). The public-private risk-layering strategy is a new innovation for index insurance and has been an effective element of the project. Government coverage of catastrophic mortality events reduces risk premiums for herders and protects the insurance industry from risk of bankruptcy.

Since its inception in 2005, IBLIP has been widely regarded as a success with solid scale up at a similar rate to the R4-Rural Resilience project. In 2014, growth appears to have slowed or slightly reversed. However, IBLIP still covers approximately 15,000 farmers and is available in every district of Mongolia. Herders also continued to purchase the insurance during a price decline of cashmere, suggesting that policy holders value the coverage (Luxbacher and Goodland 2011). Payouts were triggered during several of the years, particularly the severe dzud of 2010 and the administrative mechanisms proved effective in getting payouts to the farmers. This scaling has been attributed to the strong partnership between the private and public sector and because the historical mortality rates are available across the country. The scaling also appears to be financially sustainable, with several insurance and reinsurance companies attracted to the project.

Initial assessments suggest that IBLIP is having a positive impact on reducing the poverty of smallholder farmers, although there is significant regional variation. Luxbacher and Goodland (2011) reported that banks have been recorded offering lower loan interest rates to insured farmers. Murphy (2011) found that in Uguumur, farmers who received payouts were able to use them to cover the costs of migration for future years, but that in this region it was often just the wealthy or very wealthy farmers purchasing premiums, further exacerbating inequality. A similar result was also found in western Mongolia in 2013; below 200 livestock: 14% of herders bought IBLI, between 200-350 livestock: 15% of herders bought IBLI, above 350 livestock: 32% of herders bought IBLI (Bertram-Hümmer and Krähnert 2015).

There were also indications that in some regions of the country, middle wealth farmers are primarily purchasing the insurance, leading to positive impacts on inequality. For example, Fernandez-Gimenez et al. (2012) found that in 2010-2011, soums showing strong links between the local government and herder organizations were more likely to widely take up insurance and were generally considered resilient, whereas soums with weak institutions were at that point less likely to access the insurance with only the wealthy taking advantage. Addison and Brown (2014) found high demand from sampled farmers across the region during the

2009-2010 dzud event who had not yet bought the insurance due to access (addressed in the subsequent scale up). Access and knowledge of the project are now much higher. In 2014, 82.3% were reported as being aware of the insurance programme in the first 4 soums involved in the project, 62.5% in the second 11 soums, and 51.7% in the most recently added 6 soums (World Bank 2014).

The success of IBLIP is reflected by its announcement in 2014 that it was transitioning from a donor-funded project to a private company. In June 2014, a draft Index-Based Livestock Insurance Law was passed and followed in August by the creation of the Agricultural Reinsurance Company of Mongolia (Yadamsuren 2014). This has been designed as a public-private owned reinsurance company which is fully compliant with Mongolian and international insurance and reinsurance legislation. Current funding for IBLIP from the World Bank will continue until 2016 during the transition period (World Bank 2014).

As IBLIP moves forwards, new technical challenges are being overcome. For example, there are discussions to reduce administrative costs and the logistical barrier of physically reaching pastoralists through working with trusted partners such as banks and microfinance agencies, rather than directly employing insurance agents to sell premiums (CDKN 2013). IBLIP can also contribute still further to poverty reduction in Mongolia, especially if it can strengthen its links to initiatives addressing other problems or increasing inequalities that pastoralists face, such as a lack of markets or poorly developed supply chains (Luxbacher and Goodland 2011). It will also need to find its place within the rapidly changing flux of land tenure rights and cultural shifts amongst Mongolian pastoralists (Murphy 2014). In general, however, there is great potential for further positive impact.

Case study 5: Index-Based Livestock Insurance (IBLI) – Kenya and Ethiopia

The arid and semi-arid lands (ASALs) of northern Kenya and southern Ethiopia are regularly hit by regional droughts. These can have particularly severe impact on pastoralist households, who depend on livestock for food, income, and as their main form of savings. As Wandera and Mude (2013) discuss, loss of herds during drought can have devastating effects on local communities, pushing many households into poverty traps. This makes pastoralists amongst the most vulnerable population to climate in East Africa. The International Livestock Research Institute (ILRI), in partnership with Cornell University and the University of California – Davis, created IBLI to stabilize asset accumulation, enhance economic growth, and keep livestock keepers out of poverty traps by insuring them against the loss of their livestock due to drought (Mude et al. 2010). The product is based on two years of comprehensive research that was aimed at designing, developing and implementing market-mediated, index-based insurance products that livestock keepers – particularly in the ASALs – could purchase to protect themselves from drought-related asset losses (Mude et al. 2010, Chantarat et al. 2013).

The IBLI project took on the challenge of making insurance commercially viable amongst poor nomadic herders who occupy vast remote areas in Kenya and Ethiopia with almost non-existent communication and transport options (Ndirangu 2014). It also lacked the comprehensive 100-year mortality database that was used in Mongolia's livestock insurance programme. These challenges led the IBLI team to research innovative strategies and use new technologies in product design, for example using a statistical relationship between livestock mortality data (collected since the year 2000) and the remotely sensed Normalized Difference Vegetation Index (NDVI). IBLI has features including creative education methods for pastoralists, culturally specific products and a division-level mortality index. Since 2000, households in northern Kenya have also been surveyed to gather livestock mortality data, providing a useful calibration tool. Although it hasn't reached the scale of the other case studies in this report, IBLI is included because it has shown significant innovation in product design and implementation, and has demonstrated developmental impacts for poor pastoralists, under particularly challenging conditions. It also provides a useful comparison with IBLIP.

The programme was launched in Marsabit in northern Kenya in January 2010 and now reaches three regions in northern Kenya (Marsabit, Isiolo and Wajir), plus the Borana region of southern Ethiopia. As with the other case studies in this

work, there are multiple partners involved in the programme, including insurance companies, reinsurers, research organizations and NGOs who are assisting in identifying and training local communities in the initiative.

The IBLI index is based on NDVI data collected by satellites, which was found to have a high correlation with forage availability in the project area (Mude et al. 2010; Wandera and Mude 2013). As the livestock in East African pastoral production systems depend almost entirely on forage for their nutrition, NDVI functions as an indicator of the vegetation available in the area for the livestock to consume and is linked to mortality. In Kenya, an index was calibrated using data on livestock mortality that the Arid Lands Resource Management Programme (now the NDMA) has been collecting monthly since 2000. The index was then based on the relationship between predicted livestock mortality and forage availability. The client can choose the level of risk coverage (either a 10% or 15% trigger/deductible contract).

Due to a lack of livestock data, the index in Borana, Ethiopia, uses the cumulative deviation (from normal conditions) of area aggregate observations of satellite-based vegetation index (NDVI) over the coverage rangelands within a given boundary. The Ethiopian contract triggers a payout when cumulative deviation of NDVI falls below the 15th percentile of historical vegetation growth over a season (two seasons in a year that combines a long rain period and the subsequent long dry period, or a short rain period and the subsequent short dry period).

IBLI has reached more than 4000 pastoralists since its inception in 2010 (MacMillan 2014). Evaluation by Janzen and Carter (2013) found strong evidence that IBLI provides substantial immediate development benefits in the event of a payout, as participating households are less likely to sell livestock, more likely to buy livestock from others, and more likely to become self-reliant for food consumption. The report also found different behaviours depending on the farmer's original asset base, with insurance stopping those most likely to reduce their productive assets from doing so, while preventing those households most likely to reduce consumption from doing so (Janzen and Carter 2013). People with larger payouts planned to save some of the money, or replenish their depleted herds while prices were still low. Some even increased herd sizes utilizing the low livestock prices. Insured households were half as likely to sell livestock after receiving a payout. Finally, household modelling indicated that IBLI removes 25-40% of total livestock mortality risk (Chantarat et al. 2013).

Although women do not have ownership rights over livestock and rarely attended public meetings or elders meetings, where most of the information was disseminated, they bought more cover than men (Wandera et al. 2013). In the Marsabit region,

40% of people purchasing insurance were women (ILRI 2014). This was attributed to the fact that women: (a) have more liquidity as they participate in petty trade, (b) may be more risk adverse, and (c) tend to be more willing to adopt new innovations. IBLI project partners identified this as a topic for further exploration.

IBLI has also worked carefully with stakeholders to offer products that are culturally and socially acceptable to the region's farmers. For example, they have pioneered Africa's first Islamic compliant index insurance product. In 2013, 30 women and 71 men in arid and semi-arid Wajir became the first beneficiaries of livestock insurance that conforms to the Islamic concept of "takaful" in which risks are shared among a group of participants. Through a contract called *tabbaru* (donation), participants make contributions to a risk fund. In the case of a payout, the fund makes payments commensurate with the contributions received (Macmillan 2014).

One unique aspect of IBLI is the major role that scientific research has played in its creation and scale-up. The index is based on extensive research on livestock viability in the Horn of Africa (Chantarat et al. 2009), which then linked with social research on the best way to communicate insurance to farmers (McPeak et al. 2010). The project's approach to monitoring and evaluation has aided this learning process. The IBLI pilot from 2010 was implemented in connection with a rigorous impact evaluation, employing random sampling of households in IBLI-access locations, and control locations where IBLI is not available (Janzen and Carter 2013). A survey of more than 900 households in Marsabit provided a baseline of key livelihood indicators. The households were then re-surveyed annually to assess the economic and welfare impacts of the insurance product. Focus group discussions allows for pastoralist feedback to be incorporated into the product (Chantarat et al. 2013). This strong scientific background, together with the wide spatial coverage and low cost of satellite vegetation data, has allowed the partners to develop a product for a non-traditional insurance client that has the potential to be commercially sustainable.

As with the R4 Initiative, finding innovative methods of addressing a lack of data has been a key part of IBLI, as the project is active in an area of Kenya without good mobile phone reception, severely limiting its ability to connect with mobile services such as M-PESA. The project has recently decided to develop an open-source ICT-based platform that will be used for both sales and information dissemination. It will use mobile phone technology to collect premiums and

provide indemnity payments, to send messages to the insured clients and the sales agents on the status of the index, and to send product-related information such as upcoming sales or payouts (Wandera et al. 2013). Due to limited phone reception in the region, the system will be able to operate offline.

As with the other case studies, the IBLI project has shown evidence of flexible learning practices. For example, in 2012 lessons from the initial phases of the project were used to design improved IBLI products, better targeted to the needs of the pastoralists. This allowed IBLI to launch a product in the Borana zone of southern Ethiopia, while scaling up existing operations in Kenya. The new focus on the *Takaful* Islamic insurance product shows the programme's ability to adapt to new markets and stakeholders, allowing IBLI to expand its clientele base in a region where remote pastoral communities are difficult to reach, have very little access to technology and are not necessarily familiar with the concept of insurance. (IBLI News 2014).

Education has also played a large role in the IBLI scheme. One of the main challenges is the difficulty in reaching remote pastoral communities who often have little or no experience with insurance. To combat this, IBLI team has used insurance simulation games, "edu-tainment" videos, radio programmes and plays (McPeak et al. 2010). Pictorials and educational posters have played a big role in educating the communities on the product. In addition, some members of the community - endorsed by the community leaders - have been recruited and trained on the product through local NGOs. These community representatives have then been able to lead the explanations of the product.

In summary, IBLI has been able to introduce index-based insurance for livestock in eastern Africa, overcoming several technological, structural and financial challenges. The use of satellite information calibrated with livestock mortality data has enabled this asset protection, even when historical livestock mortality data were not available. Moreover, adapting the index design process to incorporate client feedback has enabled a more client-driven process that the pastoral communities may be more willing to trust, mixed in with robust research and validation studies.

3. Discussion

Can index insurance for vulnerable farmers go to scale?

The viability of index-based insurance for poor smallholder farmers (including pastoralists) in the developing world is a topic of ongoing debate. Several reviews of the status of index-based agricultural insurance have focused on potential ways that existing initiatives – most at a pilot scale – might be strengthened and expanded (e.g., Hellmuth et al. 2009; Hazel et al. 2010; World Bank 2011b). Citing both theoretical arguments and empirical evidence available at the time, others have expressed concern that demand seems to be weak among relatively poor smallholder farmers and pastoralists who are most vulnerable to weather-related risk and may limit the potential impact of index-based insurance (Giné et al. 2008; Cole et al. 2013; Biswanger-Mkhize 2012). The case studies that we reviewed offer evidence that is relevant to this debate.

A theoretical argument for expecting demand to be weak among poorer, vulnerable farmers is that the gain in farmers' expected utility from smoothing consumption through index insurance is often not sufficient to cover the premium (Biswanger-Mkhize 2012; Clarke 2011; Mirinda and Farrin 2012). Expected utility attempts to capture how risk aversion affects how an individual values the tradeoff between mean and variability of stochastic returns (e.g., income, consumption), by incorporating a non-linear utility function (Pratt 1964). This argument assumes that insurance does not significantly change a farmer's choice of production technology or resulting average income. However, improving

Table 2. Increases in numbers of farmers insured from 2009 to 2013

Programme	Farmers insured	
	2009	2013
WBCIS	309,000	13,620,582
ACRE	185	187,456
R4/HARITA	200	20,365
IBLIP	5620	19,455

access to credit and adoption of improved production technology are explicit objectives of the India (WBCIS and NAIS), ACRE and the R4 programmes. Available evidence suggests that these index insurance programmes do have a positive effect on adoption of more profitable production technologies. In the R4 initiative in Ethiopia, insurance allowed farmers to increase their savings, or to invest more in inputs such as fertilizers and improved seeds (Madajewicz et al. 2013). Similarly, a randomized control experiment in Andhra Pradesh, India, showed that weather index insurance, associated with WBCIS, prompted a shift toward more profitable, higher risk farm production systems (Cole et al. 2013). The ACRE project reported that insured farmers had 16% more earnings and invested 19% more compared to their uninsured neighbours (ACRE 2014).

The scale of existing insurance schemes across the developing world is very small relative to the numbers of smallholder farmers who are impacted by climate-related risk. Based on statistics presented in Hess and Hazell (2009), Biswanger-Mkhize (2012) noted that as of 2009 only three unsubsidized index insurance schemes reached more than 10,000 farmers, all in India. The agricultural index insurance landscape is however changing rapidly. Four of the schemes that we reviewed have scaled up rapidly between 2009 and 2013, the most recent year of available data across all case studies (Table 2). Three of these – ACRE, R4 and IBLIP – insured roughly 227,000 farmers and pastoralists in 2013 without direct premium subsidy.

Biswanger-Mkhize (2012) highlighted three other aspects of scale, beyond the aggregate number of farmers covered within a given scheme, that are important for understanding the potential for index-based insurance to impact poverty among smallholder farmers: (a) the proportion of eligible farmers who purchase insurance, (b) the relative economic status of farmers that chose to purchase insurance, and (c) the amount of coverage that farmers purchase. Each aspect of scale is considered below.

The proportion of eligible farmers purchasing insurance is often difficult to measure outside randomized controlled trial conditions, as it is often hard to measure the number of farmers who have access to the product. Yet the reviewed case studies do offer some evidence. In India, as of the 2012-2013 agricultural year, the 33.4 million farmers insured under WBCIS and NAIS represent 24% of India's 138 million "operational holdings" reported in the 2010-2011 India Agricultural Census (Ministry of Agriculture 2014). This was achieved in a setting where insurance is required to obtain

agricultural credit, and where premiums are subsidized by the government. In the R4 Initiative, the uptake rate in 2013 was 29% of the population across villages where insurance was offered, and up to 38% in some villages (Madajewicz 2013). Yet demand for insurance among very poor farmers who opt to use labour to purchase insurance, has exceeded project resources. In 2014, the first year that R4 offered index insurance in Senegal, 66% of the 3000 farmers that were approached, purchased contracts.

Whether these uptake rates are interpreted as positive or negative evidence depends on expectations. Although 20–40% take-up rates of unsubsidized index insurance achieved in some projects may be considered low by some researchers, these rates exceed typical take-up rates of unsubsidized conventional insurance in industrialized countries such as the USA (Glauber, 2004). For example, for the IBLIP product in Mongolia might be considered low by some at between 9–13% of the market. However, this was enough to attract enough commercial reinsurance and insurance companies to transition the project from being donor-funded to a commercial entity (Yadamsuren 2014). Our view is that index insurance is not likely to be appropriate for every farmer, but its appropriateness will depend on the risks they face, their farming system, and what other resources are already available (e.g., technologies, markets, information and advisory services, informal risk sharing mechanisms). The goal therefore of index-based insurance should be to meaningfully address risk-related bottlenecks to improving farmers' livelihoods, and not necessarily maximize uptake.

This review includes examples that have effectively addressed a second concern about scaling – that, among eligible farmers, the relatively poor farmers who would benefit the most are not usually among the purchasers. The R4 Initiative, in particular, has successfully targeted very poor farmers, using innovations such as insurance-for-work to make insurance accessible to the poorer farmers within the project's target population. A recent assessment showed that quantifiable livelihood benefits from insurance are well distributed, and currently benefit women farmers as much or more than men – possibly as a result of the gender-targeted savings and risk-reduction components of R4 (Madajewicz 2013). The IBLI project also targets an extremely poor population of pastoralists in Kenya, with measured development impacts distributed well among marginal sub-populations. In Marsabit, women purchased 40% of insurance contracts (ILRI 2014). At least one study in India indicated that insurance was purchased preferentially by marginal and small farmers (Zevenbergen 2014; Figure 2). Current evidence in

the IBLIP case study in Mongolia shows that although wealthy farmers are more likely to purchase insurance, in 2013, 15% of poorer farmers still decided to purchase contracts (Bertram-Hümmer and Krähnert 2015). Insurance uptake by poorer farmers was also seen to improve in regions with good local governance or support systems (Addison and Brown 2014).

The final scale-related concern is that farmers generally buy the smallest amount of coverage offered. While this appears to be the case in some projects, the R4 Initiative shows that this is not necessarily the case. The poor farmers that participate in the R4 Initiative have demanded more aggressive insurance packages, purchasing as much as five times the minimum insurance offered despite the higher premium cost (Norton et al. 2014).

The case studies that we reviewed provide evidence that index-based insurance can benefit significant numbers of smallholder farmers in the developing world. While we do not yet have enough evidence to project how much they can continue to scale up, rapid scaling in recent years suggests that these case studies have targeted substantial latent demand, and are effectively addressing the challenges to providing useful insurance to smallholder farmers at scale. In our opinion, the growth we have seen in recent years suggests the possibility that the uptake and benefits of index-based insurance may be constrained more by the evolving capacity to provide relevant services, than by a fundamental lack of demand among farmers. At a minimum, it calls for reassessment of some of the prior arguments that lack of demand and practical implementation challenges prevent index-based insurance from being a useful tool to reduce rural poverty.

Attributes of successful index insurance programmes

Although each of the case studies has a very different scope, target market and geographical location, there are some themes running through all of the case studies.

Insurance that increases farmers' income

In most of the case studies, index insurance has unlocked opportunities for farmers to make more money, or to show some other clear and tangible benefit such as asset

protection, increased access to services such as credit, or increased food security in bad years.

As discussed above, a theme across many of the projects is that the insurance is specifically designed to unlock a productive opportunity for farmers that was previously unattractive because of risk. The increased profit from this opportunity provides a value for the insurance, and a mechanism to pay the premiums. As reported in the general discussion above, the use of insurance as a tool to help increase productivity is central to many of the case studies. For example the ACRE project focuses on using insurance as part of a productivity-enhancing package, in some cases linked to seed sales, in other cases for loans. Even though the R4 Initiative has no compulsory links to new practices or credit, the availability of these other R4 themes has allowed farmers to invest in new technologies or savings. The IBLI project showed that farmers who participated were better able to manage existing assets. The compulsory link between agricultural credit and insurance in India has also reinforced the access of credit and insurance for farmers.

Holistic approaches

Many of the case studies have integrated index insurance into broader programmes for development and climate risk management.

Strongly entwined with the above theme is that insurance has not been used as a stand-alone product, instead it has been located within a more comprehensive climate risk management portfolio. In each case-study, index insurance has been used to target a clearly defined risk, such as drought, complemented by other risk management approaches that might be more appropriate to address more frequent, less severe events. Farmers also face multiple risks and constraints, thus appropriate risk assessment and context analysis have been shown to be an important prerequisite to designing suitable products in each case study. In all of the cases, insurance has also formed the last component of a climate risk management plan, only used to transfer risk that cannot be reduced in any other way. In the Indian and ACRE case studies, this has been achieved by formal bundling to credit or improved inputs. Bundling tools has the added advantage of exposing farmers to insurance who might not have normally purchased the product. In R4, a holistic approach is at the core of the programme - insurance is purposefully only one component of a larger risk management system which includes risk reduction through better agronomic practices, prudent risk taking by access 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.

IBLIP shows another approach to holistic risk management, as a combination of self-insurance, market-based insurance and a social safety net, promoted alongside other risk management tools in the World Bank's Sustainable Livelihood Programme. These other risk management tools were included in IBLIP because research showed that improved techniques in husbandry – for example, strategic locations of winter fodder stores – ameliorated the insurance risk. Their multi-stage programme also meant that allowed risk to be more comprehensively managed. For example, herders bear the cost of small losses that do not affect the viability of their business, larger losses are transferred to the private insurance industry and the final layer of catastrophic loss is borne by the Government of Mongolia.

Identifying and implementing these holistic risk management solutions in a new location is rarely something that one party can do alone. Instead, the case-studies have shown that success requires close collaboration between farmers, businesses, policy makers, scientists and implementers, where all the parties must have a good understanding of all the products, trade-offs, solutions and limitations. Taking the time to address these project management challenges to build strong inter-organizational relationships is a valuable strategy echoed in all of the case studies.

Farmer-driven design

Many of the case studies have reported substantial benefits from involving end-clients in the index design process.

In one sense, index is more difficult to administer than traditional indemnity insurance because it cannot cover all losses and risks. Identifying a clear, obvious and measurable risk is therefore a key aspect of setting up an index insurance programme, especially for weather-based indices which are a level further removed from loss than area yield indices. Farmer-driven design is one method of bridging this distance 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. Another example of farmer-driven design is in the Islamic insurance product developed by IBLI that was designed specifically to address the needs of farmers who couldn't take up a standard insurance contract. In India, a recent impact review (Zevenbergen 2014) reported that becoming more involved in the design process was the most requested improvement by farmers in the NAIS programme. It also reported extremely high uptake in a community-designed trial project in the region, particularly because it opened up formal avenues for feedback and validation.

It is important to note that farmer-led design does not mean that local and international experts were ignored in the case studies; instead their expertise was shown to be crucial. All of the case studies included regional and international experts to better understand the relevant agronomic, climatic, economic and statistical background of the target area region.

Building trust and capacity

Education and capacity development proved a key aspect of many case studies.

Unlike a loan, insurance is a promise for a payment later for a premium paid now and as such, trust is inherently at the core of the process. In parallel, the ability of farmers to understand and discuss the product being offered is an important method of building demand. Unsurprisingly, partnering with organizations that have already built trust and capacity within the clients was instrumental for successful scale-up of the case studies. In the case of formal bundling, ACRE and the Indian insurance projects partnered with companies or institutions already trusted by partners and clients. This was particularly the case for the link between ACRE and M-PESA mobile banking, which allowed farmers to pay for insurance and receive payouts in a well-understood and trusted manner. The R4, IBLIP and ILRI projects have also partnered with NGOs and initiatives that are well respected by the community.

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 with farmers on index design using games and community discussions. IBLIP reported that its increase in demand was in part because of intensive information campaigns supported by the Government of Mongolia (Mahul and Stutley 2010) and awareness was quoted as one of the key constraints to scaling further. Education also plays a large role in IBLI where the project reported successful use of insurance simulation games, educational videos, radio programmes, plays and cartoon strips as educational tools (McPeak et al. 2010). In India, Kakumanu (2011) showed that a significant factor in a farmer's willingness to buy the WBCIS plan was the impact of a large-

scale awareness programme run by AIC. Finally in the ACRE programme, in 2011 it was reported that 40% of the project's budget went towards paying for trainers who work with farmers, a telephone helpline and radio programmes about insurance. Education about new agricultural practices was also a formal part of the bundle.

Developing markets, supply chains, and logistical support systems

Insurance projects that have scaled have also invested in policy frameworks, supply chain integration and market integration.

One important aspect of many of the case studies was the ability of implementers to work in advance with policy makers, market leaders and businesses to develop supply chains and legislative frameworks. Some of this focus is on building supply chains for the insurance itself, for example ACRE has built close links to M-PESA mobile banking and IBLI is now starting to invest in technologies that can work outside the mobile phone network to allow insurance coverage to be easily bought and tracked.

In addition to engaging insurance supply chains, providing access to and supply chains for productive assets attached to the insurance has proven equally important. This was a well reported barrier in early index insurance projects. For example in 2005, the World Bank led a project in Malawi that provided an excellent example of how index insurance might be used in a development context. Although farmers paid the complete cost of the insurance, inputs, loans, interest and even tax, demand for the product outstripped the project capacity and swamped the supply chain, which led to the total size of an otherwise successful project being capped at 1000-2000 farmers (Hellmuth 2009). In the case studies reported here, the scale up of the R4 project is currently limited by its ability to sign up people to the insurance-for-labour part of the project, rather than farmer demand for the product. ACRE and the Indian insurance programmes work in close consultation with microfinance institutions and credit companies to provide additional access and supply chains.

Finally, building the legislative landscape for insurance is equally important to be able to give insurance the space to scale. Both IBLIP and the Indian projects are working in close conjunction with national governments to develop supportive legislative frameworks and in Ethiopia, the R4 project is operating at a large scale using the well-established PSNP project run by the Government of Ethiopia. In all of the case studies, linking formally with the government was crucial in transitioning insurance from a fixed time-scale pilot into a sustainable large-scale system.

Solid science, technology, and basis risk

Solid scientific research and good communication allowed many of the case studies to scale, especially when addressing data poverty or reducing the impact of basis risk.

Finally, basing index insurance projects on robust scientific output and working closely with research organizations has been a core theme of many of the case studies, allowing them to use agro-meteorological research and knowledge to quantify basis risk and social science research to aid communication with farmers.

Many of the projects highlighted in this report have stressed the importance of building a project on solid scientific knowledge, aiming to balance technological innovation with statistically robust products that are understandable by farmers. Modern scientific research is key in almost all aspects of index design, from dealing with data sparse environments, to new datasets such as indexes based on remote sensing, to modelling and understanding climate trends, to quantifying uncertainties. For example in the IBLI and R4 projects, physical scientists, social scientists and economists have been involved since project conception.

Many of the case studies have shown that addressing the issue of data poverty is vital for scaling. In many developing countries there are limited agronomic or meteorological data for index design e.g., limited crop yield data or rain gauge networks. One method of overcoming this is to use remotely sensed data from satellites, an option that is seen in several of the case studies. In ACRE, a proportion of their products are based on the output of rainfall estimates from satellites, and satellite based indices are currently insuring 37, 000 Rwandan farmers (Fiondella 2013). In the R4 Initiative, the index is similarly 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. IBLI also uses satellites, but in this case employs an innovative relationship between livestock mortality and the satellite vegetation estimate NDVI. There is currently intensive research into the use of satellites (Stanimirova 2014). Current efforts include a project led by the Weather Risk Management Facility (WRMF), a joint IFAD and World Food Programme (WFP) initiative to support the sustainable development of weather risk-management instruments in developing countries. This is currently examining the feasibility, accuracy, and reliability of seven satellite remote sensing-derived approaches in index insurance design, including vegetation, evapotranspiration, soil-moisture and rainfall datasets. In addition a NASA-led collaboration is exploring the potential of new satellite technologies such as active/passive sensing of soil moisture in

current and future index insurance projects. Plus researching mobile data collection and information transfer mechanisms for multiple user groups (Mann and Stanimirova 2014).

Basis risk, or the differences between a payout and a farmer's actual loss, is sometimes quoted as a key constraint for index insurance and many of the design processes discussed above are dedicated to finding statistically robust indices with low basis risk. While it is impossible to entirely eliminate basis risk from index insurance products, a lot of effort has been spent minimizing it through careful index selection, and contract design that maps the index data to historical as well as anticipated patterns of losses (Norton et al. 2014). In India, there has also been a lot of work done on studying and validating basis risk events (Clarke et al. 2012). In Mongolia, basis risk has been minimized by working using average reported livestock mortality rates rather than assuming that some proxy such as rainfall could better model losses. This is possible in IBLIP due to the cultural importance of reporting the correct number of livestock losses, the existing framework in place to do so and the very long nature of the historical data (~100 years). The R4 and IBLI projects have dedicated significant amounts of time to minimizing basis risk events through examining multiple data sources.

Alongside basis risk reduction, another theme running through the case studies is the importance of basis risk communication. Projects such as R4 have spent significant resources on discussing what a community might do in a basis risk event. They are working towards a situation where farmers will no longer see the event as a failure, rather as a year where they need to take Option B (e.g., use a community savings fund or their savings at the MFI).

4. Conclusion

Although agricultural insurance has a long heritage with significant ongoing investment, it has only started to become more widely applied across the developing world in recent years, driven in part by innovations in index-based insurance. There still remains much to learn from the successes and failures of existing initiatives. This report demonstrates that despite the challenges, there are index insurance programmes that have made recent advances in scaling up services for relatively poor smallholder farmers and pastoralists in the developing world, with demonstrable benefits. For example, India's index-based insurance programmes (NAIS and WBCIS) have reached tens of millions of farmers through their link with agricultural credit and strong government support. ACRE in East Africa has proven that it is possible to engage hundreds of thousands of farmers in just a few years and that it is possible to capitalize and partner with new technological initiatives such as M-PESA mobile banking. The R4 Rural Resilience Initiative in Ethiopia and Senegal has shown that it is possible to use unsubsidized, unbundled index insurance as one component of a comprehensive risk management portfolio to reach over 20,000 smallholder farmers who were previously considered uninsurable. The Mongolian IBLIP project has demonstrated how a strong public-private partnership can sustainably reach over 15,000 nomadic herders. Other smaller projects, such as the IBLI case study, are also starting to fill important niches in climate risk management for smaller communities that face particular challenges.

The case studies considered in this report target a wide range of groups, in very different parts of the world, yet there are still many similarities and themes running across them. We hope these similarities provide encouragement for other insurance projects hoping to grow to a scale that might meaningfully address poverty. The factors that appear to be contributing to their recent progress are generally consistent with earlier assessments. These include investigations into new technologies (particularly remote sensing) to address index design, basis risk and validation questions, holistic linkages to supply chains and other risk management initiatives, plus solid farmer-driven design based on a robust assessment of the risks they are facing. Most importantly, all of the case studies appear to unlock opportunities for farmers to make more money, or to show some other clear and tangible benefit such as asset protection, increased access to services such as credit, or increased food security in bad years. The case studies show that achieving maturity in any insurance programme takes time, careful planning and attention to detail; success cannot be achieved overnight. It is equally important to note the differences between the case studies, as agricultural practices and risks in developing countries are very

diverse and any single index insurance 'success story' cannot be universally adopted. The case studies have also shown that index insurance is not going to be appropriate in every circumstance and that there are still several challenges still to overcome, including data management, basis risk, logistical and client communication.

Although the scale of existing insurance schemes across the developing world remains very small relative to the numbers of smallholder farmers who are impacted by climate-related risk, the agricultural index insurance landscape is changing rapidly. While there are still many obstacles to overcome, the emerging picture is encouraging. Rapid scaling observed in a few of the case studies we reviewed indicates that they have targeted substantial latent demand among smallholder farmers and pastoralists, and are effectively addressing the challenges to providing useful insurance in a manner that is scalable. These case studies also provide updated evidence that counters significant concern, based on earlier surveys of the state of index insurance, that lack of demand may prevent index-based insurance from becoming an effective tool to reduce rural poverty at a meaningful scale. Instead, it suggests the possibility that the uptake and benefits of index-based insurance may have been constrained more by the evolving capacity to provide relevant services than by a fundamental lack of demand among farmers, and that continued effort is worthwhile. We expect that what happens in some of the stronger agricultural insurance initiatives over the next few years will resolve this debate, and strengthen the evidence base needed to inform appropriate investment in insurance for smallholder agriculture in the developing world.

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This report presents evidence and insights from five case studies that have made significant recent progress in addressing the challenge of insuring poor smallholder farmers and pastoralists in the developing world. The rapid progress observed in recent years suggests that index insurance has the potential to benefit smallholder farmers at a meaningful scale, and suggests the need to reassess arguments that lack of demand and practical implementation challenges prevent index-based insurance from being a useful tool to reduce rural poverty.

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